REVISED DRAFT REPORT

FEASIBILITY STUDY - ASHLAND/NORTHERN STATES POWER LAKEFRONT SUPERFUND SITE

Prepared for

Northern States Power Company - WI
1414 West Hamilton Avenue
Eau Claire, WI 54701

May 15, 2008

URS

6737 W. Washington Street
Suite 3365
Milwaukee, WI 53214
25688375

Table of Contents

Table of Contents i

List of Tables and Figures vi

Acronyms and Abbreviations x

Executive Summary ES-1

Introduction 1-1
- 1.0 Purpose and Organization of Report 1-1
- 1.1 Site Description 1-1

2.0 Summary of Community Relations Support 2-1

3.0 Summary of the Remedial Investigation 3-1
- 3.1 Summary of RI Findings 3-1
  - 3.1.1 Site History 3-2
  - 3.1.2 Site Setting 3-4
  - 3.1.3 Nature and Extent of Contamination 3-5
  - 3.1.4 Contaminant Fate and Transport 3-9
  - 3.1.4 Conceptual Site Model 3-10
    - 3.1.4.1 Historical Setting Summary 3-10
    - 3.1.4.2 Contaminant Sources and Disposition 3-11
    - 3.1.4.3 Summary 3-12
- 3.2 Summary of Site Risks 3-13
  - 3.2.1 Current and Future Site Use 3-13
  - 3.2.2 Risks to Human Health 3-13
  - 3.2.3 Risks to Ecological Receptors 3-15
- 3.3 Calculation of Areal Extent and Volume of Contaminated Media 3-16
  - 3.3.1 Soil 3-18
  - 3.3.2 Groundwater 3-19
  - 3.3.3 Sediment 3-20

4.0 Results of SITE Program Demo/Treatability Studies 4-1
- 4.1 SITE Program Demo 4-1
- 4.2 Cap Flux Testing 4-6
- 4.3 Bench Scale Air Emissions Testing 4-8
- 4.4 Multiphase Flow and Consolidation Testing 4-9

5.0 Identification of Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) Criteria 5-1
- 5.1 Introduction 5-1
- 5.2 Chemical-Specific ARARs 5-2
- 5.3 Location-Specific ARARs 5-2

5.4 Action-Specific ARARs 5-3
5.5 To Be Considered Information 5-3

6.0 Development and Evaluation of Remedial Action Alternatives –Soil 6-1
6.1 Remedial Action Objectives for Soil 6-1
6.2 Screening of Remedial Action Alternatives for Soil 6-2
6.2.1 Chemicals of Potential Concern – Soil 6-2
6.2.2 Screening of Remedial Alternatives – Soil 6-2
6.3 Development of Remedial Action Alternatives for Soil 6-4
6.3.1 Alternative S-1 - No Action 6-4
6.3.2 Alternative S-2 – Containment Using Engineered Surface Barriers 6-5
6.3.3 Alternative S-3 - Removal and Off-site Disposal 6-6
6.3.4 Alternative S-4 - Removal and On Site Disposal 6-10
6.3.5 Alternative S-5 – Ex-situ Thermal Treatment 6-11
6.3.6 Alternative S-6 – Limited Removal and On-site Soil Washing 6-15
6.4 Detailed Analysis of Remedial Alternatives for Soil 6-20
6.4.1 Threshold Criteria 6-20
6.4.2 Balancing Criteria 6-20
6.4.2.1 Long Term Effectiveness and Permanence 6-21
6.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment 6-25
6.4.2.3 Short Term Effectiveness 6-29
6.4.2.4 Implementability 6-32
6.4.2.5 Cost 6-36
6.4.3 Modifying Criteria 6-38
6.5 Comparative Analysis of Retained Remedial Alternatives for Soil 6-38
6.5.1 Overall Protection of Human Health and the Environment 6-40
6.5.2 Compliance with ARARs and TBCs 6-40
6.5.3 Long-term Effectiveness and Permanence 6-40
6.5.4 Reduction of Toxicity, Mobility, and Volume Through Treatment 6-41
6.5.5 Short-term Effectiveness 6-42
6.5.6 Implementability 6-42
6.5.7 Cost 6-42
6.5.8 Summary 6-43

7.0 Development and Evaluation of Remedial Action Alternatives – Groundwater 7-1
7.1 Remedial Action Objectives for Groundwater 7-1
7.2 Screening of Remedial Action Alternatives – Groundwater 7-2
7.2.1 Chemicals of Potential Concern – Groundwater 7-2
7.2.2 Screening of Remedial Alternatives – Groundwater 7-2
7.3 Development of Potential Remedial Alternatives for Groundwater 7-3
7.3.1 Alternative GW-1 - No Action 7-3
7.3.2 Alternative GW-2 -Containment Using Engineered Surface and Vertical Barriers 7-3
7.3.3 Alternative GW-3 - In-situ Treatment Using Ozone Sparge 7-7
7.3.4 Alternative GW-4 - In-situ Treatment using Surfactant Injection and Dual Phase Recovery 7-8
7.3.5 Alternative GW-5 - In-situ Treatment using Permeable Reactive Barrier Walls 7-10
7.3.6 Alternative GW-6 – Treatment using Chemical Oxidation 7-12

7.3.7 Alternative GW-7 - In-situ Treatment using Electrical Resistance Heating 7-14
7.3.8 Alternative GW-8 - In-situ Treatment using Steam Injection (Including Contained Recovery of Oily Wastes (CROW) and Dynamic Underground Stripping (DUS) Processes) 7-16
7.3.9 Alternative GW-9 – NAPL Removal using Groundwater Extraction Wells 7-19
7.4 Detailed Analysis of Retained Remedial Action Alternatives for Groundwater 7-24
7.4.1 Threshold Criteria 7-24
7.4.2 Balancing Criteria 7-24
7.4.2.1 Long Term Effectiveness and Permanence 7-24
7.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment 7-27
7.4.2.3 Short Term Effectiveness 7-30
7.4.2.4 Implementability 7-32
7.4.2.5 Cost 7-35
7.4.3 Modifying Criteria 7-37
7.5 Comparative Analysis of Retained Remedial Alternatives for Groundwater 7-37
7.5.1 Overall Protection of Human Health and the Environment 7-39
7.5.2 Compliance with ARARs and TBCs 7-39
7.5.3 Long-term Effectiveness and Permanence 7-39
7.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment 7-39
7.5.5 Short-term Effectiveness 7-40
7.5.6 Implementability 7-40
7.5.7 Cost 7-41
7.5.8 Summary 7-41

8.0 Development and Evaluation of Remedial Action Alternatives – Sediment 8-1
8.1 Remediation Action Objectives for Sediment 8-1
8.2 Screening of Remedial Action Alternatives – Sediment 8-1
8.2.1 Chemicals of Potential Concern – Sediment 8-1
8.2.2 Screening of Remedial Alternatives – Sediment 8-2
8.3 Development of Potential Remedial Alternatives for Sediment 8-4
8.3.1 Alternative SED-1: No Action 8-4
8.3.2 Alternative SED-2: Sediment Containment within a Confined Disposal Facility 8-4
8.3.2.1 Introduction 8-4
8.3.2.2 Concept 8-5
8.3.2.3 Rationale and Precedent 8-6
8.3.2.4 Site-specific Elements of a CDF Design 8-8
8.3.2.5 Implementation of Remedy 8-10
8.3.2.6 Cost 8-16
8.3.3 Alternative SED-3: Subaqueous Capping 8-16
8.3.3.1 Introduction 8-16
8.3.3.2 Concept 8-18
8.3.3.3 Rationale and Precedent 8-19
8.3.3.4 Site-specific Elements of a Subaqueous Cap Design 8-19
8.3.3.5 Implementation of Remedy 8-21
8.3.3.6 Cost 8-24
8.3.4 Alternative SED- 4: Removal 8-25

8.3.4.1 Introduction 8-25
8.3.4.2 Concept and Precedent 8-26
8.3.4.3 Implementation of Remedy 8-27
8.3.4.4 Cost 8-32
8.3.5 Alternative SED-5 – Dry Excavation 8-32
8.3.5.1 Introduction 8-32
8.3.5.2 Concept and Precedent 8-35
8.3.5.3 Implementation of Remedy 8-35
8.3.5.4 Cost 8-39
8.4 Detailed Analysis of Retained Remedial Action Alternatives – Sediment 8-40
8.4.1 Threshold Criteria 8-40
8.4.1.1 Overall Protection of Human Health and the Environment 8-40
8.4.1.2 Compliance with ARARs and TBCs 8-41
8.4.2 Balancing Criteria 8-50
8.4.2.1 Long Term Effectiveness and Permanence 8-50
8.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment 8-53
8.4.2.3 Short Term Effectiveness 8-55
8.4.2.4 Implementability 8-57
8.4.2.5 Cost 8-60
8.4.3 Modifying Criteria 8-61

8.5 Comparative Analysis of Retained Remedial Alternatives – Sediment 8-61
8.5.1 Overall Protection of Human Health and the Environment 8-63
8.5.2 Compliance with ARARs and TBCs 8-64
8.5.3 Long-term Effectiveness and Permanence 8-64
8.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment 8-64
8.5.5 Short-term Effectiveness 8-65
8.5.6 Implementability 8-65
8.5.7 Cost 8-66
8.5.8 Summary 8-66

9.0 Integrated Remedial Alternatives 9-1
9.1 Introduction 9-1
9.2 Site-Wide Integrated Remedies 9-2
9.2.1 Remedial Scenario I: No Action 9-8
9.2.2 Remedial Scenario II: 9-8
9.2.2.1 Site Utilization and Staging 9-8
9.2.2.2 Integration of Remedial Processes 9-9
9.2.2.3 Estimated Cost of Integrated Remedy 9-9
9.2.3 Remedial Scenario III 9-10
9.2.3.1 Site Utilization and Staging 9-11
9.2.3.2 Integration of Remedial Processes 9-11
9.2.3.3 Estimated Cost of Integrated Remedy 9-12
9.2.4 Remedial Scenario IV 9-14
9.2.4.1 Site Utilization and Staging 9-15
9.2.4.2 Integration of Remedial Processes 9-15
9.2.4.3 Estimated Cost of Integrated Remedy 9-16
9.2.5 Remedial Scenario V 9-18
9.2.5.1 Site Utilization and Staging 9-18

9.2.5.2 Integration of Remedial Processes 9-19
9.2.5.3 Estimated Cost of Integrated Remedy 9-20
9.2.6 Remedial Scenario VI 9-21
9.2.6.1 Site Utilization and Staging 9-21
9.2.6.2 Integration of Remedial Processes 9-22
9.2.6.3 Estimated Cost of Integrated Remedy 9-23
9.2.7 Remedial Scenario VII 9-25
9.2.7.1 Site Utilization and Staging 9-25
9.2.7.2 Integration of Remedial Processes 9-26
9.2.7.3 Estimated Cost of Integrated Remedy 9-27
9.2.8 Remedial Scenario VIII 9-28
9.2.8.1 Site Utilization and Staging 9-29
9.2.8.2 Integration of Remedial Processes 9-30
9.2.8.3 Estimated Cost of Integrated Remedy 9-31
9.2.9 Remedial Scenario IX 9-33
9.2.9.1 Site Utilization and Staging 9-33
9.2.9.2 Integration of Remedial Processes 9-34
9.2.9.3 Estimated Cost of Integrated Remedy 9-34

10.0 References 10-1

List of Tables and Figures

TABLES

Table 3-1 Volumes and Areal Extent of Contaminated Media
Table 4-1 Summary of Free Product and Groundwater Volume Recovered Since November 2006
Table 6-1A Soil Preliminary Remediation Goals for Construction Workers (mg/kg)
Table 6-1B Soil Preliminary Remediation Goals for Residents (mg/kg)
Table 6-2 Summary of Soil Technologies Reviewed
Table 6-3 Summary of Potential Remedial Alternatives for Soil
Table 6-4 Evaluation of Long-term Effectiveness and Permanence for Potential Soil Remedial Alternatives
Table 6-5 Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Soil Remedial Alternatives
Table 6-6 Evaluation of Short Term Effectiveness for Potential Soil Remedial Alternatives
Table 6-7 Evaluation of Implementability for Potential Soil Remedial Alternatives
Table 6-8 Evaluation of Cost for Potential Soil Remedial Alternatives
Table 6-9 Comparison of Potential Soil Remedial Alternatives
Table 7-1 Summary of Groundwater Technologies Reviewed
Table 7-2 Summary of Potential Remedial Alternatives for Groundwater
Table 7-3 Evaluation of Long-term Effectiveness and Permanence for Potential Groundwater Remedial Alternatives
Table 7-4 Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Groundwater Remedial Alternatives
Table 7-5 Evaluation of Short Term Effectiveness for Potential Groundwater Remedial Alternatives
Table 7-6 Evaluation of Implementability for Potential Groundwater Remedial Alternatives
Table 7-7 Evaluation of Costs for Potential Groundwater Remedial Alternatives
Table 7-8 Comparison of Potential Groundwater Remedial Alternatives
Table 8-1 Summary of Sediment Technologies Reviewed
Table 8-2 Cost Summary – Alternative SED-2:CDF
Table 8-3 Cost Summary – Alternative SED-3:Dredge/Cap
Table 8-4 Potential Engineering Controls
Table 8-5 Alternatives for Controlling Volatilization at Dredge Site
Table 8-6 Cost Summary – Alternative SED-4:Dredge All
Table 8-7 Cost Summary – Alternative SED-5:Dry Excavation
Table 8-8 Evaluation of Long Term Effectiveness and Permanence for Potential Sediment Remedial Alternatives
Table 8-9 Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Sediment Remedial Alternatives
Table 8-10 Evaluation of Short Term Effectiveness for Potential Sediment Remedial Alternatives
Table 8-11 Evaluation of Implementability for Potential Sediment Remedial Alternatives

Table 8-12 Cost Summary of Remedial Alternatives for Potential Sediment Remedial Alternatives
Table 8-13 Summary of Comparative Analysis for Potential Sediment Remedial Alternatives
Table 9-1 Summary of Remedial Alternatives by Areas of Concern
Table 9-2 Summary of Integrated Remedial Scenarios
Table 9-3 Cost Summary for Remedial Scenario II
Table 9-4 Cost Summary for Remedial Scenario III
Table 9-5 Cost Summary for Remedial Scenario IV
Table 9-6 Cost Summary for Remedial Scenario V
Table 9-7 Cost Summary for Remedial Scenario VI
Table 9-8 Cost Summary for Remedial Scenario VII
Table 9-9 Cost Summary for Remedial Scenario VIII
Table 9-10 Cost Summary for Remedial Scenario IX

FIGURES

Figure 1-1 Site Location
Figure 1-2 Site Features
Figure 1-3 Former MGP Features
Figure 3-1 Lateral Extent of Soil Contamination in Upland Area and Kreher Park
Figure 3-2 Lateral Extent of Shallow and Deep Groundwater Contamination
Figure 3-3 Area of Impacted Sediment
Figure 3-4 Extent of DNAPL in Upper Bluff – Filled Ravine and Copper Falls
Figure 3-5 Extent of DNAPL at Kreher Park
Figure 4-1 Total Product Removed to Date
Figure 4-2 Weekly Pumping Summary
Figure 6-1 Existing Conditions at Upper Bluff and Kreher Park
Figure 6-2 Engineered Surface Barriers - Upper Bluff and Kreher Park
Figure 6-3A Limited Removal and Off-site Disposal – Upper Bluff Area and Kreher Park
Figure 6-3B Unlimited Removal and Off-site Disposal – Upper Bluff Area and Kreher Park
Figure 6-4A Onsite Disposal at Kreher Park - One Acre Disposal Cell
Figure 6-4B Onsite Disposal at Kreher Park - Four Acre Disposal Cell
Figure 7-1 Containment & Engineered Using Surface and Vertical Barriers
Figure 7-2A In-situ Ozone Sparge – Shallow Groundwater at Upper Bluff and Kreher Park
Figure 7-2B In-situ Ozone Sparge – Copper Falls Aquifer
Figure 7-3 Surfactant Injection and Dual Phase Recovery – Copper Falls Aquifer
Figure 7-4 Permeable Reactive Barrier Wall & Containment Using Engineered Surface and Vertical Barriers
Figure 7-5A In-situ Chemical Oxidation – Shallow Soil and Groundwater in Upper Bluff Area
Figure 7-5B In-situ Chemical Oxidation – Shallow Soil and Groundwater at Kreher Park
Figure 7-5C In-situ Chemical Oxidation – Copper Falls Aquifer
Figure 7-6A In-situ Electrical Resistance Heating – Shallow Soil and Groundwater in Upper Bluff Area

Figure 7-6B In-situ Electrical Resistance Heating – Shallow Soil and Groundwater at Kreher Park
Figure 7-6C In-situ Electrical Resistance Heating – Copper Falls Aquifer
Figure 7-7A In-situ Steam Injection – Shallow Soil and Groundwater in Upper Bluff Area
Figure 7-7B In-situ Steam Injection – Shallow Soil and Groundwater at Kreher Park
Figure 7-7C In-situ Steam Injection – Copper Falls Aquifer
Figure 7-8A Removal Using Groundwater Extraction – Copper Falls Aquifer and Ravine Fill
Figure 7-8B Removal Using Groundwater Extraction – Shallow Groundwater at Kreher Park
Figure 8-1 Alternative SED-2: Construct CDF over Sediment
Figure 8-2 Ashland / NSP Lakefront Site – Section Concept (for CDF)
Figure 8-3 Ashland / NSP Lakefront Site – Redevelopment Concept Plan (for CDF)
Figure 8-4 Final Construction – Sheet Pile Wall Cross Section for CDF
Figure 8-5 Above Membrane Cap Infiltration Drainage for CDF
Figure 8-6 Below Cap Gas & Water Drainage Layer for CDF
Figure 8-7 Alternative SED-3 – Remove Sediment to a Depth of 4 Feet, Cap, Treat Sediment Onsite, and Dispose of Sediment Offsite
Figure 8-8 Completed Plan View –Subaqueous Cap
Figure 8-9 Dredge Area & Sediment Treatment Layout
Figure 8-10 Capping Cross Section – Subaqueous Cap
Figure 8-11 Alternative SED-4 – Remove Sediment, Treat On Site, Dispose of Sediment Off Site
Figure 8-12 Alternative SED-5 – Dry Excavation, Treat On Site, Dispose of Sediment Off Site
Figure 8-13 Site Plan with Existing Conditions
Figure 8-14 Existing Conditions & Cross Sections
Figure 8-15 Proposed Construction Elements & Cross Section
Figure 8-16 Proposed Final Site Features Plan View and Cross Section
Figure 8-17 Wave Attenuator Sections Ready for Shipment
Figure 8-18 Wave Attenuators Deployed as Breakwater

APPENDICES

Appendix A Feasibility Study Technical Memorandum
A1 Alternative Screening Technical Memorandum
A2 Comparative Alternatives Analysis Technical Memorandum
Appendix B Treatability Study Reports
B1 SITE Demonstration Report
B2 Cap Flux Testing Report
B3 Bench Scale Air Emission and Multiphase Flow Report
B4 Multiphase Flow and Consolidation Testing Report
Appendix C October 2007 Community Workshop Summary
Appendix D Volume and Water Budget Calculations used for Evaluating Remedial Alternatives
D1 Volumes and Areal Extent of Contaminated Media
D2 Water Budget Calculations for Kreher Park
Appendix E ARARs and TBCs for the Ashland/NSP Lakefront Site
Table E-1 ARAR Summary for Potential Soil Remedial Alternatives
Table E-2 ARAR Summary for Potential Groundwater Remedial Alternatives
Table E-3 ARAR Summary for Potential Sediment Remedial Alternatives
Appendix F Preliminary Remediation Cost Estimates
F1 Remedial Responses for Soil
F2 Remedial Responses for Groundwater
F3 Remedial Responses for Sediment
Appendix G Wave Run-Up Analysis for CDF
Appendix H List of Subaqueous Capping Projects
Appendix I Summary Cost for Siting, Constructing, and Operating a Landfill in Ashland

Acronyms and Abbreviations

AOC	Administrative Order on Consent
ASTM	Alternatives Screening Technical Memorandum
ARAR	Applicable or Relevant and Appropriate Regulations
bgs	Below ground surface
^{o}C	Degrees Celsius
CAATM	Comparative Analysis of Alternatives Technical Memorandum
CERCLA	Comprehensive Environmental Response and Compensation Liability Act
COPC	Chemical of Potential Concern
DNAPL	Dense Non-Aqueous Phase Liquid
ES	Enforcement Standard
^{o}F	Degrees Fahrenheit
FS	Feasibility Study
GRA	General Response Action
LNAPL	Light Non-Aqueous Phase Liquid
MGP	Manufactured Gas Plant
MNA	Monitored natural attenuation
MNR	Monitored natural recovery
MSL	Mean Sea Level
NAPL	Non-Aqueous Phase Liquid
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NOAA	National Oceanographic and Atmospheric Administration
NSPW	Northern States Power Wisconsin
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic Aromatic Hydrocarbon
PRG	Preliminary Remediation Goal
RAO	Remedial Action Objective
RCL	Residual Contaminant Level
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
TBC	To Be Considered regulations
UCL	Upper Confidence Limit
URS	URS Corporation
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources
WWTP	Wastewater Treatment Plant

Executive Summary

A Feasibility Study (FS) has been completed to evaluate potential remedial responses for contamination identified at the Ashland NSP Lakefront Superfund Site (the "Site") and results are presented in this report. Contamination was initially discovered in 1989 during exploratory drilling in preparation for a planned expansion of the City wastewater treatment plant (WWTP) located at Kreher Park. Site investigations were subsequently completed culminating in the identification of the former manufactured gas plant (MGP) as the primary source for contamination at the Site. The Wisconsin Department of Natural Resources (WDNR) named Northern States Power Company, a Wisconsin corporation (d.b.a. Xcel Energy, a subsidiary of Xcel Energy Inc. ("NSPW") as a potentially responsible party (PRP) for the MGP wastes/contamination at the site in 1995. The City of Ashland and an operating railroad were later named as PRPs for solid wastes disposed on their properties.

The NSPW and WDNR subsequently performed several independent investigations to assess the extent of contamination on the NSPW property, and at Kreher Park (including adjacent off-shore sediments), respectively. In 1998 a local environmental group petitioned the United States Environmental Protection Agency (USEPA) to evaluate the Site for scoring on the national priorities list (NPL) for Superfund. The site was nominated in 2000, and formally added to the NPL in 2002. NSPW subsequently signed an administrative order on consent (AOC) with USEPA in 2003 to conduct a remedial investigation/feasibility study (RI/FS) at the Site.

The RI/FS Process

The AOC included a Statement of Work that defined eight tasks for this RI/FS. These tasks included:

- Task 1: Project Scoping and RI/FS Planning Documents
- Task 2: Community Relations Support
- Task 3: Site Characterization
- Task 4: Remedial Investigation Report
- Task 5: Development and Screening of Alternatives Technical Memorandum. This task also included development of a Remedial Action Objectives Technical Memorandum.
- Task 6: Treatability Studies
- Task7: Detailed Analysis of Alternatives (FS Report). This task also specified that a Comparative Analysis of Alternatives Technical Memorandum would be submitted to USEPA for approval prior to submission of the FS report.
- Task 8: Progress Reports.

Tasks 1 and 3 involved the scoping and conduct of the Remedial Investigation (RI) which was completed between March and November 2005 to fill data gaps identified from earlier investigations, and to obtain additional data to develop remedial alternatives for the Site. Results from that investigation and previously completed site investigations were presented in the *Remedial Investigation Report for the Ashland/Northern States Power Lakefront Superfund Site* report (Task 4), which was finalized in August 2007. The RI Report was verbally approved by USEPA on October 9, 2007[1] and final written approval issued on February 5, 2008. A summary of RI results is included in section 3.0 of this FS report. A detailed history of the Site can be found in the RI report.

Task 5: Remedial Action Objectives (RAO) Technical Memorandum and Development and Screening of Alternatives Technical Memorandum

Task 5 consisted of two tasks. The RAO Technical Memorandum was submitted as Appendix A to the RI and approved by USEPA on June 6, 2007. The Alternatives Screening Technical Memorandum was initially submitted to USEPA as a draft report on January 22, 2007. Following Agency review and resubmission, this technical memorandum was finalized on September 7, 2007.

The initial step of the alternatives screening process involved the identification of general response actions (GRAs), remedial action technologies and remedial action processes that potentially can be applied to Site media to meet RAOs

General response actions are defined as actions that can be applied to Site media that will result in a RAO being achieved. Potential GRAs for the Site include the following categories:

- No Action;
- Institutional Controls;
- Monitored Natural Recovery
- Containment;
- Removal;
- In-situ Treatment; and
- Ex-situ Treatment.

Several different remedial action technologies could potentially be employed to achieve a RAO. After evaluating each alternative for technical implementability those retained were evaluated in more detail. The evaluation of these alternatives considers implementability, effectiveness and cost and included such information as:

- Time required for the alternative to achieve RAOs;

[1] As described in the February 5, 2008 RI Report approval letter from USEPA, on September 26, 2007 USEPA received comments to the RI Report along with a revised version of the Human Health Risk Assessment (HHRA). The HHRA dated September 19, 2007 contained minor modifications to the HHRA appended to the RI Report dated August 31, 2007.

- Relative cost of the alternative;
- How much risk reduction will be achieved from implementing the alternative;
- Land use required for implementation;
- Compliance with ARARs and TBCs;
- Need for any institutional controls after alternative is implemented; and
- Other relevant information.

After comments from USEPA, the Alternatives Screening Technical Memorandum was revised and served as the basis for the next step in the FS process, a comparative analysis of remedial alternatives, Task 7.

Task 7: Detailed Analysis of Alternatives (FS Report)

Tasks 7 consisted of two tasks. The first deliverable of Task 7, the Comparative Analysis of Remedial Alternatives Technical Memorandum was initially submitted to USEPA as a draft report on May 25, 2007. Following Agency review, this document was finalized on October 5, 2007. This memorandum further evaluated the remedial alternatives that were retained from the alternatives screening. This evaluation consisted of a detailed analysis of remedial alternatives against the nine Superfund evaluation criteria, and then an analysis comparing all of these alternatives using these nine criteria as a basis for comparison. The nine Superfund criteria are categorized as threshold criteria, primary balancing criteria and modifying criteria and are further described below.

Threshold criteria, which relate to statutory requirements that each alternative must satisfy in order to be eligible for selection, include:

- Overall protection of human health and the environment, and
- Compliance with ARARs.

The *primary balancing criteria*, which are the technical criteria upon which the detailed analysis is primarily based, include:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability, and
- Cost.

The third group, the *modifying criteria*, includes:

- State/support agency acceptance, and
- Community acceptance.

In the Comparative Alternatives Analysis, these nine evaluation criteria were applied to the remedial alternatives retained from the Alternatives Screening memo to ensure that the selected remedial alternative will:

- protect human health and the environment and meet remedial action objectives;
- comply with or include a waiver of ARARs;
- be cost-effective;
- utilize permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable; and
- address the statutory preference for treatment as a principal element.

This FS report, the second element of Task 7, is the culmination of the process required by the SOW. It summarizes the remedial alternatives that were retained from the Alternatives Screening Technical Memorandum (ASTM) and the detailed and comparative evaluation of these retained alternatives that was conducted in the Comparative Analysis of Alternatives Technical Memorandum (CAATM). Both documents were submitted for USEPA review, and USEPA provided comments both initial and revised draft documents. USEPA comments were incorporated into both technical memoranda. As described in an August 17, 2007 letter from USEPA, EPA modified the ASTM pursuant to Subparagraph 21(c) of the AOC. This modified document was attached to that letter. The final ASTM was submitted on September 7, 2007. The revised draft CAATM was subsequently submitted on October 5, 2007 in accordance with deadlines established in the AOC. There has been no formal response received from the USEPA since that revised draft was submitted. This revised draft FS Report incorporates this latest version of the CAATM as Appendix A2. .

All potential remedial alternatives evaluated in this report were evaluated in the accordance with USEPA guidance (USEPA 1988). Remedial alternatives evaluated in this FS are summarized below.

Soil

The following eight alternatives were retained for soil:

Alternative S-1	No action
Alternative S-2:	Containment using engineered surface barriers;
Alternative 3-A:	Limited removal and off-site disposal;
Alternative S-3B:	Unlimited removal and off-site disposal;
Alternative S-4A:	Limited removal and on-site disposal;
Alternative S-4B:	Unlimited removal and on-site disposal;
Alternative S-5A:	Limited removal and on-site thermal treatment;
Alternative S-5B:	Limited removal and off-site incineration; and
Alternative S-6	Limited removal and on-site soil washing.

The no action alternative (***Alternative S-1***) while costing little to nothing will not provide any long-term protection. Containment using surface barriers (***Alternative S-2***) will prevent direct contact with surface contamination thereby reducing the risk to human health, but will need to be used in combination with other remedial alternatives for soil and groundwater to optimize effectiveness. Unlimited removal and off-site disposal (***Alternative S-3B***) will provide the highest long-term protection. However, this benefit is outweighed by the costs associated with this alternative, and potential short term and long term impacts during implementation. Although removal of all wood waste and fill soil from Kreher Park was evaluated as a potential remedial response, it may not be acceptable to the community if it results in the loss of future use of the park (i.e. restoration as shallow lakebed or wetland). Additionally, potential remedial alternatives requiring limited removal are more cost effective. Limited removal and off-site disposal (***Alternative S-3A***), limited and unlimited removal and on-site disposal (***Alternatives S-4A and S-4B***), and limited removal and thermal treatment (***Alternative S-5A***) will provide long-term protection with minimal short-term implementation issues. Unlimited removal and on-site disposal (***Alternative S-4B***) and off-site incineration (***Alternative S-5B***) would also provide long-term protection with minimal short-term implementation issues, but at a much higher cost. A pilot test would be needed to further evaluate the feasibility of limited removal and on-site soils washing (***Alternative S-6***) to ensure its effectiveness, but it could also provide long-term benefits with minimal short-term implementation issues.

Groundwater

The following nine alternatives were retained for groundwater:

Alternative GW-1:	No Action;
Alternative GW-2:	Containment using surface and vertical barriers;
Alternative GW-3:	In-situ Treatment using ozone sparge;
Alternative GW-4:	In-situ Treatment using surfactant injection and removal using dual phase recovery;
Alternative GW-5:	In-situ treatment using PRB walls:
Alternative GW-6:	In-situ treatment using chemical oxidation;
Alternative GW-7:	In-situ treatment using electrical resistance heating;
Alternative GW-8:	In-situ treatment using steam injection, and,
Alternative GW-9:	Groundwater extraction.

Institutional controls and monitored natural attenuation were not retained for screening as stand alone remedial responses; both technologies were evaluated as elements of other active remedial alternatives for soil and groundwater. Surface barriers, vertical barriers, and in-situ remedial responses that can also be used for soil were combined with other potential remedial technologies for soil and shallow groundwater contamination.

Groundwater remedial alternatives evaluated in this report include no action, containment, in-situ treatment, and removal technologies identified in the Alternative Screening Technical Memorandum (URS 2007a). No Action (***Alternative GW-1***) was also retained as required by the

NCP as a basis for comparing the other alternatives. Containment alternatives include ***Alternatives GW-2A and 2B*** (containment using surface and vertical barriers; Alternative GW-2A includes partial caps at Kreher Park, and Alternative GW-2B includes a cap for the entire park) and ***Alternatives GW-5*** (in-situ treatment using PRB walls). If implemented, ***Alternatives GW-5*** would be used with ***Alternatives GW-2A or GW-2B*** to minimize long-term treatment of shallow groundwater. Although costs to implement Alternative GW-2B and GW-5 are higher, long term operation maintenance costs would be reduced. Based on cost estimates presented in this report, the PRB wall ***(Alternative GW-5)*** will yield the lowest cost for containment at Kreher Park. ***Alternatives S-2A and S-2B*** yield higher costs due to long-term treatment of groundwater removed from the contained area. The remaining in-situ treatment alternatives include the following:

Alternative GW-3:	In-situ Treatment using Ozone Sparge;
Alternative GW-4:	In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery;
Alternative GW-6:	In-situ Treatment using Chemical Oxidation;
Alternative GW-7:	In-situ Treatment using Electrical Resistance Heating; and,
Alternative GW-8:	In-situ Treatment using Dynamic Underground Stripping/Steam Injection.

Removal technologies evaluated for groundwater include dual phase recovery and removal using extraction wells. Dual phase recovery was evaluated with ***Alternative GW-4*** (in-situ treatment using surfactant injection), and removal using groundwater extraction wells (***Alternatives GW-9A and GW-9B)*** was evaluated as a stand alone remedial technology; ***Alternative GW-9A*** includes continued operation of the existing system, and ***Alternative GW-9B*** includes the installation of additional groundwater extraction wells. However, all in-situ remedial technologies evaluated may require groundwater extraction in some capacity.

Containment is not a feasible remedial alternative for the Copper Falls aquifer. The remaining groundwater remedial alternatives could be used for shallow groundwater in the upper bluff area and Kreher Park and for the Copper Falls aquifer. Buried structures in the upper bluff area and the wood waste layer at Kreher Park may limit the effectiveness of in-situ treatment in these areas. If removal and disposal (on- or off-site) or on-site treatment is selected as a remedial response for soil, or if containment is selected for shallow groundwater, in-situ treatment and or removal will not be necessary for soil and shallow groundwater contamination. However, one or more of the in-situ or removal technologies evaluated in this report will be required for the Copper Falls aquifer.

Sediment

Five alternatives were retained for sediment:

Alternative SED-1:	No Action;
Alternative SED-2:	Limited dredging and containment within an on-site CDF;
Alternative SED-3:	Dredging to a four foot depth and containment with a subaqueous cap;
Alternative SED-4:	Dredge all sediment above the Remedial Action Objective; and
Alternative SED-5	Dry Excavation.

Alternative SED-1 (no action), while costing little to nothing, would not provide any long-term protection, and therefore should not be considered. ***Alternative SED-2*** would provide the most long-term benefit with the fewest short-term technical implementation and short term impacts of remedy (due to volatilization) issues. However there would be permanent loss of approximately seven acres of shallow lake bed habitat and administrative implementability may be difficult.

With ***Alternative SED-3***, approximately 78,000 cubic yards would be removed from the environment and either treated or disposed in a NR500 landfill. However, a subaqueous cap at the shoreline may be considered less permanent than a CDF. In addition the requirement for more debris removal and for sediment treatment as compared to SED-2 increases the short term risk of implementation of this alternative due to the likelihood that these activities would result in release of potentially harmful volatile emissions. As with ***Alternative SED-2***, administrative implementability may be difficult, although no lake bottom would be lost since the top of the cap would be designed to provide a fully functioning benthic habitat and not change the present bathymetry.

Alternative SED-4 would offer greater protection of human health and the environment than ***Alternatives SED-2 and SED-3***, but at a cost that is almost 30% greater than ***Alternative SED-2 and SED-3***. If all dredging is conducted mechanically and there is no need for thermal treatment ***Alternative SED-4*** is approximately $11,000,000 greater than ***Alternative SED-3*** ($41,300,000 versus $30,100,000). However if hydraulic dredging is required and there is a need to thermally treat the sediments the cost for ***Alternative SED-4*** could be as much as $20,000,000 greater than ***Alternative SED-3*** ($61,100,000 versus $41,700,000) In addition the requirement for substantially greater debris removal and for treatment of almost twice as much sediment under ***Alternative SED-3*** results in this alternative having the greatest short term risk of implementation due to the likelihood that these activities would result in release of potentially harmful volatile emissions. Unlike ***Alternatives SED-2 and SED-3***, ***Alternative SED-4*** does not have to be approved by the Governor and Legislature.

Alternative SED-5 is similar to SED-4 in achieving greater protection of human health and the environment. However, this alternatives is substantially more expensive than Alternative SED-4 (from approximately $25,000,000 to $33,000,000 or about 65% more expensive using similar sediment treatment) and also presents potentially greater risk to human health, because of the

need to work behind barriers engineered to keep out the waters of Lake Superior and because the project duration is estimated to be at least twice as long. If SED-5 were implemented the use of Kreher Park by the public would be precluded for almost four years which is two years more than with other alternatives..

If both ***Alternative SED-4*** and soil ***Alternative S-3B*** are selected, as much as 350,000 cubic yards of sediment and soil or more may require disposal. Given that outcome, it may be cost effective to site a private NR500 landfill in the Ashland area on property owned or purchased by NSPW.

Based on this evaluation, ***Alternative SED-4*** would provide the most long-term benefit at the least cost and with the fewest short-term technical implementation issues.

Introduction

1.0 Purpose and Organization of Report

This Feasibility Study (FS) report is the culmination of the feasibility process for the Ashland/Northern States Power Lakefront Superfund Site (Site). It was prepared consistent with the Statement of Work (SOW) appending Administrative Order on Consent CERCLA Docket No. V-W-04-C-764. As required by Tasks 5 and 7 of the SOW this FS report was preceded by the submission of three technical memoranda:

1) A Remedial Action Objectives Technical Memorandum (RAOTM): Finalized on June 6, 2007;
2) An Alternatives Screening Technical Memorandum (ASTM): Finalized on September 7, 2007; and
3) A Comparative Analysis of Remedial Alternatives (CAATM): Finalized on October 5, 2007.

The RAOTM was included as Appendix A of the RI Report. The ASTM is included in Appendix A1, and the CAATM is included in Appendix A2 of this FS Report.

In addition four treatability studies were conducted as part of the FS process. These treatability studies were proposed consistent with Task 6 of the SOW and included:

1) SITE demonstration project for treatment of groundwater;
2) Cap Flux Testing;
3) Bench Scale Air Emissions Testing; and
4) Multiphase Flow and Consolidation Testing.

A report describing activities completed during the SITE demonstration is included in Appendix B1. The Cap Flux Testing, Bench Scale Air Emission, and Multiphase Flow and Consolidation Testing report are included as Appendices B2, B3, and B4, respectively.

This FS report summarizes the development and screening of the remedial alternatives, presents the detailed analysis of remedial alternatives that were presented in the Comparative Analysis Technical Memorandum, and considers how the treatability studies influences the selection of remedial technologies. Section 9.0 includes an evaluation of integrated remedial responses completed for each area of concern to provide information EPA will need to prepare relevant sections of the Record of Decision (ROD) for the Site

1.1 Site Description

The Site consists of property owned by Northern States Power Company – Wisconsin (NSPW, a Wisconsin corporation doing business as Xcel Energy, which is a subsidiary of Xcel Energy

Inc.), a portion of Kreher Park[2], and sediments in Chequamegon Bay of Lake Superior which is an offshore area adjacent to Kreher Park. The Site is located in Section 33, Township 48 North, Range 4 West in Ashland County, Wisconsin, as shown on Figure 1-1. Existing site features showing the boundary of the site are shown on Figure 1-2, and former MGP features are shown on Figure 1-3.

The NSPW service center is located at 301 Lake Shore Drive East in Ashland, Wisconsin. The facility lies approximately 1,000 feet southeast of the shore of Chequamegon Bay of Lake Superior. The NSPW property is occupied by a small office building and parking lot fronting on Lake Shore Drive, and a larger shop/garage building and parking lot area located south of St. Claire Street between Prentice Avenue and 3rd Avenue East. There is also a gravel-covered storage yard area north of St. Claire Street between 3rd Avenue East and Prentice Avenue, and a second gravel-covered storage yard at the northeast corner of St. Claire Street and Prentice Avenue. A large microwave tower is located on the north end of the storage yard. The office building and vehicle maintenance building are separated by an alley. The area occupied by the buildings and parking lots is relatively flat, at an elevation of approximately 640 feet above mean sea level (MSL). Surface water drainage from the NSPW property is to the north. Residences bound the site east of the office building and the gravel-covered parking area. Our Lady of the Lake Church and School is located immediately west of Third Avenue East. Private homes are located immediately east of Prentice Avenue. To the northwest, the site slopes abruptly to the Canadian National (formerly known as Wisconsin Central Limited) Railroad property at a bluff that marks the former Lake Superior shoreline, and then to the City of Ashland's Kreher Park, on the shore of Chequamegon Bay.

[2] Reference to this portion of the Site as Kreher Park developed colloquially over the course of this project. Kreher Park consists of a swimming beach, a boat landing, an RV park and adjoining open space east of Prentice Avenue, lying to the east of the study area of the Site. For purposes of this document and to be consistent with past reports referenced, the portion of the Site to the west of Prentice Avenue, east of Ellis Avenue and north of the NSPW property is referred to as the "Kreher Park Area" or simply Kreher Park.

2.0 Summary of Community Relations Support

USEPA has delegated lead for the Community Relations aspects of the RI/FS to Wisconsin Department of Natural Resources (WDNR). NSPW has pledged its support in staffing and assisting in community outreach activities for the RI/FS process, as contemplated in the SOW.

USEPA and the Wisconsin Department of Natural Resources (WDNR) held a community workshop for residents in the Ashland area on October 25, 2007. The purpose of the work shop was to identify the outcomes or characteristics of a cleanup remedy most acceptable to the community. A summary report of the workshop prepared by USEPA is included in Appendix C.

3.0 Summary of the Remedial Investigation

3.1 Summary of RI Findings

Site characterization began in 1989 when apparent contamination was discovered at Kreher Park. Several phases of investigation were subsequently completed at Kreher Park and at the adjacent upper bluff area including a Remedial Investigation (RI) completed between March and November 2005. All historic and RI investigation results were presented in the *Remedial Investigation Report* dated August 31, 2007. As described in that report, the primary contaminants at the Site are derived from tar compounds,[3] including volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbon (PAH) compounds. Additionally, some free-phase hydrocarbons product (free product) derived from the tars is present as a non-aqueous phase liquid (NAPL), and have impacted soils, groundwater, and offshore sediments. Free-product referenced in this document includes both light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL).

DNAPL has been encountered in the upper reaches of a filled ravine near the former MGP facility on the NSPW property, at isolated areas at Kreher Park including the former "seep" area, in the offshore sediments, and in the upper elevations of the Copper Falls Formation, which behaves as a confined aquifer near the former MGP at the upper bluff area. DNAPLs encountered in the filled ravine (near the former MGP facility) and at isolated areas at Kreher Park were encountered at the base of these fill units overlying the Miller Creek Formation. The Miller Creek Formation is the confining unit for the underlying Copper Falls aquifer (see Section 3.1.2). LNAPLs were also observed across much of Kreher Park[4] as oily sheen in the underlying wood waste layer encountered during a test pit investigation at the Park.

Although DNAPL has also been encountered in off-shore sediment, it is less defined than on-shore locations due to the dynamic conditions in the affected sediments. DNAPLs in the deep aquifer correspond to high levels of VOCs in groundwater (> 50,000 µg/L), which is surrounded by a dissolved phase contaminant plume that extends north from the NAPL area in the direction of groundwater flow. A description of the site history, site setting, nature and extent of soil, groundwater, and sediment contamination from the RI follows.

[3] The term "tar" is used generically in this document to refer to a suite of VOC and PAH compounds the sources of which are the former MGP and other lakefront industrial operations including wood treatment activities.

[4] Fill used to construct Kreher Park consists of several feet of clean fill soil overlying several feet of wood waste. This wood waste layer consists of slab wood, logs, and other wood debris submerged near the shoreline to form a platform for lumbering operations in the late 19th century. Native soil units beneath the wood waste layer consist of a thin sand unit (beach sand unit) and the Miller Creek formation. The Miller Creek behaves as a confining unit for the underlying Copper Falls aquifer.

3.1.1 Site History

The Ashland NSP Lakefront Superfund Site (the "Site") consists of land and sediment located along the shore of Lake Superior, in Ashland, Wisconsin. The Site contains: (i) property owned by Northern States Power Company, a Wisconsin corporation (d.b.a. Xcel Energy, a subsidiary of Xcel Energy Inc. ("NSPW")); (ii) a portion of Kreher Park[5], a City owned property fronting on the bay which includes the former City Wastewater Treatment Plant (WWTP) structure; (iii) an inlet area containing contaminated sediment directly offshore from the former WWTP, and (iv) Our Lady of the Lake Church/School, as well as private residences. The Site is bounded by US Highway 2 (Lake Shore Drive) to the south, Ellis Avenue and its extension to the City marina to the west, Prentice Avenue and its extension to a boat launch to the east, and a line between the north termini of the marina and the boat launch to the north.

The NSPW property, located on an upper bluff fronting on Kreher Park, is the site of a former manufactured gas plant (MGP) that operated between 1885 and 1947. The MGP began as a small producer of gas for street lighting and other residential and commercial uses, and expanded over the next several decades. The plant predominantly employed the carburetted water gas process to manufacture gas.[6] The plant ceased operation in 1947 when the facility was dedicated to propane distribution. Since that time, the property has been used as an electrical repair shop and equipment storage facility first for Lake Superior District Power, followed by its current successor, NSPW.

Kreher Park includes lands formed from the filling of the bay during the late 1800s and early 1900s when the area was the site of major lumbering operations. These operations began in 1884 with the Barber Mill, which shortly changed ownership to the Sutherland Mill and then the Pope Mill over the succeeding 17 years. In 1901, the John Schroeder Lumber Company acquired the property and continued to expand lumber operations and shipping facilities on the lakefront. Schroeder's operations may have included wood treatment. Schroeder ceased operation around 1931, but owned the property until 1939. Ashland County then took ownership through a bankruptcy action in 1941, and subsequently transferred the title to the City of Ashland in 1942.

The lakefront property was utilized for the uncontrolled disposal of MGP waste (primarily tar through the ravine). Solid wastes, primarily demolition debris, were disposed along the western

[5] Kreher Park consists of a swimming beach, a boat landing, an RV park and adjoining open space east of Prentice Avenue, east of the subject study area of the Site. For purposes of this RI report and to be consistent with past documents, the portion of the Site to the west of Prentice Avenue, east of Ellis Avenue and north of the NSPW property is referred to as the "Kreher Park Area" or simply Kreher Park.

[6] LSDP and its predecessor records indicate that the MGP produced water gas exclusively during its tenure. An exception is for the year 1917, when records indicate that less than 15% of the total gas production was recorded as "coal gas." Brown's Directories for the same period (1913 – 1916) records that the Ashland MGP "will construct coal gas plant of 14,000,000 cf (14,000 mcf) capacity per annum." There is no further mention of this facility in Brown's beginning in 1917 (A history of Ashland MGP Tar Generation Records is included in Appendix D of the March 1999 Ashland/NSP Lakefront Feasibility Study report.)

side of the property in the 1940s. The City's waste water treatment plant (WWTP) was constructed in the early 1950s, expanded in the 1970s and continued to operate through the early 1990s. Since the City's ownership, numerous construction activities that resulted in substantial filling operations continued. These included the aforementioned waste disposal operation, construction in the early 1950s (and expansion in the early 1970s) of the WWTP, and construction of the City's marina in the mid 1980s. Marina construction included construction of boat slips and the extension of Ellis Avenue, which forms the western boundary of the Site.

In 1989 during exploratory drilling in preparation for another planned WWTP expansion, the City encountered coal tar contamination in the area south of the plant. The City notified the Wisconsin Department of Natural Resources (WDNR). The plant was ultimately relocated southeast of the City. Since the early 1990s, the WWTP has remained dormant. Since that time, the Kreher Park area has been used only for minor recreational purposes (a one-time miniature golf facility) and dry-dock marina boat storage.

The discovery of contaminants at Kreher Park initiated several investigations that culminated in the identification by the WDNR of the former MGP, and the naming of NSPW a potentially responsible party (PRP) for the MGP wastes/contamination at the site. The City of Ashland and an operating railroad were also named as PRPs for solid wastes disposed on their properties, in the mid to late 1990s. The WDNR and NSPW subsequently performed a series of independent investigations to assess the extent of contamination at Kreher Park and the NSPW property, respectively. In 1998 a local environmental group petitioned the United States Environmental Protection Agency (USEPA) to evaluate the Site for scoring on the national priorities list (NPL) for Superfund. The site was nominated in 2000, and formally added to the NPL in 2002. NSPW subsequently signed an administrative order on consent (AOC) with USEPA in 2003 to conduct a remedial investigation/feasibility study (RI/FS) at the Site. The purpose of this program is to fill data gaps identified from earlier investigations, and develop remedial alternatives for the Site.

A Work Plan for a supplemental site investigation was submitted and approved by USEPA in February 2005 fulfilling Task 1 of the AOC. This investigation was completed in 2005. Results of all historical and supplemental investigations were presented in a Remedial Investigation Report finalized in August 2007; these activities fulfilled Tasks 3 and 4, respectively, of the AOC. Potential remedial responses were screened in the Alternative Screening Technical Memorandum finalized in September 2007, which fulfilled Task 5 of the AOC. Treatability tests were completed in 2007 in accordance with USEPA approved work plans, fulfilling Task 6 of the AOC. Potential remedial responses were further evaluated in the Comparative Alternatives Analysis Technical Memorandum (CAATM) in accordance with Task 7 of the AOC. A revised draft of the CAATM was submitted for Agency review on October 5, 2007. The draft FS Report was submitted on October 29, 2007. This revised draft FS Report presents a summary of the RI Report, treatability study results, and detailed analysis of potential remedial responses.

3.1.2 Site Setting

Site geologic conditions have been determined from previous investigations along with supplemental investigations completed during the RI performed during 2005. Historic investigations included the visual classification of subsurface soil units from numerous soil borings, monitoring well boreholes and exploration test pits. Supplemental investigations completed for the RI included the installation of additional monitoring wells, the collection of surface and subsurface soil samples from borings and test pits, and a downhole geophysical survey. Geologic units investigated at the Site include the Miller Creek Formation and underlying Copper Falls Formation. Fill soil units were also encountered at the upper bluff and at Kreher Park. At the upper bluff area, fill soil was encountered in a former ravine that dissected the Miller Creek Formation in the vicinity of the former MGP facility. Kreher Park consists of fill material used to fill the former lakebed.

Hydrogeologic units correspond to geologic units identified during previous phases of investigation. The uppermost water bearing unit at the upper bluff area includes the Miller Creek Formation. Groundwater is also encountered in the fill material used to backfill the former ravine that dissected the Miller Creek Formation in the vicinity of the former MGP facility. The uppermost water bearing unit at Kreher Park consists of fill material used to fill the former lakebed; this fill material overlies the Miller Creek Formation. The fine-grained low permeability Miller Creek Formation creates an aquitard overlying the Copper Falls aquifer, behaving as a confining unit.[7]

Previous investigations have identified groundwater contamination in the ravine fill, the Kreher Park fill and the underlying Copper Falls aquifer. Groundwater contamination in the underlying Copper Falls aquifer is the result of former MGP operations. Contaminants, including nonaqueous phase liquids (NAPL) migrated to the underlying Copper Falls aquifer in the vicinity of the former MGP facility where the Miller Creek Formation lacks plasticity and where vertical hydraulic gradients indicate downward flow in the Copper Falls aquifer. These migration pathways may have been exacerbated by construction operations during the early life of the MGP. Strong upward gradients have likely limited the vertical migration of contaminants at down gradient locations north of this area. The transition from downward to upward gradients within the Copper Falls aquifer occurs at the alley immediately south of the NSPW service center. Site investigation results indicate that contaminants in the Copper Falls aquifer have migrated laterally along the interface between the Copper Falls aquifer and overlying Miller Creek aquitard.

[7] This document utilizes the term “aquifer” when referring to the hydrogeologic conditions in the Copper Falls Formation; similarly, it uses the term “aquitard” when referring to hydrogeologic conditions in the Miller Creek Formation.

3.1.3 Nature and Extent of Contamination

The contaminants at the Site are typical manufactured gas plant wastes. These include volatile organic compounds (VOCs) and a subgroup of the larger list of semivolatile organic compounds (SVOCs) referred to as polycyclic aromatic hydrocarbons (PAHs). The most abundant compounds from each of these groups include benzene (VOCs) and naphthalene (PAHs). Soils and groundwater at the Site are contaminated with these compounds, as are the offshore sediments in the affected inlet. Additionally, tar is present as dense non-aqueous phase liquids (DNAPLs) in the upper reaches of the filled ravine on the NSPW property south of St. Claire Street, and in the vicinity of a clay pipe encountered at the base of the ravine on the north side of the Street. It is also present at isolated areas at Kreher Park, including the former "seep" area and north of the former WWTP, in an area parallel to the shoreline extending across the historic lakebed northwest of the former WWTP, and in the upper elevations of the deep Copper Falls aquifer. The DNAPL in the deep aquifer has resulted in a dissolved phase contaminant plume that extends north from the DNAPL zone in the direction of groundwater flow, toward the bay. However, the thick clay aquitard (the Miller Creek Formation) provides a hydraulic barrier that separates the deep aquifer from the shallow groundwater encountered in Kreher Park fill and the bay waters in the area of the affected inlet. This separation is demonstrated by the strong artesian pressures measured at Kreher Park wells that are screened in the Copper Falls aquifer.

NSPW implemented interim removal actions in 2000 and 2002 to mitigate exposure risks to contaminants and to recover tar from the deep aquifer. A low-flow pumping system currently extracts tar from the deep aquifer, treating the entrained groundwater before discharging it to the City of Ashland's sanitary sewer. Additionally, NSPW installed an extraction well at the base of the former filled ravine that was the source of the seep discharge at Kreher Park. This extraction well was part of a larger interim action that included excavation of contaminated materials at the former seep area and placement of a low-permeability cap to eliminate the intermittent seep discharge and mitigate environmental exposure of the associated contaminants.

The remaining sources of contamination at the Site consist of discrete DNAPL zones derived from the tars that within each of the following locations:

1. In the filled ravine on the NSPW property;
2. At isolated areas at Kreher Park including the former "seep" area and former coal tar dump area;
3. In the offshore sediments; and
4. In the upper elevations of the deep Copper Falls aquifer.

The lateral extent of soil contamination identified in the upper bluff area, primarily in the backfilled ravine, and throughout the Kreher Park fill soil is shown in Figure 3-1. The lateral extent of shallow and deep groundwater contamination is shown on Figure 3-2. The area of impacted sediment is shown on Figure 3-3. The lateral extent of DNAPL in the filled ravine and Copper Falls aquifer is also shown on Figure 3-4, and the lateral extent of DNAPL at Kreher Park is shown on Figure 3-5. A description of the nature and extent of contamination in each area follows.

Filled Ravine

DNAPL has been encountered at the base of the filled ravine located south of St. Claire Street beneath the NSPW service center building and adjacent asphalt courtyard area. Part of this building includes an older section incorporating the former MGP building, and gas holders for the MGP are located within the filled ravine (see Figure 1-3). The depth of the center of the ravine in this area ranges from 15 to 20 feet below ground surface. The former ravine dissected the Miller Creek formation, which is the uppermost unconsolidated geologic unit in the Ashland area. This low permeability silty-clay/clayey silt unit is encountered at the base and flanks of the filled ravine. A perched aquifer has formed in the filled ravine because the fill material, which includes cinders, debris, and other locally derived detritus, is more permeable the surrounding native soil unit. Groundwater encountered within four to six feet of the ground surface is in hydraulic connection with the regional water table that extends across Site within the Miller Creek Formation.

Soil and groundwater in the filled ravine are contaminated largely by contact/proximity with the DNAPL on the south side of St. Claire Street. Contamination within the filled ravine down gradient from this area (beneath St. Claire and on the north side of St. Claire) has also been encountered. DNAPL was encountered in and around a 12-inch clay tile encountered at the base of the filled ravine on the north side of St. Claire Street during a 2001 investigation (see Figure 3-4). This clay tile was found to extend beyond the mouth of the filled ravine to the former seep area at Kreher Park. This discharge was eliminated in 2002 with the installation of an interception well (EW-4) at the mouth of the former ravine following the removal of contaminated soil and cap installation at the seep area. Although DNAPL or LNAPL has not been encountered in EW-4, groundwater currently extracted from the filled ravine is conveyed to the existing tar removal system for treatment prior to discharge to the sanitary sewer.

Kreher Park

Based on current data, the impacted area of Kreher Park consists of a flat terrace adjacent to the Chequamegon Bay shoreline. The surface elevation of the park varies approximately 10 feet, from 601 feet above MSL, to about 610 feet above MSL at the base of the bluff overlooking the park. The bluff rises to an elevation of about 640 feet above MSL, which corresponds to the approximate elevation of the NSPW property. The lake elevation has historically fluctuated about two feet, from 601 to 603 feet above MSL[8]. At the present time, the park area is predominantly grass covered. A gravel overflow parking area for the Ashland Marina occupies the west end of the property, while a miniature golf facility formerly occupied the east end of the site. The City of Ashland former waste water treatment plant (WWTP) and associated structures front the shoreline on the north side of the property. The impacted area of Kreher Park occupies approximately 13 acres and is bounded by Prentice Avenue and a jetty extension of Prentice

[8] Lake Superior has experienced historic low water levels since 2005. These historic low elevations have rebounded several inches in recent months (spring 2008) but remain below the normal range of 601 – 603 msl.

Avenue to the east, the Canadian National Railroad to the south, Ellis Avenue and the marina extension of Ellis Avenue to the west, and Chequamegon Bay to the north.

At Kreher Park, DNAPL is present at the seep area and in the former coal tar dump area north of the mouth of the filled ravine at Kreher Park. DNAPL contaminated soil above the wood waste layer was removed from the seep area in 2002 and replaced with clean fill. In the former coal tar dump area, DNAPL contaminated soil was encountered beneath several feet of clean fill overlying the wood waste layer. In both areas, DNAPL remains in the underlying wood waste layer, which underlies the entire Park. The former coal tar dump area and lateral extent of DNAPL at Kreher Park is shown on Figure 3-5.

Although the lateral extent of the DNAPL zone is limited, contaminated soil and groundwater conditions are widespread across the entire park area. Elsewhere at Kreher Park, contaminants were encountered in the wood waste layer beneath several feet of clean surficial soil. A LNAPL sheen was also observed in this wood waste layer, which was encountered at test pits locations throughout Kreher Park during the test pit investigation. Areas at Kreher Park with LNAPL yielded total VOC concentrations in groundwater below 5,000 µg/l significantly lower than VOC concentrations associated with DNAPL (> 50,000 µg/l).

Offshore Sediment

The offshore area with impacted sediments is located in a small bay created by the Prentice Avenue jetty and marina extensions previously described. For the most part, contaminated sediments are confined within this small bay by the northern edge of the line between the Prentice Avenue jetty and the marina extension. The affected sediments consist of lake bottom sand and silts, and are mixed with wood debris likely originating from former log rafting and lumbering operations. The wood debris layer is up to seven feet thick in areas, with an average thickness of nine inches. Wood debris overlays approximately 95% of the impacted sediments. Based on current data, the entire area of impacted sediments encompasses approximately sixteen acres based upon a Preliminary Remediation Goal (PRG) for sediment of 9.5 µg PAH /g @0.415% OC.

NAPL is also present in some sediments in the offshore zone along the Kreher Park shoreline, mainly at the sand/wood waste interface (historic lakebed). The most NAPL is in the area between the marina and an area north of the former WWTP from 100 to 300 feet from the shore. In this area NAPL is found at depths up to four feet below the sediment/water interface in this zone. A separate NAPL area is found at depths up to 10 feet between the former WWTP and the boat launch.

Copper Falls Aquifer

A DNAPL mass is present underlying the Miller Creek Formation in the same area of the NSPW service center. This material is found within the upper reaches of the Copper Falls aquifer, a sandy, coarse grained unit. DNAPL extends from depths of approximately 30 to 70 feet. The greatest thickness of DNAPL is present directly south of St. Claire Street within the main access drive of the NSPW service center. It thins in all directions from this area. The lateral extent of DNAPL in the underlying Copper Falls aquifer is shown on Figure 3-4.

NSPW has maintained a free product recovery system consisting of three extraction wells since the system was installed in 2000. Although this is a low flow pumping system, groundwater is used as a carrier to remove free product (NAPL), which necessitates the removal of groundwater. Through April 2008, 1.98 million gallons of contaminated groundwater have been removed from the Copper Falls aquifer. A significant percentage (99.3 percent) of this volume extracted is water. An oil water separator is used to separate NAPL from water. Contaminated water is then treated by carbon filtration prior to discharge to the sanitary sewer system. NAPL is placed in a storage tank and periodically transported off-site for disposal. Through April 2008, approximately 9,700 gallons of NAPL has been separated from groundwater for off-site disposal (0.7% of the total volume removed).

Although the carburetted water gas process used by the former MGP likely generated tar-water emulsions (typically 10% oil/tar and 90%water), NAPL with low water content is separated from the recovered groundwater. Analysis of free product/NAPL ("oil") samples collected from the storage tank yielded NAPL water contents of 0.17 and 4.34 percent[9].

Hydrogeologic conditions at the site have restricted the migration of contaminants in the underlying Copper Falls aquifer. The fine grained low permeability Miller Creek Formation behaves as a confining unit (aquitard) for the Copper Falls as indicated by strong upward vertical gradients that increase with depth in nested wells screened in this unit. These strong upward gradients have resulted in the migration of the plume in the upper Copper Falls along the interface with the Miller Creek. Although it has been determined that groundwater flow in the upper bluff area is to the north toward Chequamegon Bay, the lateral extent of contamination beneath Kreher Park is limited by a stagnation zone located between the shoreline and the bluff face. This stagnation zone has formed in response to an increase in the thickness of the Miller Creek aquitard toward the shoreline, which results in and increase in the artesian pressure in the underlying confined aquifer. Wells screened in the aquifer north of the bluff face forming the boundary between Kreher Park and the NSPW property are flowing (artesian) wells. This stagnation zone is characterized by a trough of low artesian pressure located near the center of the Park between the shoreline and at the bluff face. In the deeper portions of the Copper Falls aquifer groundwater likely flows beneath Chequamegon Bay. Additional wells may be needed

[9] Samples D-1 and D-2 yielded water contents of 43,400 and 1,700 ug/g, respectively, by the Karl Fisher titration method, which is commonly used to accurately measure water content in oil. Laboratory reports for these samples are included in Appendix D-4 of the RI Report.

to ensure that contaminants are not migrating beyond the shoreline in deeper portions of the Copper Falls.

3.1.4 Contaminant Fate and Transport

The source of the contamination at the Site was caused primarily by the MGP and other multiple industrial activities that began in the 1880's and continued until the mid 20th century. Although contaminant sources were no longer active after that time, continued filling activities further dispersed these contaminants. However, no large scale activities capable of mobilizing contaminants, or filling activities that add contaminant mass to the source areas have occurred at the Site since the closure of the WWTP in the early 1990s.

The primary source of contamination at the upper bluff/filled ravine, Kreher Park, Copper Falls aquifer and Chequamegon Bay is from the historic MGP operations. Contamination likely resulted from discharge of waste tars generated from the carburetted water gas manufacturing process. The tar material accumulated at the base of the ravine fill in the immediate area of the MGP facilities south of St. Claire Street and was dispersed throughout the inlet prior to filling at Kreher Park.

The tar has migrated into the bay and contaminated the Chequamegon Bay area. The migration of this material to the Copper Falls aquifer also occurred where the overlying Miller Creek Formation is less plastic and hydrogeologic conditions allow downward flow conditions. This area is south of the alley behind the present NSPW service center.

Waste tars released during MGP operations migrated through the ravine fill and the buried clay tile to the base of the former ravine. The source of the NAPL at the seep was the MGP. The tile was likely part of a sewer system installed contemporaneously during the early operation of the MGP. A 1902 City of Ashland sewer ordinance required the underground discharge of MGP wastes, and this pipe may have been installed as a result. However, the NAPL mass found south of St. Claire Street indicates this material was released at least in part and not entirely captured by this pipe system. Following backfilling of the ravine, releases of NAPL likely continued through the clay tile pipe. This material migrated to the downstream end of the tile, likely connected to a second tile system identified during the 2005 RI. This tile paralleled the bluff face and was traced to the location of an upstream inlet of a former open sewer identified at the west side of Kreher Park. Although actual records have not been recovered, this pipe network was likely part of a larger sewer system abandoned following cessation of industrial activities at the park in the late 1930s, when the open sewer was filled. Once the open sewer was abandoned, NAPL then discharged through breeches in the pipe network, such as at the seep.

The source of NAPL to the sediments likely resulted from a combination of effects. Direct discharge of wastes through the open ravine to the inlet prior to its filling is one source. Discharges of wastes from the open sewer prior to its filling and abandonment constitute another source. The wastes came primarily from the MGP, and potentially from other upland locations connected to the open sewer. Additionally, based on the distribution of NAPL in the sediments other discharge points in addition to the open sewer could be present. It is likely that the

distribution of this material has been affected by construction and filling activities that continued following cessation of other lakefront operations.

The highest levels of VOC contaminants at Kreher Park are found at areas corresponding to NAPL zones. These are comparable with levels near other NAPL zones at the upper bluff/filled ravine and Copper Falls aquifers. The levels are consistent for both soil and groundwater. Because of the high mobility and high solubility of the VOCs, the high permeability/flat horizontal groundwater gradient has led to widespread VOC contamination in groundwater at Kreher Park. However, these levels are generally an order of magnitude lower than samples collected near the NAPL areas.

In contrast, the soil data from Kreher Park show the opposite relationship regarding PAHs, with an order of magnitude increase in PAH levels across the majority of the park compared to the upper bluff/filled ravine. The PAHs are less mobile and less soluble compared to the VOCs, degrading more slowly. This chemical behavior combined with the physical characteristics in the fill material have created conditions for the PAHs to remain present and at similar levels in the fill since they were first released. The highest levels are most pronounced in the area of the former coal tar dump. Another potential source is the off-loading of fuel feedstocks for other raw materials to support lakefront industrial activity.

Contaminants in the affected sediments likely originated from a variety of sources. One likely source may have been the open sewer when it was functional.

3.1.4 Conceptual Site Model

This section develops a conceptual site model (CSM) for the Site with regard to historical perspective regarding current contaminant disposition. This overview builds upon the previous information discussed to construct this model. The information presented is based on the historical record gathered from maps, physical and forensic analyses, eyewitness accounts and other documents. It is intended to provide a comprehensive interpretation of contaminant sources and present conditions based on previously developed as well as the latest data developed during the 2005 RI.

3.1.4.1 Historical Setting Summary

The MGP was constructed on the east flank of the former ravine in the mid 1880s. Contemporaneously, lumber operations at the lakefront were active with the Pope, Barber and Sutherland mills. The land on which these mills operated was reclaimed lakebed constructed from logs and other wood materials rafted from the Apostle islands and the Arrowhead Region of northern Minnesota. By 1901 the ravine was filled with locally available materials to the level of St. Claire Street, although it was still open to the north. Filling continued at that time at the lakefront; much of the western portion of present day Kreher Park was filled and the open sewer was present. The John Schroeder Lumber Company had begun its operations by this date. During this time the sewer network linking the open sewer to the clay tile in the ravine was installed. This timeframe corresponds to the 1902 City of Ashland ordinance forbidding the

direct discharge to Chequamegon Bay of manufactured gas plant wastes except via an underground conveyance. Eight years later, by 1909, much of the ravine had been filled, although the bluff face was several feet south of its current location. Later records from 1923 show an expansion of the gas plant with the addition of gas holders and tanks, and expansion of the sawmill and appurtenances at the Schroeder facility. By 1946, Schroeder's facilities remained, but active operations had ceased in the late 1930s. The open sewer was still visible, and the MGP reached its maximum output. By 1951, some of the MGP facilities remained (one holder), although it was no longer operating. A large horizontal tank (propane) was present on the MGP plant site.[10] At the lakefront, the area of the open sewer had been filled, and the Schroeder facilities had been removed. The shoreline had been altered/filled in the area of the former sawmill, and the coal tar dump area was shown on historical maps.

The WWTP was constructed in the early 1950s and began operation in 1953, and was expanded in 1973. During this time, the shoreline east of the WWTP was altered, and additional filling occurred to extend the Prentice Avenue boat launch. The NSPW service center was constructed in the late 1960s. The Ellis Avenue marina was later constructed in 1986. When investigation for a second expansion of the WWTP found contamination in the area of the former coal tar dump in 1989, the project was abandoned. The City later moved operations for the WWTP to another location southeast of the City in 1992.

3.1.4.2 Contaminant Sources and Disposition

During the life of the MGP, releases of NAPL to the environment occurred. Records indicate that a small quantity of this tar material was utilized for fuel or sold, but much was inadvertently lost. The likely routes for discharge of tar is direct discharge of tar into the filled ravine prior to installation of the 12-inch clay tile, and continuing releases to the clay tile pipe network/open sewer when it was functional. It is possible that some of the tar material was entrained in plant wastewater that was discharged to a sewer (e.g., the clay tile). Other tars and NAPL generated as co-product in the gas manufacturing process (such as at holders or releases from fuel tanks) discharged directly to the environment. This material migrated to the base of the ravine, following complete backfilling of the ravine early in the life of the MGP. Other material migrated to the Copper Falls aquifer. Wastewater and other incidental NAPL discharged to the sewer were conveyed via the clay pipe network to the open sewer and then to the bay inlet.

In 1900, Schroeder Lumber began operation at the lakefront. It performed active sawmilling and other lumber operations for more than three decades. The County acquired the lakefront property in 1941; the City then acquired the property from the County in 1942.

Additionally, other industrial sources (such as rail car offloading of feedstocks and raw materials for MGP and other industrial activities) may have caused or contributed to high levels of PAH-rich contaminants at the Lakefront.

[10] This tank and another smaller tank were serviced by underground lines which extended to a railcar loading manifold located at the seep area. These operated during the late 1940s through the 1960s.

In 1947, continued releases of NAPL from the MGP were eliminated with cessation of its operations. However, remnants of NAPL in the ravine continued to migrate via the clay tile to the seep area, discharging to the surface during high flow (storms, etc.) conditions. Since this time, NAPL and the associated groundwater plume in the Copper Falls aquifer continued to migrate north. However, data from these investigations confirm that a potential stagnation or convergence zone in the Copper Falls aquifer in the area of MW-2B(NET) has potentially restricted further movement of the plume to the north (since 2000), the NAPL removal system has removed a fraction (more than 9,700 gallons of product) of the NAPL and dissolved plume mass).

In 1952, the City of Ashland began construction of the WWTP. During the construction, the remnants of the industrial wastes including historic waste from the MGP at the Lakefront were likely discharged to the bay to allow for installation of the new sewer network. The clay core wall was installed to prevent groundwater infiltration into basement areas, and the pipe/sewer distribution network to the new WWTP was constructed. The latter further damaged the earlier pipe network connected to the former open sewer. The distribution of contaminants in sediments along the shoreline was significantly affected by this activity. Other construction actions that occurred after this time that may have further affected contaminant disposition include the WWTP expansion in 1973, and the marina construction in 1986. Since operations at the WWTP were relocated in 1992, no significant contaminant contribution action has occurred.

The residual contamination remaining in the ravine continued to discharge to Kreher Park via the buried tile and fill material. Surface breakthrough was observed following rainfall events. The tile investigation in 2001 crushed and removed much of the tile. The seep remediation in 2001 removed much of the surface contamination at the seep, replaced it with clean fill, and installed EW-4 to capture residual contamination migrating through the seep into the mouth of the ravine. This pathway has been subsequently removed and further migration through the ravine controlled.

The residual contamination at Kreher Park continues to migrate to the lake sediments from the primary NAPL source areas. The contaminants in the fill appear to be in dynamic equilibrium with the sediments. NAPL sources in sediments near the shoreline appear to impact near shore upland areas, as shown by historical monitoring of product levels near the north side of the WWTP (TW-11) and shoreline water quality (PDB) data. These conditions are also demonstrated by vertical gradient measurements between piezometers screened at the base of the fill and water table wells at the shoreline.

3.1.4.3 Summary

The above mentioned CSM corresponds with the historical findings and data developed since investigations began at the Site. The zones of NAPL in the filled ravine and Copper Falls aquifers as well as at the seep occurred through the transport mechanisms described above. Contaminant loading to sediments potentially occurred from the day the MGP began operation

initially through direct discharge in ravine and later through clay tile, bluff pipe and open sewer networks. Following filling and abandonment of the sewer system this pathway was eliminated. However, the contaminant loading in the sediments continued through groundwater/NAPL discharge into the lake. Later discharge of residual contamination at Kreher Park by the City via culverts and construction activities occurred prior to and after WWTP construction. The distribution of contaminants in sediments are only explained as multiple discharge points. However, the primary source for the sediment contamination is likely the former MGP. Additionally, the high levels of PAHs in soil at Kreher Park compared to the upper bluff suggest the likelihood of a source at the Lakefront not exclusively caused by MGP waste tars. These other potential sources include spills during rail car off loading of fuel feedstocks and raw materials to support industrial activity, including the former MGP facility and former lumber operations at the lake front.

3.2 Summary of Site Risks

3.2.1 Current and Future Site Use

Current and future uses of the Site include recreational users/visitors, residential (in established residential areas on top of bluff near Xcel Energy office), fishers (both recreational and potentially subsistence), and construction, maintenance and industrial workers. Trespassers are also likely under current conditions in the abandoned WWTP area. Future use of the Kreher Park portion of the Site does not include a residential scenario.

3.2.2 Risks to Human Health

The results of the human health risk assessment (HHRA) for Ashland/NSP Lakefront Superfund Site (Site) in Ashland, Wisconsin (Site) indicate that seven exposure pathways result in estimated risks that exceed U.S. Environmental Protection Agency's (USEPA's) target risk levels(an incremental cancer risk [CR] of 10^{-4} to 10^{-6} and a hazard index [HI] $\leq$ 1) and eight exposure pathways result in estimated risks that are either equivalent to or exceed the Wisconsin Department of Natural Resources' (WDNR's) threshold of (i.e., CR $\leq 1\times10^{-5}$ and HI] $\leq$ 1). These exceedances are indicated below.

Exceeds USEPA Threshold ($CR \geq 1\times10^{-4}$ or HI >1)	Exceeds WDNR Threshold ($CR \geq 1\times10^{-5}$ or HI >1)
Residents (Soil[0-3 feet and all soil depths] - Cancer)	Residents (Soil[0-3 feet and all soil depths] - Cancer)
–	Residential Child (Soil – Noncancer)
Construction Worker (Soil [0-10 feet bgs]/Groundwater)	Construction Worker (Soil [0-10 feet bgs]/Groundwater)
Construction Worker (Trench Air)	Construction Worker (Trench Air)
Adult Swimmer (Surface Water)	Adult Swimmer (Surface Water)
Adult Wader (Surface Water/Oil slicks)	Adult Wader (Surface Water/oil Slicks/Sediment)
Industrial Worker (Indoor Air)	Industrial Worker (Indoor Air)
Subsistence Fisher (Biota)	Subsistence Fisher (Biota)

HI: Hazard index for noncarcinogenic effects

These include estimates for the reasonable maximum exposure (RME) scenarios for potential cancer risks and non-cancer risks. These conclusions are based on assumed exposures to soil in the filled ravine area (for residential receptors) and the filled ravine, upper bluff and Kreher Park area (for construction worker receptors), and to indoor air samples collected at NSPW Service Center. Carcinogenic risks based on central tendency evaluation (CTE) scenarios indicate that only the residential receptor exposure to soil (all soil depths to 10 feet bgs) are estimated to be at a CR of 1×10^{-4}, the upper-end of the USEPA target risk range or greater than the WDNR threshold. Noncarcinogenic risks for the residential receptor (for soil depths 0-1 foot and 0-3 foot bgs) and risks associated with the construction scenario are within acceptable levels. However, residential receptor exposure to subsurface soil is not expected, given the current and potential future land use of the Site. For this Site, residential risks associated with exposures to surface soil (0 to 1 foot bgs) are within the target risk ranges.

Although the results of the HHRA indicate risks for the construction workers under the RME conditions exceed USEPA's target risk levels, the assumptions used to estimate risks to this receptor were conservative and assumed the worst case. Given both the current and future land use of the Site, it is unlikely that construction workers would be exposed to soil in the filled ravine and Upper Bluff. The most likely scenario for the future construction worker is exposure to soil within 0 to 4 feet below ground surface (bgs) at Kreher Park (a typical depth for the installation of underground utility corridors), as most activities associated with the implementation of the future land use would be associated with regrading, landscaping, and road or parking lot construction. Therefore, risks to this receptor population are most likely overstated in this HHRA.

An HI of 3 was calculated for the general industrial worker exposure to indoor air pathway under the RME conditions. This risk level is likely to be an overestimate because:

- It was estimated using the maximum detected concentrations as the concentrations at points of exposure.
- It was calculated based on USEPA default exposure parameters for the industrial /commercial workers (i.e., an individual works at the Site for 8 hours per day, 5 days per week, 50 weeks per year for a total of 25 years). The NSPW Service Center is used as a warehouse; there is an office space inside the building, but used only on a part-time basis.

Cancer risks to subsistence fisher (finfish) are equivalent to the upper-end of the USEPA target risk range, but greater than the WDNR threshold of a CR of 1×10^{-5}. Noncarcinogenic risk is within acceptable limits for both USEPA and WDNR.

Risks to recreational children (surface soil) are equivalent to the WDNR risk threshold. However, risks to adolescent and adult receptors exposed to surface soil are below the USEPA acceptable risk range and below the WDNR risk threshold.

Risks to waders and swimmers (sediments), industrial workers (surface soil), and maintenance workers (surface soil) are all within USEPA's target risk range of 10^{-4} to 10^{-6} for lifetime cancer risk and a target HI of less than or equal to 1 for non-cancer risk and are greater than the WDNR threshold of 1×10^{-5} for lifetime cancer risk and a target HI of less than or equal to 1 for non-cancer risk.

At the request of the Wisconsin Department of Health and family Services (WDHFS), risks were also estimated for construction workers exposed to "oily materials" in groundwater via dermal contact and swimmers and waders who may be exposed to oil slicks in surface water via ingestion and dermal contact. Because no media-specific concentrations are available for either scenario, risks were estimated using analytical data collected from the product stream from the active NAPL recovery system for the Copper Falls aquifer or chemical-specific solubility values detected in the DNAPL sample. Risks to construction workers exposed to "oily material" in groundwater and adult swimmers and waders exposed to "oil slicks" in surface water is greater than both the USEPA upper risk range (CR 1×10^{-4} and HI of 1) and than WDNR threshold (CR 1×10^{-5} and HI of 1). However, it is important to note that there is much uncertainty associated with estimating risks to oily material in groundwater or oil slicks in surface water. The primary uncertainties are associated with the lack of established methodology for estimating this exposure pathway.

3.2.3 Risks to Ecological Receptors

The BERA concluded that the potential for adverse effects to ecological receptors other than benthic macroinvertebrates was not sufficient to result in significant adverse alterations to populations and communities of these ecological receptors. Unacceptable impacts to the benthic macroinvertebrate community in aquatic portions of the Site are possible. Two lines of evidence, bulk sediment chemistry and sediment toxicity testing, indicated that the probability of impairment at the community level was likely.

However, the fact that hydrocarbons are sporadically released as sheens from Site sediment during some high energy meteorological events or when disturbed indicates the potential for impact to the benthic community that may not have necessarily been fully measured by the studies conducted to support the RI. While there is no evidence that effects from these releases will lead to impairment of populations and communities of these receptors inhabiting the waters of Chequamegon Bay, the presence of this continuing source degrades the functioning of a healthy aquatic community in the Site area.

In addition, if normal lakefront activities, i.e., wading, boating etc., were not presently prohibited, the disturbance of sediments and concomitant release of subsurface contaminants of potential concern (COPCs) would increase. This potentially could lead to greater impacts than were measured during these RI/FS studies.

3.3 Calculation of Areal Extent and Volume of Contaminated Media

Based on site investigation results presented in the RI Report, subsurface contamination in the upper bluff area is associated with the former gas holders and located in the filled ravine adjacent to the former MGP building. The filled ravine south of St. Claire Street is currently occupied by the NSPW service center/garage building and an asphalt covered court yard area. However, the filled ravine extends to the north beneath St. Claire Street and a gravel covered NSPW storage yard. The former ravine is filled with material consisting of a mixture of soil, ash, cinders, brick and concrete debris, and minor amounts of glass and metal debris. DNAPL has been encountered in the filled ravine in the vicinity of former gas holders south of St. Claire Street and along the trace of a clay tile encountered at the base of the ravine north of the street. DNAPL has also migrated into the underlying Copper Falls aquifer. The Copper Falls is a confined aquifer underlying the low permeability Miller Creek Formation, which behaves as the confining unit. DNAPL has migrated vertically in this area. The release to the Copper Falls is believed to be located near the former MGP facility where the former ravine dissected this confining unit.

Kreher Park consists of a flat terrace adjacent to the Chequamegon Bay shoreline. The impacted area of Kreher Park occupies approximately 11.5 acres and is bounded by Prentice Avenue and a jetty extension of Prentice Avenue on the east, the Canadian National Railroad on the south, Ellis Avenue and the marina extension of Ellis Avenue on the west, and Chequamegon Bay on the north. The surface elevation of the park varies approximately 10 feet, from 601 feet above MSL, to about 610 feet above MSL at the base of the bluff overlooking the park. The bluff rises to an elevation of about 640 feet above MSL, which corresponds to the approximate elevation of the NSPW property. The lake elevation has historically fluctuated two feet, from 601 to 603 feet above MSL. At the present time, the park area is predominantly grass covered. A gravel overflow parking area for the Ashland Marina occupies the west end of the property; the residual structures of a former miniature golf facility occupy the east end of the site. The City of Ashland former waste water treatment plant (WWTP) and associated structures front the shoreline on the north side of the property. Assuming an average thickness of 12 feet, an estimated 223,000 cubic yards of fill material has been placed between Prentice and Ellis Avenues.

The offshore area with impacted sediments is confined to a small bay created by the Prentice Avenue jetty and marina extensions previously described. The affected sediments consist of lake bottom sand and silts, mixed with and overlain by wood debris that originated from former log rafting lumbering operations. The wood debris layer is up to six feet thick in areas, with an average thickness of nine inches. Wood debris overlays approximately 95% of the impacted sediment. Based on current data, the entire area of impacted sediments encompasses approximately sixteen acres based upon a Preliminary Remediation Goal (PRG) for sediment of 9.5 µg PAH /g @0.415% OC.

The areal extent of soil, groundwater and sediment contamination has been identified based in historic and RI Site Investigation results presented in the RI Report. For the purpose of preparing this document, these results were used to estimate the areal extent of contamination be media. The areal extent of contamination identified for soil, groundwater, and sediment is shown on Figures 3-1, 3-2, and 3-3, respectively. The volume of contaminated media is summarized in Table 3-1, and calculations are included in Appendix D1.

Remedial Action Objectives (RAOs) for the Site, included in Appendix A of the RI Report, can be achieved by containing contaminants on-site, removing highly contaminated source areas, or removing all contaminated media. Potential remedial alternatives evaluated for soil include containment, limited removal of highly contaminated soil, and unlimited removal of all fill soil. Potential remedial responses for sediment include: removal of all sediment to maximum depths of four and ten feet with off-site disposal and/or containment within a CDF, and/or various capping methods. Consequently volume calculations for these potential remedial responses are also shown on Table 3-1, and calculations are included in Appendix D1.

Table 3-1. Volumes and Areal Extent of Contaminated Media

Media	Volume (cubic yards)	Assumptions
Soil		
Upper Bluff Area		
Upper Bluff Area	32,600	Areal extent of contamination at upper bluff where benzene exceeds RCL is approximately 2.02 acres, and thickness is 10 feet. (Includes soil contamination beneath former MGP building).
Filled Ravine Volume	20,700	Areal extent of filled ravine is approximately 1.28 acres, and thickness is 10 feet.
Filled Ravine - Unlimited Removal Volume (Unsaturated and Saturated Zones)		
Filled Ravine	35,000	Areal extent south of alley is approximately 1.09 acres and average depth of 20 feet.
Filled Ravine - Limited Removal Volume (Unsaturated and Saturated Zones		
Former Gas Holder Area	9,400	Areal extent of contamination is 130 by 130 feet, and thickness is 15 feet.
Former Clay Tile Area	150	Areal extent of contamination is 75 by 10 feet, and thickness is 5 feet.
Kreher Park		
Kreher Park	224,600	Areal extent of all fill is approximately 11.6 acres and thickness is 12 feet.

Table 3-1. Volumes and Areal Extent of Contaminated Media		
Media	**Volume (cubic yards)**	**Assumptions**
Unsaturated Zone Soil Volume	83,700	Areal extent of contamination is approximately 10.38 acres, and average thickness is 5 feet.
Saturated Zone Soil Volume	117,200	Areal extent of contamination is approximately 10.38 acres, and average thickness is 7 feet.
Former Coal Tar Dump Area	4,800	Areal extent of contamination is 260 feet by 100 feet (approximately 0.5 acres), and layer is 5 feet thick.
Groundwater		
Upper Bluff Area	65,600	Areal extent of contamination is approximately 2.71 acres, and saturated thickness is 15 feet.
Kreher Park	133,900	Areal extent of contamination is approximately 10.38 acres, and saturated zone is 7 feet.
Copper Falls Aquifer	Upper Bluff 366,700 Kreher Park 133,500 Total 500,200	Areal extent of contamination is 6.9 acres, average thickness of 35 feet beneath Kreher Park, and 50 feet beneath upper bluff area.
Sediment		
Sediment exceeding 10 µg/g[1]	73,800	Approximate areal extent of contamination outside of CDF "footprint" is 10 acres. Estimate includes removal of all wood waste and contaminated sediment in this area.
Sediment exceeding 10 µg/g[1]	78,000	Approximate areal extent of contamination is 16 acres, and includes removal of wood waste and all contaminated sediment to maximum depth of 4 feet.
Sediment exceeding 10 µg/g[1]	133,900	Approximate areal extent of contamination is 16 acres, and includes removal of wood waste and all contaminated sediment to maximum depth of 10 feet.

[1]For purposes of estimating sediment volumes the 9.5 ug PAH/g dwt was rounded to 10 ppm and it was assumed that the concentration was on a dry weight basis.

3.3.1 Soil

Soil contamination was identified at the upper bluff area, primarily in the backfilled ravine, and throughout the Kreher Park fill soil (see Figure 3-1). Benzene was used to conservatively approximate the lateral extent of soil contamination because it has a low clean up standard and is the most frequently occurring VOC constituent in free product waste generated at the former MGP facility. Based on the benzene exceedances of residual contaminant level (RCL) per ch. NR 720, WAC, the areal extent of contamination in the upper bluff area encompasses approximately 2 acres. Assuming an average thickness of 10 feet, this yields 32,600 cubic yards of contaminated soil in the upper bluff area However, as shown in Figure 3-1, soil contamination underlies the NSPW facility buildings (including the former MGP building), parking lots, and St. Clair Street. Approximately 1.28 acres of this 2 acre area is underlain by the filled ravine. Assuming an average thickness of 20 feet, the filled ravine contains an estimated 41,300 cubic yards of fill material.

The filled land at Kreher Park between Prentice and Ellis Avenues occupies approximately 11.6 acres. Assuming a thickness of 12 feet, approximately 224,600 cubic yards of fill material was placed in this former lakebed area to create the existing lakefront area. As with the upper bluff area, benzene was used to conservatively estimate that the lateral extent of soil contamination at the lakefront includes approximately 10.38 acres of Kreher Park. Contaminated soil at Kreher Park underlies a layer of clean fill that ranges in thickness from two feet at the former coal tar dump area to five feet across the remainder of the park. The surface of the park is approximately 5 feet above lake level. Assuming an average thickness of 5 feet, this yields approximately 83,700 cubic yards of unsaturated zone fill soil at Kreher Park. Comparatively, an average thickness of 7 feet yields approximately 117,200 cubic yards of saturated zone fill material.
Potential remedial alternatives for soil evaluated in Section 6.3 focused on the removal of areas with the highest levels of contamination to achieve RAOs. As described in Section 3.1.3 above, these include areas where DNAPL is encountered. At the upper bluff area, this includes an area approximately 130 feet by 130 feet located beneath the central portion of the NSPW service center and adjacent courtyard area; former gas holders for the former MGP were located in this area. Removal south of St. Claire Street will include the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 to 9,400 cubic yards. Additionally, removal north of St. Claire Street will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide; at the base of the ravine contaminated soil will be removed from a zone 5 to 10 feet wide, 75 feet long, and 5 feet thick. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.

At Kreher Park, the highest levels of soil contamination encountered above the saturated wood waste layer in the former "coal tar dump area." This area is approximately 260 by 100 feet. Assuming an average depth of 5 feet, there is an estimated 4,800 cubic yards of contaminated soil in this area.

3.3.2 Groundwater

Groundwater contamination was identified in the perched aquifer overlying the Miller Creek formation and in the underlying Copper Falls aquifer. As shown on Figure 3-2, the areal extent of shallow groundwater contamination at the upper bluff area and at Kreher Park is similar to the areal extent of soil contamination (see Figure 3-1.) Compared to shallow groundwater contamination, the areal extent of contamination in the Copper Falls is more extensive at the upper bluff area, but less extensive at Kreher Park. Benzene was used to conservatively approximate the lateral extent of groundwater contamination because it has a low clean up standard and is the most frequently occurring VOC constituent in free product waste generated at the former MGP facility. Based on benzene Enforcement Standard (ES per ch. NR, 140 WAC exceedances), the areal extent of shallow groundwater contamination encompasses almost 3 acres in the upper bluff area and over 10 acres at Kreher Park. The plume in the underlying Copper Falls aquifer is almost 7 acres in size.

Assuming an average thickness of 15 feet, this yields a volume of 65,600 cubic yards of contaminated saturated media (groundwater) in the upper bluff area. Assuming an average thickness of 7 feet, this yields 129,900 cubic yards of contaminated saturated media at Kreher Park. There is an estimated 500,200 cubic yards of contaminated saturated media for the Copper Falls aquifer. This estimate assumes an average plume thickness of 50 feet in the upper bluff area and 35 feet beneath Kreher Park. The actual volume of contaminated groundwater will be less than the volume of saturated media

3.3.3 Sediment

The areal extent of sediment contamination is shown on Figure 3-3. Laboratory results and sample coordinate data for sediment samples were incorporated into geographic information system (GIS). Using ArcGIS, the areal extent of contaminated sediment was first calculated for total PAH concentrations exceeding 10 ppm dry weight (dwt)[11]. Approximately 16 acres of the Site contains total PAH concentrations in excess of 10 ppm. The volume of sediment in the 16 acres was then calculated for contamination up to maximum depths of 4 and 10 feet. Total PAHs exceeding 10 ppm include an estimated 77,800 cubic yards of sediment between 0 and 4 feet, and an estimated 133,900 cubic yards of sediment up to a maximum depth of 10 feet. All volume estimates include wood waste overlying and mixed with the contaminated sediment.

[11] For purposes of estimating sediment volumes the 9.5 ug PAH/g dwt was rounded to 10 ppm and it was assumed that the concentration was on a dry weight basis. The volume of contaminant mass increases as the clean-up standard declines, but the difference between 9.5 and 10 ppm is likely insignificant when estimating volumes for such a large area. In addition the data do not support any greater accuracy in estimating the volume for purposes of FS cost estimates.

4.0 Results of SITE Program Demo/Treatability Studies

4.1 SITE Program Demo

In collaboration with NSPW, EPA conducted a Superfund Innovative Technology Evaluation (SITE) technology demonstration project at the former MGP site. Participants in the demonstration include NSPW, USEPA (Region 5), WDNR, USEPA's Office of Research and Development's National Risk Management Laboratory (NRML) based in Cincinnati, Ohio, and EPA's Technology Innovation and Field Services Division (TIFSD) based in Washington, DC. The technology evaluated is In Situ Chemical Oxidation (ISCO) process using Cool-Ox provided by collaboration between DCI Environmental Remediation Contractors and DeepEarth Technologies, Inc. (DCI/DTI). The field demonstration was completed between November 2006 and February 2007. A report prepared by DCI/DTI describing completed activities and preliminary results is included in Appendix B1.

ISCO is one of the most prevalent technologies currently in use to address deeper subsurface contamination. Despite the extent of use, ISCO has been described by experts as 'developmental' and 'innovative'. A different chemical oxidant has been used at full-scale at least one other former MGP site in Wisconsin, and a pilot-scale project involving activated persulfate was completed at a former MGP in Maryland with promising results. The Cool-Ox®technology is currently undergoing pilot-scale evaluation at a former MGP site in Illinois. Given promising lab and field results using both Cool-Ox® and other ISCO products, EPA's SITE program determined that there was sufficient promise to proceed with the demonstration. Field-scale deployments allow evaluation of the ability of the vendor to deliver active agents to achieve adequate contact with the contaminants.

The Cool-Ox® process relies upon a tailored mixture, an important component of which is an aqueous suspension of solid peroxygen compounds. Theoretically this suspension results in a slow, protracted release of hydrogen peroxide. Through a number of chemical processes, the hydrogen peroxide generates components which attack and destroy VOC and PAH compounds. This process can also result in the generation of oxygen which enhances the biological degradation of the target contaminants.

The SITE Demonstration

USEPA prepared a detailed Quality Assurance Project Plan (QAPP) covering all aspects of the technology demonstration. The SITE demonstration was completed in two areas. These included fill soils in the MW-15 well nest area, where an early gas holder was located, and the deep Copper Falls aquifer at the MW-13 well nest area, where NAPL is being removed via a free-product recovery system.

At the MW-15 area, the demonstration determined that large amounts of free product were present in fill soil placed above the low permeability Miller Creek silty clay within the former holder wall. Field activities included soil sampling before and after injection of Cool-Ox®

reagent into this zone. Sampling analyses indicated that the NAPL was emulsified by the reagent, but that high levels of NAPL within the holder wall minimized increases in microbial populations that could result in bioremediation (injections outside the holder wall where contaminant levels were lower conversely resulted in substantial increases in microbes). Regardless, the NAPL within the holder wall underwent a change in chemical character resulting in a less viscous, miscible material.

The emulsification results at the MW-15 area were also observed at MW-13. Injection of the reagent at this area resulted in vigorous reactions observed at extraction wells. Although the well points were sealed in the Copper Falls aquifer below the Miller Creek formation, bubbling and frothing of the reacted NAPL with the reagent was observed following several injection intervals. Most significantly, the rate of NAPL removal increased nearly four times over a two month period following cessation of the demonstration.

Details of the demonstration and its findings are detailed in the DCI/DTI report (DCI/DTI, August 2007 - Appendix B1).

Free-Product Recovery System – Post SITE Demonstration Findings

Between early February 2007, when the SITE injection program at the MW-13 well nest area ended, and early April 2007, the rate of free-product recovery increased from approximately 1 gal/day to nearly 6 gal/day. For the subsequent eight months, between April and December 2007, the recovery rate slowly declined to its pre-SITE rate of about 1 gal/day. This same period in the decline of the free-product recovery rate saw an increase in the total flows. Although fluctuations in total flow were measured during these eight months (very dry conditions during late summer/early fall corresponded to a decline in flow at that time), a notable flow increase compared to the previous winter months was observed, primarily at EW-4. During the winter of 2007, the EW-4 weekly flows did not exceed 500 gallons; during the following spring through fall period, the weekly flows increased to several thousand gallons.

Beginning in December 2007 through early March 2008, the conditions again reversed. High free-product recoveries were measured compared to lower total flow rates.[12] These conditions are tabulated on Table 4-1 for each of the measurement dates (Summary of Free Product and Groundwater Volumes Removed Since November 2006), and shown graphically on Figures 4-1 (Total Product Removed to Date) and Figure 4-2 (Weekly Pumping Summary). The slope of the total product recovery curve steepens beginning February 2007, then flattens beginning April 2007 through November 2007. It then steepens through March 2008.[13] Comparatively, the weekly pumping summary shows the dramatic increase in the withdrawal at EW-4 beginning in April 2007, corresponding to fluctuations in the flow from this well during the following spring-fall, and then declines in the EW-4 flow December 2007 – March 2008. The weekly pumping curves also show the relatively steady flow from the other extraction wells.

[12] The cumulative flow recovery from EW-1, EW-2 and EW-3, the three extraction wells screened in the Copper Falls Aquifer, generally remains more constant throughout the year compared to the flows measured at EW-4.
[13] Table 4-1 shows a large measurement of free product recovery on March 10, 2008. Product had accumulated at the base of the oil-water separator for several weeks before being conveyed to the storage tank.

This data suggests that the Cool-Ox ISCO process caused a definite improvement in free-product recovery. The injection may have caused changes in free-product chemistry, surfactant effects and increases in formation permeability (via hydraulic fracturing), and/or combinations of these conditions, and enhanced total recovery. The data also implies that increases in flow from EW-4, screened in the filled ravine, tend to "mask" free-product recovery from the Copper Falls aquifer. Consequently, this data will be essential to optimize the design for a future ISCO program and enhanced recovery system if this method is selected for remedial action on the Copper Falls aquifer.

Table 4-1 Summary of Free Product and Groundwater Volume Recovered Since November 2006

Date	Cumulative Volume of Free Product Removed (gals)	Cumulative Volume of Free Product Removed (lbs)	Cumulative Volume of Groundwater Removed from Wells EW-1, EW-2, EW-3 (gals)	Cumulative Volume of Groundwater Removed from well EW-4 (gals)	Cumulative Volume of Total Groundwater Removed (gals)
29-Nov-06	8,273.0	72,447	1,136,723	346,077	1,482,800
06-Dec-06	8,277.1	72,483	1,138,386	346,415	1,484,800
11-Dec-06	8,281.1	72,518	1,140,343	346,657	1,487,000
19-Dec-06	8,285.2	72,554	1,144,773	346,927	1,491,700
27-Dec-06	8,293.4	72,626	1,152,915	347,385	1,500,300
03-Jan-07	8,297.4	72,661	1,158,558	347,742	1,506,300
09-Jan-07	8,301.5	72,696	1,163,598	348,202	1,511,800
18-Jan-07	8,309.7	72,768	1,169,548	348,953	1,518,500
22-Jan-07	8,313.7	72,803	1,173,360	349,240	1,522,600
01-Feb-07	8,321.9	72,875	1,182,142	349,959	1,532,100
08-Feb-07	8,338.2	73,018	1,186,156	350,444	1,536,600
15-Feb-07	8,358.6	73,196	1,191,766	350,834	1,542,600
21-Feb-07	8,370.8	73,303	1,195,200	351,100	1,546,300
01-Mar-07	8,383.0	73,410	1,199,427	351,473	1,550,900
06-Mar-07	8,383.0	73,410	1,202,260	351,640	1,553,900
15-Mar-07	8,440.0	73,909	1,209,660	351,641	1,561,300
22-Mar-07	8,456.3	74,052	1,213,560	351,641	1,565,200
29-Mar-07	8,537.9	74,767	1,227,660	351,641	1,579,300
10-Apr-07	8,562.3	74,980	1,227,433	351,967	1,579,400
17-Apr-07	8,619.4	75,480	1,232,571	367,329	1,599,900
23-Apr-07	8,664.2	75,873	1,229,536	377,664	1,607,200
30-Apr-07	8,709.0	76,265	1,231,877	387,623	1,619,500
09-May-07	8,729.4	76,444	1,236,096	398,904	1,635,000
15-May-07	8,766.1	76,765	1,243,207	403,393	1,646,600
23-May-07	8,843.5	77,443	1,252,542	403,758	1,656,300
30-May-07	8,855.7	77,550	1,257,605	412,795	1,670,400
05-Jun-07	8,880.2	77,764	1,261,410	416,990	1,678,400
11-Jun-07	8,896.5	77,907	1,265,114	419,945	1,685,059
19-Jun-07	8,912.8	78,050	1,267,664	422,336	1,690,000
25-Jun-07	8,933.1	78,227	1,271,172	426,771	1,697,943
05-Jul-07	8,945.4	78,335	1,278,051	430,249	1,708,300
12-Jul-07	8,969.8	78,549	1,281,828	431,673	1,713,501
20-Jul-07	8,982.0	78,656	1,290,577	433,771	1,724,348
16-Aug-07	9,153.2	80,155	1,305,010	437,790	1,742,800
20-Aug-07	9,153.2	80,155	1,307,902	440,198	1,748,100
29-Aug-07	9,165.4	80,262	1,315,407	443,793	1,759,200
05-Sep-07	9,185.8	80,440	1,322,292	445,808	1,768,100
10-Sep-07	9,198.0	80,547	1,327,954	446,946	1,774,900
19-Sep-07	9,202.1	80,583	1,332,189	449,836	1,782,025
26-Sep-07	9,206.2	80,619	1,333,696	457,254	1,790,949

Table 4-1 Summary of Free Product and Groundwater Volume Recovered Since November 2006

Date	Cumulative Volume of Free Product Removed (gals)	Cumulative Volume of Free Product Removed (lbs)	Cumulative Volume of Groundwater Removed from Wells EW-1, EW-2, EW-3 (gals)	Cumulative Volume of Groundwater Removed from well EW-4 (gals)	Cumulative Volume of Total Groundwater Removed (gals)
02-Oct-07	9,210.3	80,655	1,334,914	462,412	1,797,325
12-Oct-07	9,210.3	80,655	1,334,717	462,809	1,797,525
22-Oct-07	9,210.3	80,655	1,331,638	469,763	1,801,400
06-Nov-07	9,222.5	80,762	1,330,449	489,294	1,819,742
12-Nov-07	9,234.7	80,868	1,331,478	495,067	1,826,544
21-Nov-07	9,242.9	80,940	1,334,520	501,132	1,835,651
29-Nov-07	9,246.9	80,975	1,337,816	504,345	1,842,160
06-Dec-07	9,251.0	81,011	1,340,906	506,666	1,847,571
10-Dec-07	9,267.3	81,154	1,342,685	507,837	1,850,521
19-Dec-07	9,283.6	81,297	1,346,224	510,677	1,856,900
27-Dec-07	9,312.1	81,546	1,349,590	512,962	1,862,551
02-Jan-08	9,336.6	81,761	1,352,432	514,171	1,866,602
08-Jan-08	9,365.1	82,010	1,352,568	514,533	1,867,100
18-Jan-08	9,385.5	82,189	1,356,915	518,176	1,875,090
24-Jan-08	9,405.9	82,368	1,359,510	519,289	1,878,798
31-Jan-08	9,409.9	82,403	1,362,684	520,622	1,883,305
07-Feb-08	9,442.5	82,688	1,365,922	521,979	1,887,900
13-Feb-08	9,471.1	82,939	1,367,735	523,266	1,891,000
26-Feb-08	9,475.1	82,974	1,371,204	526,234	1,897,437
07-Mar-08	9,487.4	83,081	1,372,849	527,552	1,900,400
10-Mar-08	9,691.1	84,865	1,373,978	528,514	1,902,491
20-Mar-08	9,691.1	84,865	1,374,132	538,269	1,912,400
28-Mar-08	9,691.1	84,865	1,375,385	542,016	1,917,400
02-Apr-08	9,699.3	84,937	1,380,985	542,016	1,923,000
08-Apr-08	9,703.3	84,972	1,388,850	542,016	1,930,865
14-Apr-08	9,707.4	85,008	1,393,168	542,016	1,935,183
21-Apr-08	9,711.5	85,044	1,409,516	542,021	1,951,537
29-Apr-08	9,715.6	85,080	1,418,809	548,709	1,967,517
07-May-08	9,715.6	85,080	1,495,927	554,298	1,980,224

4.2 Cap Flux Testing

Cap flux testing was conducted to evaluate the potential for transport of PAHs, VOCs, and NAPL in contaminated sediment. The full report, which was submitted to USEPA on August 8, 2007, is included as Appendix B2.

Cap flux testing indicated that transport of PAHs, VOCs, and NAPL can potentially occur via the following processes:

- Migration within pore spaces caused by consolidation under the weight of a cap;
- Diffusion;
- Adsorption to bubbles resulting from microbial metabolism (ebullition); and
- Advection from upward water flow.

Because most of these transport processes are temperature dependent, testing was conducted under conditions similar to those experienced at the Site during the summer as well as under higher than ambient temperatures. These bench scale tests evaluated the effectiveness of various size caps as well as a cap with a carbon mat layer. A report titled *Cap Flux Testing Report* is included as Appendix B2.

The cap flux test evaluated contaminant transport under varying conditions using the following flux columns:

- Accelerated environment without capping – This column was heated to an optimal temperature for bacterial growth (35°C) to simulate the amount of bacterial activity that would typically occur over a longer period of time at in-situ conditions.
- Standard environment without capping - This column was used as a standard to compare performance of capped columns.
- Standard environment with a 1.5 ft sand cap and carbon mat.
- Standard environment with approximately a 3 ft sand cap.
- Standard environment with approximately a 5 ft sand cap.
- Standard environment with a 3 ft cap over a longer period of time - This column test was completed in September 2007; this test and simulates activity over a longer period of time.

Columns used for this test were undisturbed core samples collected from areas of the Site known to have contaminated sediment. A net upward head of 0.01-0.07 feet/foot was placed on all of the test columns to simulate any potential head and transport resulting from the rise and fall of water levels due to seiching.

As part of the testing protocol the following were measured:

1) Consolidation of the sediment columns resulting from the weight of the cap.

2) Contaminants in water and gas that migrated through the columns and caps and were collected at the top of the column.
3) Contaminants and NAPL that migrated through the columns and were adsorbed to glass wool placed at the top of the columns.
4) Contaminants in the top and bottom six inches of the caps as well as in visibly contaminated portions of the sediment core itself.

The results of the flux test indicated that low levels of both VOCs and PAHs were transported through all of the caps and captured in the glass wool. However levels of these constituents passing through the caps were one to two orders of magnitude less than in the uncapped column and two or three orders of magnitude less than in the heated, uncapped column.

Visual evidence shows that NAPL in the form of black drops was transported to the glass wool in the uncapped columns. However, this NAPL was not visible in the glass wool of the capped columns and the presence of substantially lower PAHs and VOCs in the glass wool confirmed that NAPL was not transported into the cap and that significant retention of PAHs and VOCs was achieved during these tests

Only very low levels of the more water-soluble compounds such as of 1- and 2-methylnaphthalene and naphthalene were able to pass though the caps in the dissolved phase under a significantly greater upward flow than is expected at the Site.

Based upon analysis of the sand cap, with one exception, no PAHs or VOCs above 1 mg/kg were transported to even the base of the cap in any column during the testing. The bottom of the cap in the column with a 1.5 ft cap and a carbon mat had 1 mg/kg total PAHs. It is possible that this is an artifact as the duplicate sample from this stratum had 0.632 mg/kg total PAHs.

The absence of contaminants in the gas and in the sand cap indicates that it is likely low levels of contaminants were transported with the water that was used to provide the upward flow gradient. Some contaminants were apparently adsorbed onto the glass wool as they passed through and came into contact with it, the remainder passed through the glass wool and remained in the water.

Overall, results of this cap flux test indicate that even under conditions more favorable to transport than what would be found at the Site, i.e. tests having significant groundwater upwelling, all of the caps were effective in eliminating or substantially reducing the transport of contaminants and NAPL. Based upon the results of this test it is also expected that the presence of organic carbon or some other absorptive material in the capping material would further reduce transport of any contaminants. Additionally, actual temperatures in the Site sediment would be less conducive to bacterial metabolism than the temperatures under which these tests were conducted and as a result gas generation rates would be less.

4.3 Bench Scale Air Emissions Testing

Bench Scale Air Emission testing and dispersion modeling was conducted on selected sediment and soil samples collected from the Site following the USEPA-approved February 2007 Treatability Study Work Plan. The full report, which was submitted to USEPA on September 18, 2007, is appended as Appendix B3.

Sediment samples for this assessment were collected in the part of the Site in Lake Superior at several nearshore locations (Areas 1, 2, and 2A); one soil sample was collected from an upland location (Area 4) (See Appendix B3). Emissions testing on the sediment samples was designed to simulate potential PAH and VOC emission rates associated with dredging operations, sediment dewatering and sediment treatment. Emissions testing conducted on soil from Area 4 was intended to simulate potential PAH and VOC emission rates associated with saturated soil exposure during excavation

Air dispersion modeling based upon the results of the emissions testing was conducted to evaluate how volatilized contaminants would be dispersed under scenarios developed to simulate remedial activities. In particular, modeling was conducted to determine whether receptors outside of the immediate Site area would be exposed to levels of volatile emissions that exceeded risk-based air quality criteria during remedial activities. The USEPA AERMOD model (version 07026) was used for this modeling assessment.

Sediment from each area was homogenized and split into batches to test sediment under three conditions:

1) Exposed sediment;
2) A 10% solids by weight slurry; and
3) A 1% solids by weight slurry.

The slurry mixtures were tested both while being mixed and while quiescent to simulate both active dredging operations and periods of inactivity. Air emissions and sediments were analyzed for 18 VOCs and 27 PAHs. Particular interest was given to benzene, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene based upon their sediment concentrations and their potential health effects.

Initial analysis found Area 2A to be the most highly contaminated with PAHs and Area 4 to be the most highly contaminated with VOCs. In general, emission rates increased with increasing % of solids and decreased with elapsed time. The highest emission rates were from exposed sediment or mixed 10% solids slurry at the start of the testing runs. Area 2A had the highest overall emission rates.

Odor analysis was conducted on the 10% solids mixed slurry from both Area 2 and 2A to determine the potential for odor impacts resulting from dredging operations. Odor concentrations increased over time, with maximum odor concentrations occurring during the 6-22 hour time interval.

Air dispersion modeling results indicated that, under several of the remedial scenarios, receptors outside the Site work area would be exposed to naphthalene and benzene above health risk levels. The model predicted that under the worst case condition a much larger area outside of the immediate work area would be above the benzene standard than the area where naphthalene standard was exceeded. Results of the modeling, including detailed information on predicted atmospheric concentrations compared to health risk levels are provided in Appendix B3

Similarly, modeling of odor dispersion indicated odor detection units above one odor unit would be experienced beyond the immediate Site work area under some remedial scenarios.

In general, dispersion of volatile contaminants and odor was less for Remedial Alternative 2 (a Confined Disposal Facility) than for Remedial Alternative 3 (Dredge-Cap) or Alternative 4 (Dredge All).

4.4 Multiphase Flow and Consolidation Testing

This report presents the results of the Multiphase Flow and Consolidation Testing, one of several treatability studies recommended in the Candidate Technologies and Testing Needs Technical Memorandum [Treatability Studies Memorandum (Task 6 of the SOW): URS 2006] that was originally submitted to USEPA on September 22, 2006 and approved on February 21, 2007. This test is a type of triaxial test setup known as a Seepage Induced Consolidation (SIC) test. The purpose of this testing is to provide data to be used for evaluating the technical implementability of capping and disposal technologies. The SIC setup was especially designed for very soft sediments to determine multiphase flow and consolidation properties of the sediments at low and medium high stress levels. The full report, which was submitted to USEPA on October 26, 2007, is appended as Appendix B4.

As explained in the introduction to the report, the SIC test works by subjecting a test sample to a constant downward flow rate and measuring the hydraulic pressure differential over the sample. As the stress is applied in this way, the pore fluid is expelled and consolidation occurs resulting in permeability changes within the sediment. These changes can be used to determine the:

1) Compressibility of the sediment;
2) Permeability of the sediment for gas (bubbles), water and non aqueous phase liquids (NAPL);
3) Threshold flow rate necessary to mobilize NAPL;
4) Threshold for air entry into the interstitial spaces which can then be used to evaluate the probability for gas bubble growth (ebullition); and
5) Amount of fluid released upon consolidation.

These characteristics can then be used as inputs to a model (the DELCON model) to predict the behavior of gas, fluid and NAPL in the underlying sediment during capping and during the period that underlying sediments are being consolidated by the cap. The cap can either be one that is applied subaqueously to in-place sediments or a cap applied to sediments after they have been deposited in a confined disposal facility (CDF).

The sediments used for this testing were collected by coring from a representative area of the Site known to be contaminated with polycyclic aromatic hydrocarbons (PAHs), volatile organic carbons (VOCs) and NAPL.

The SIC test was conducted using water, air (nitrogen) and NAPL (diesel fuel) as boundary conditions. Water, air and diesel fuel were forced through the sediment sample in separate tests and various measurements such as pressure, displacement and temperature were made.

A numerical model (DELCON) then was used to simulate the behavior of the sediments under a hypothetical subaqueous or CDF cap. In addition to the data developed in the SIC test supplemental data on the characteristics of Site sediment were used to "populate" the model. Characteristics of Site geology, bathymetry and stratigraphy also were incorporated into the model. Lastly, deposition rates of contaminated material and capping material for various remedial alternatives as well as the properties of sand that will be used as cap material grain (particle) size distribution, minimum and maximum porosity, etc., were provided.

The DELCON model was used to simulate sediment behaviour under two remedial alternatives: dredging and disposal into a CDF (SED 2) and placement of a subaqueous cap (SED 3). Results of the DELCON model indicated:

1) Under the CDF remedial scenario there would be relatively rapid consolidation of the wood layer under the CDF.
2) Only a small amount of consolidation in the Miller Creek clay layer under the wood layer will occur, but that will take place relatively rapidly (within the first five years).
3) Ebullition (gas release) in the underlying wood layer during the consolidation period is possible, however, conditions would no longer favor gas releases after the relatively rapid consolidation of the wood layer and the dredged slurry layer that would take place during the slurry deposition and cap placement time, say 180 days.
4) There would be no NAPL displacement expected from filling the CDF and subsequent consolidation since the predicted pore water discharges through the top layer of the dredged sediment are much smaller than are needed to mobilize NAPL.
5) Settlement consolidation after mechanical dredging under the CDF scenario was predicted to be almost the same as for the hydraulic dredging scenario because of the rapid consolidation of the wood layer beneath the CDF. Assuming the same depth CDF cap, settlement of the mechanically dredged material would be approximately 0.2 ft more than for settlement after hydraulic dredging.
6) Simulation of remedial scenario that includes dredging approximately 4 feet and then placement of a subaqueous cap, indicated that there would be virtually no consolidation of the native sediment given that the level cap re-establishes original bathymetry. Under this remedial scenario the discharges of pore water during capping are not sufficient to mobilize NAPL, nor should the capping result in gas releases substantially greater than what may presently occur.

5.0 Identification of Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) Criteria

5.1 Introduction

Section 121(d) of CERCLA requires that remedial actions undertaken pursuant to CERCLA comply with or otherwise attain legally applicable or relevant and appropriate standards or requirements (ARARs) where such compliance is technically practicable. While not legally binding, consideration is also to be given to TBCs. ARARs and TBCs are the statutes, regulations, ordinances, and guidance, relating to all aspects of the GRAs contemplated in this FS. Remedial alternatives considered in this Technical Memorandum must meet, insofar as practical, the requirements of the ARARs and must consider the interests advanced by the TBCs, including:

- Air, groundwater, surface water quality and residual soil concentration standards,
- Waste handling, storage, transfer and disposal, permitting and siting, requirements and limitations,
- Operating parameters,
- Health and safety requirements, and
- Monitoring requirements.

The identification of ARARs and TBCs depends on the media, COPCs, site-specific characteristics, and the technologies employed during remediation. ARARs are those cleanup standards or controls that are promulgated under state or federal law that specifically address a hazardous substance, pollutant or contaminant, action, location or other situation at a site. A requirement may be “relevant” but may not be “appropriate” to apply for various reasons, and therefore, not well suited for the site. ARARs and TBCs can be chemical-, action- or location-specific requirements. The three types of ARARs are described below.

Chemical-specific ARARs are usually health or risk-based numerical values or methodologies which, when applied to site-specific conditions, define acceptable concentration limits of a chemical that may be found in, remain in, or discharged to, the ambient environment. These standards establish site remediation targets for the COPCs in the designated medium (e.g. water, soil, sediment or air) because those standards are considered protective of human health and the environment. Examples of chemical-specific ARARs include state and federal drinking water quality standards.

Location-specific ARARs are “restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in a specific location.” (EPA 1988) Location-specific ARARs place restrictions on remedial activities due primarily to the presence of environmentally sensitive areas. Examples of location-specific ARARs include the standards and requirements imposed for work conducted affecting wetlands.

Action-specific ARARs govern the design, performance, or operational aspects of contaminated materials management. Action-specific requirements "do not themselves determine the cleanup alternative, but define how chosen cleanup alternatives should be achieved" (EPA 1988). Examples of action-specific ARARs include establishment of safe concentrations of discharge of materials during implementation of a remedial action.

ARARs and TBCs that may contribute to defining remedial alternatives for the Ashland/NSP Lakefront Site are presented in Tables E-1 through E-3 in Appendix E. These tables contain detailed information on the relevancy of the ARARs and the TBCs for each potential remedial alternative by environmental media, soil (Table E-1), groundwater (Table E-2) and sediment (Table E-3).

5.2 Chemical-Specific ARARs

Chemical-specific ARARs identified in the Alternatives Tech Memo are as follows:

- Clean Air Act
- Clean Water Act
- Resource Conservation and Recovery Act (RCRA)
- State of Wisconsin Groundwater Quality Standards - WAC Chapter NR 140
- State of Wisconsin Water Quality Standards- WAC Chapter NR 300
- State of Wisconsin Air Quality Standards - WAC Chapter NR 400
- State of Wisconsin Hazardous Substance Spill Law and Soil Cleanup Standards - WAC Chapter NR 700

5.3 Location-Specific ARARs

Location-specific ARARs identified in the Alternatives Tech Memo are as follows:

- Clean Water Act
- Section 10 – Rivers and Harbors Act
- State of Wisconsin - WAC Chapter NR 1.05 and Wisconsin Statute 30.01
- State of Wisconsin Statutes Chapter 289
- State of Wisconsin Solid Waste Management – Beneficial Reuse Exemption WAC Chapter NR 500.08
- State of Wisconsin Statutes Chapter 30

5.4 Action-Specific ARARs

The principal action-specific ARARs that apply to the Ashland/NSP Lakefront Site are as follows.

Action-specific ARARs identified in the Alternatives Tech Memo are as follows:

- Clean Air Act
- Clean Water Act
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- Resource Conservation and Recovery At (RCRA)
- Department of Transportation Rules for Hazardous Materials Transport
- Occupational Safety and Health Administration (OSHA)
- State of Wisconsin Requirements for Plans and Specification Submittal – WAC Chapter NR 108
- State of Wisconsin Environmental Policy Act - Sec. 1.11, Wis. Stats. and WAC Chapter NR 150
- State of Wisconsin Laboratory Certification and Registration Program – WAC Chapter NR 149
- State of Wisconsin Pollutant Discharge Regulations (WPDES) – WAC Chapter NR 200
- State Stormwater Pollution Control Program - WAC Chapter NR 216
- State of Wisconsin Water Quality Regulations – WAC Chapter NR 300
- State of Wisconsin Air Pollution Control Regulations – WAC Chapter NR 400
- State of Wisconsin Solid Waste Management Regulations - WAC Chapters NR 500 through 520
- State of Wisconsin Solid Waste Management Regulations – WAC Chapter NR 500 and Wisconsin Statute 289.43
- State of Wisconsin Hazardous Waste Management Rules – WAC Chapter NR 600
- State of Wisconsin Investigation and Remediation of Environmental Contamination – WAC Chapter NR 700
- State of Wisconsin Statutes Chapter 30

5.5 To Be Considered Information

TBCs can be grouped into chemical-, location-, and action-specific categories. Important laws, regulations and guidance that are TBCs for the Ashland/NSP Lakefront site are listed below. A complete discussion is presented in the Alternatives Tech Memo.

- USEPA's Contaminated Management Strategy
- USEPA's Contaminated Sediment Remediation Guidance
- Agency for Toxic Substances and Disease Registry

- Great Lakes Water Quality Initiative
- State of Wisconsin Interim Consensus Based Sediment Quality Guidance
- WDNR Dredge and Fill Requirements
- Federal Safe Drinking Water Act
- Great Lakes Water Quality Agreement
- Section 303(d) – Clean Water Act
- State of Wisconsin Water Quality Regulations - WAC Chapter NR 300
- WDNR Sediment Quality Assessment at MGP Guidance
- WDNR Management of Waste from Remediation of Manufactured Gas Plants
- WDNR Soil Cover Systems Guidance
- WDNR Soil Cleanup Levels for PAH Guidance
- WDNR Investigation Derived Waste Management Guidance
- WDNR Groundwater Discharge Guidance
- Sediment Remediation Implementation Guidance
- Local Permits

6.0 Development and Evaluation of Remedial Action Alternatives – Soil

6.1 Remedial Action Objectives for Soil

RAOs are subject to the criteria evaluated in the FS. As described in the RAO Technical Memorandum (URS 2007b) preliminary remedial action objectives for soil are as follows:

- Protect human health by reducing or eliminating exposure (ingestion/direct contact/inhalation) to soil having COPCs representing an excess cancer risk greater than 10^{-6} as a point of departure (with cumulative excess cancer risks not exceeding 10^{-5}) and a hazard index (HI) greater than 1 for reasonably anticipated future land use scenarios.
- Ensure future beneficial commercial/industrial use of the Site and recreational use of Kreher Park.
- Protect populations of ecological receptors or individuals of protected species by eliminating exposure (direct contact with or incidental ingestion of soils or prey) to soil with levels of COPCs that would pose an unacceptable risk.
- Conduct NAPL removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water.
- Protect the environment by minimizing/eliminating the migration of contaminants in the soil to groundwater or to surrounding surface water bodies.

The general goal of RAOs is to protect human health and environmental receptors at risk due to the unacceptable concentrations of COPCs at the Site, which are summarized below.

Table 6-1A Remedial Action Objectives for Construction Workers (mg/kg)

Chemical	Carcinogenic Effects			Noncarcinogenic Effects	
	CR = 10^{-6}	CR = 10^{-5}	CR = 10^{-4}	HI = 0.1	HI = 1.0
SVOCs					
2-Methylnaphthalene	NA	NA	NA	1.13E + 02	1.13E + 03
Benzo(a)anthrancene	2.01E + 00	2.01E + 01	2.01E + 02	1.06E + 04	1.06E + 05
Benzo(a)pyrene	2.01E - 01	2.01E + 00	2.01E + 01	NA	NA
Benzo(b)fluoranthene	2.01E + 00	2.01E + 01	2.01E + 02	NA	NA
Dibenzo(a,h)anthracene	2.01E - 01	2.01E + 00	2.01E + 01	NA	NA
Indeno(1,2,2-cd)pyrene	2.01E + 00	2.01E + 01	2.01E + 02	7.06E + 03	7.06E + 04
Naphthalene	NA	NA	NA	3.81E + 00	3.81E + 01
VOCs					
Benzene	1.4E + 00	1.4E + 01	1.4E + 02	4.11E + 00	4.11E + 01

Table 6-1B Soil Remedial Action Objectives for Residents (mg/kg)

Chemical	Carcinogenic Effects		Noncarcinogenic Effects	
	CR = 10^{-5}	CR = 10^{-4}	HI = 0.1	HI = 1.0
SVOCs				
Benzo(a)anthrancene	6.21E + 00	6.21E + 01	NA	NA
Benzo(a)pyrene	6.21E - 01	6.21E + 00	NA	NA
Benzo(b)fluoranthene	6.21E + 00	6.21E + 01	NA	NA
Dibenzo(a,h)anthracene	6.21E - 01	6.21E + 00	NA	NA
Naphthalene	NA	NA	1.70E + 00	1.70E + 01
VOCs				
Benzene	7.37E + 00	7.37E + 01	1.80E + 00	1.80E + 01

6.2 Screening of Remedial Action Alternatives for Soil

6.2.1 Chemicals of Potential Concern – Soil

This evaluation focuses on VOCs and PAHs contained in MGP tar waste as the primary COPCs. NAPL and inorganics associated with the fill soil are also considered in the screening of certain process options for treatment.

6.2.2 Screening of Remedial Alternatives – Soil

Potential remedial alternatives that are capable of preventing direct contact with subsurface soil contamination or reducing the toxicity and mobility of soil contaminants at the upper bluff area and at Kreher Park are summarized in Table 6-2. Those retained in the Alternatives Screening Technical Memorandum (see Appendix A1) are shown in bold in Table 6-2.

Table 6-2 Summary of Soil Technologies Reviewed (Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Option
No Action	**None**	**Not Applicable**
Institutional Controls	**Physical, engineering or legislative restrictions**	Fencing **Deed restriction** **Legislative action**
Monitored Natural Recovery	**Monitored Natural Attenuation**	Soil monitoring **Groundwater monitoring**
Containment	**Engineered Surface Barrier**	**Installation of ch. NR 500 Clay Cap, Geomembrane, or Geocomposite**
		Existing asphalt pavement and facility buildings (upper bluff area) **Existing soil cover (Kreher Park)**

Table 6-2 Summary of Soil Technologies Reviewed
(Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Option
	Engineered Vertical Barrier	**Sheet piling and/or slurry wall.** Concrete barriers Natural barrier
In-situ Treatment	**Enhanced Bioremediation**	**Oxygen enhancement (air/ozone sparge)** Oxygen enhancement (with chemical oxidation)
	Phytoremediation	Enhanced Rhizosphere Biodegradation Hydraulic Control Phyto-degradation Phyto-volatilization
	Soil Flushing	Cosolvent enhancement Surfactant flooding
	Soil Vapor Extraction (SVE)	Bioventing **Passive SVE** **Active SVE**
	Chemical Oxidation	Ozone sparge **Hydrogen peroxide injection/mixing** **Permanganate injection/mixing**
	Thermal Treatment	Radio Frequency/Electromagnetic Heating **Electrical Resistance Heating** **Steam Injection** Hot Air Injection Vitrification
Removal	**Excavation**	**Limited shallow excavation** **Unlimited shallow excavation** Deep excavation with shoring
Ex-situ Treatment	**Disposal**	**On-site disposal** **Off-site disposal**
	Thermal treatment	Asphalt batch plant mixing **Thermal desorption** **Incineration** Vitrification
	Biological Treatment	Biopile treatment Land spreading
	Solidification /Stabilization	Bituminisation Emulsified asphalt Pozzolan / Portland cement Sludge stabilization
	Physical//Chemical Treatment	**Soil washing** Chemical Oxidation

6.3 Development of Remedial Action Alternatives for Soil

As described in Section 3.3.2, perched aquifer conditions are present above the Miller Creek formation within fill soils at the upper bluff area and at Kreher Park. Saturated fill soil at the upper bluff area is limited to the filled ravine. The thickness of the former "v-shaped" ravine is variable; it is thickest along its axis, but thins perpendicular to its axis. The maximum thickness of fill is approximately 28 feet at the mouth located at the crest of the bluff overlooking Kreher Park, between 15 and 20 feet south of St. Claire Street, and less than 5 feet south of the alley between St Claire and Lakeshore Drive. The water table is encountered within five feet of the ground surface south of St. Claire Street, but at a depth over 10 feet on the north side of the street. The location of the filled ravine is shown on Figure 6-1. (The filled ravine is also shown on Figures 1-2, 1-3, and 3-1.)

Because in-situ treatment cannot be segregated between saturated and unsaturated zone contaminants in the filled ravine, potential in-situ remedial alternatives for soil and shallow groundwater contamination at the upper bluff were evaluated as potential remedial responses for groundwater in Section 7.0. Containment using surface barriers was evaluated as potential remedial responses for soil, and in combination with groundwater remedial responses. Limited and unlimited removal alternatives at the upper bluff include both saturated zone and unsaturated zone soils, and were evaluated as potential soil remediation alternatives because the lateral extent of the filled ravine and contamination within the ravine is well defined. Excavation alternatives include management of shallow groundwater seepage into excavations. Limited removal includes the area within the filled ravine with the highest levels of contamination. This includes removal of areas containing DNAPL, which are shown on Figure 3-4.

Kreher Park also consists of saturated and unsaturated zone fill material overlying the Miller Creek formation. As with the upper bluff area, in-situ treatment cannot be segregated between saturated and unsaturated zone soils. Groundwater is encountered at a shallow depth, and the saturated zone is below lake level. Containment using vertical barriers, and in-situ treatment (for saturated and unsaturated zone soils) were evaluated as potential remedial alternatives for groundwater in Section 7.0. Containment using surface barriers was evaluated as a potential remedial response for unsaturated zone soil, and in combination with potential groundwater remedial responses. For the purpose of evaluating potential remedial alternatives for soil, unlimited removal includes all saturated zone and unsaturated fill material used to construct Kreher Park. Limited removal at the upper bluff area includes removal at DNAPL areas shown on Figure 3-5.

Conceptual designs for potential remedial alternatives for soil retained for screening and evaluated in this report are presented in the following sections, and summarized in Table 6-3.

6.3.1 Alternative S-1 - No Action

The National Contingency Plan (NCP) at Title 40 Code of Federal Regulations (40 CFR §300.430(e)(6)) provides that the no-action alternative should be considered at every site. Implementation of no further action consists of leaving contaminated soil in place; no

engineering, maintenance, or monitoring will be required. The "no action" alternative for soil was retained as required by the NCP as a basis for comparing the other alternatives.

6.3.2 Alternative S-2 – Containment Using Engineered Surface Barriers

Surface barriers that would prevent direct contact with subsurface soil contamination include the following:

- Asphalt cap;
- Clay cap;
- Multi-layer cap with a minimum two-foot thick clay barrier, drainage layer, soil and vegetated top soil cover; and,
- Multi-layer cap with geomembrane or equivalent (geocomposite fabric layer or GCL).

The locations of potential surface barriers at the upper bluff and at Kreher Park are shown on Figure 6-2. Key elements of the conceptual design for the use of these engineered surface barriers are as follows:

1. In the upland area the existing building and asphalt pavement will be repaired, upgraded or replaced to improve the integrity of the barriers on the south side of St. Claire Street.
2. New asphalt pavement on the north side of St. Claire Street (NSPW storage yard) and at Kreher Park (marina parking lot) could be installed as surface barriers for these areas to replace existing gravel surfaces.
3. A RCRA class D (i.e., ch. NR 500, WAC) cap will be placed over the former coal tar dump area. This will be an extension of the fine grained low permeability soil cap installed in the adjacent former seep area (following the removal of contaminated soil) as an interim response in 2002.
4. Existing fill soils covering the remainder of Kreher Park are currently preventing contact with subsurface contamination. With respect to soil contamination, capping the remainder of Kreher Park will be unnecessary to prevent direct contact with contaminated soil because no VOC or SVOC contaminants exceed RAOs in fill soils.. However, partial and complete capping options for Kreher Park were evaluated as potential groundwater containment remedial responses in Section 7.0.The former waste water treatment plant is preventing direct contact with the subsurface contamination in that area.[14] In the event that the building is removed, the area will be covered with a clay cap or asphalt pavement to prevent direct contact with subsurface contamination.
5. Surface barriers will be periodically inspected and repaired or replaced as needed to ensure they are performing as designed.

[14] Potential risks associated with the former WWTP were evaluated in detail in the Human Health Risk Assessment. Potential remedial responses for Kreher Park assume that these risks can be mitigated by restoration or redevelopment of the facility in accordance with the City's Waterfront Development Plan.

Surface barriers would not reduce contaminant mass or toxicity of contaminants remaining in place, but they would prevent direct contact with contaminated soil and groundwater. Surface barriers would also reduce infiltration minimizing the potential migration of contaminants from the unsaturated zone to the saturated zone where contaminated soil is present. Consequently, surface barriers were evaluated in combination with remedial responses for soil (described below). Because surface barriers can also be used to reduce groundwater recharge from infiltration, surface barriers as caps were also evaluated in combination with groundwater remedial alternatives described in Section 7.3.

6.3.3 Alternative S-3 - Removal and Off-site Disposal

Removal consists of the excavation of contaminated soil with conventional earth moving equipment. Off-site disposal consists of the transportation of excavated material to an off-site landfill for disposal. Off-site disposal may include the selection of one or more existing landfill facilities for disposal, or alternatively siting and constructing a landfill in the Ashland area in accordance with ch. NR 500, WAC specifically for the disposal of material removed from the Site. Removed material will include contaminated soil from the filled ravine at the upper bluff area, contaminated soil from Kreher Park, and sediment dredged from the offshore inlet area adjacent to the Park. A cost benefit analysis will be needed to evaluate the use of existing landfills, or the construction of a landfill specifically for material removed from the site. Off site disposal facilities will be evaluated in the design phase, and will depend on the cumulative disposal volume of all material from the Site. Both limited and unlimited removal alternatives for contaminated soil from the filled ravine and at Kreher Park were retained for evaluation as potential remedial alternatives.

Following excavation, residual soil and groundwater contamination may remain, which may require natural attenuation and institutional controls for site closure if contaminants remain above RAOs. Direct contact with residual soil and groundwater contamination can be prevented with asphalt pavement or clay caps as surface barriers; using asphalt pavements as a surface barrier was also included to restore site use to pre-remediation conditions.

Alternative S-3A - Limited Removal and Off-site Disposal

Limited removal involves the excavation of material from areas with the highest levels of contamination. At the upper bluff area, this will require the removal of material from the two areas in the filled ravine. The first and largest area is the former gas holder area on the south side of St. Claire Street where NAPL has been encountered. The second and smaller area is at the base of the filled ravine on the north side of St. Claire Street; NAPL was encountered at the base of the ravine at this location in and around a former clay pipe encountered during a 2001 site investigation. The lateral extent of these limited removal excavations are shown on Figure 6-3A. Key elements of the conceptual design for limited removal at the upper bluff area are as follows:

1. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
2. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
3. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.
4. Removal will be limited to the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders south of St. Claire Street and the clay tile north of St. Claire Street) at the upper bluff area.
5. Removal south of St. Claire Street will include the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 to 9,400 cubic yards.
6. Removal north of St. Claire Street will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
8. Groundwater seeping into the excavation will be collected, temporarily placed in storage tanks, and treated by the existing on-site treatment system prior to discharge to the sanitary sewer.
9. Excavated material will be transported off site for disposal at an existing commercial licensed landfill facility. As an alternative to using existing commercial off-site landfills, a NR500 WAC landfill may be sited on property owned or purchased by NSPW for the disposal of all material removed from the Site.
10. Site restoration will include backfilling excavated areas with clean fill material and installation of new asphalt pavement as a surface barrier over the excavated area south of St. Claire Street to prevent contact with residual soil contamination. On the north side of St. Claire Street, fill soil (overlying NAPL contaminated soil) will be returned to the excavation, and clean soil will be used as to backfill the excavation to grade. Asphalt pavement will be then be placed over the entire gravel covered storage yard as a surface barrier to prevent exposure to fill material left in place on this side of the street. The existing street will be upgraded as needed to provide a surface barrier for this portion of the filled ravine.

At Kreher Park, limited removal will require the excavation of approximately 4,800 cubic yards of contaminated soil overlying the saturated wood waste layer at the former coal tar dump area. The lateral extent of this excavation is also shown on Figure 6-3A. Key elements of the conceptual design for limited removal at Kreher Park are as follows:

1. Site preparation will include clearing and grubbing of small trees and bushes near the south side of the former coal tar dump area.

2. Clean fill soil overlying contaminated soil at the former coal tar area will be removed and used as backfill material following the removal of contaminated soil above the saturated wood waste layer.
3. Removal will include the excavation of unsaturated and saturated zone soils approximately 5 feet thick for an area approximately 260 feet by 100 feet, yielding approximately 4,800 cubic yards.
4. Groundwater seeping into the excavation will be collected, temporarily placed in storage tanks, and treated by the on-site treatment system prior to discharge to the sanitary sewer.
5. Excavated material will be transported off site for disposal at an existing licensed landfill facility, or as an alternative to using an existing off-site landfill, a ch. NR500 landfill may be sited on property owned or purchased by NSPW for the disposal of all material removed from the Site.
6. Site restoration will include backfilling with clean fill material, and installation of a new RCRA or D (NR 500) cap over the excavated area.

With the exception of the former coal tar dump area no RAOs were exceeded in unsaturated zone soil at Kreher Park. Existing fill soils covering the remainder of Kreher Park are currently preventing contact with LNAPL contamination in the underlying saturated wood waste layer. The former waste water treatment plant also prevents contact with subsurface materials. In the event that the building is removed, the area will be covered with a clay cap or asphalt pavement to prevent direct contact. Using surface barriers as caps that prevent infiltration are evaluated as potential groundwater remedial alternatives in Section 7.3.

Alternative S-3B - Unlimited Removal and Off-site Disposal

Unlimited removal will consist of the removal of all fill material and contaminated soil above RAOs. At the upper bluff area, this will require the excavation of all fill material from the filled ravine north from the alley between Lake Shore Drive and St. Claire Street. The lateral extent of the unlimited removal option for the filled ravine is shown on Figure 6-3B. Key elements of the conceptual design for unlimited removal at the upper bluff area are as follows:

1. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
2. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
3. Removal and replacement of the section of St. Claire Street overlying the filled ravine (including underground utility realignment) will also be required.
4. Removal will include the excavation of soil containing NAPL, and the removal of all underground structures (i.e. former gas holders) at the upper bluff area. Unlimited removal will include the entire filled ravine north of the alley located between Lake Shore Drive and St. Claire Street to the bluff face. This will include the excavation of approximately 35,000 cubic yards of unsaturated and saturated zone fill material from the filled ravine. This volume includes an estimated 15,000 cubic yards of fly ash material from the area on the north side of St. Claire Street.

5. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
6. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the on-site treatment system prior to discharge to the sanitary sewer.
7. Excavated material will be transported off site for disposal at an existing licensed landfill facility. (Fly ash material may be transported to NSPW's fly-ash landfill for disposal.)
8. As an alternative, depending on the available existing landfill capacity, an NR500 landfill may be sited on property owned or purchased by NSPW.
9. Site restoration will include backfilling with clean fill material, replacement of St. Claire Street and utilities, and the installation of new asphalt pavement over excavated areas on the north and south side of St. Claire Street as a surface barrier for any residual soil contamination.

At Kreher Park, this will require the removal of the wood waste layer and overlying fill soil between Prentice and Ellis Avenues. The lateral extent of the excavation area is shown on Figure 6-3B. Key elements of the conceptual design for unlimited removal at Kreher Park are as follows:

1. Site preparation will include clearing and grubbing small trees and bushes near the south side of the former coal tar dump area, and demolition of the former WWTP facility.
2. Clean fill soil overlying the wood waste layer will be removed, salvaged and used to backfill the excavated former ravine at the upper bluff area, or returned to Kreher Park for use as fill material.
3. Removal will include the excavation of the wood waste layer and the overlying fill soil. The estimated volume of fill soil and wood waste material is approximately 223,000 cubic yards.
4. Because the excavation will be completed below lake level, a temporary sheet pile wall will constructed on the north, east, and west sides of the construction area to separate the excavation area from the lake. Approximately 2,000 feet of sheet pile would be installed to a minimum depth of 16 feet below ground surface.
5. Groundwater removed from the saturated portion of the excavation and any seepage into the excavation will be collected and treated by an on-site treatment system prior to discharge to the sanitary sewer[15].
6. Excavated material will be transported off site for disposal at a new landfill facility sited and constructed for the disposal of this material. If possible, wood suitable for fuel at the Bayfront power plant will be salvaged and used for power generation.

Removal of all fill material at Kreher Park could require the construction of an off-site landfill to accommodate the large volume of material removed from the Site. Unlimited removal will result in significant site disturbance, which may result in temporary or permanent loss of the current use of Kreher Park.[16] Kreher Park could be restored to pre-filling conditions (i.e. wetland area or

[15] If sediment removal is selected, on-site treatment equipment from sediment de-watering activities will be utilized for the on-site treatment of groundwater encountered in the unlimited excavation of Kreher Park.

[16] Kreher Park is currently utilized as a recreation area, but it also contains the marina boat storage area, a City street adjacent to the shoreline, and the former waste water treatment building.

shallow lakebed), or backfilled with clean fill to restore it to present elevations. If the area is restored to pre-filling conditions, the sheet pile will be removed. If the excavated area is backfilled to existing grade, the sheet pile wall will remain in place until filled to present grade.

The excavated area could also be backfilled with contaminated sediment dredged from the inlet area, which would require the construction of an onshore confined disposal facility (CDF) for the placement of material removed from the adjacent inlet area. Wisconsin Administration Code Chapter 30 does not prohibit construction of a nearshore CDF and disposal of dredged sediments into a newly constructed CDF. Because contaminated soil will be excavated from the saturated zone encountered below lake level, removal and treatment of contaminated groundwater seeping into the excavation will be required.

6.3.4 Alternative S-4 - Removal and On Site Disposal

Removal will consist of the excavation of contaminated soil with conventional earth moving equipment. On-site disposal consists of the transportation of excavated material to an on-site landfill for disposal. Residual soil and groundwater contamination may remain above RAOs, which may require natural attenuation and institutional controls for site closure if contaminants remain above RAOs. Inadequate space is available for on-site disposal at the upper bluff area, but adequate space is available at Kreher Park for the construction of an on-site disposal cell. The on-site disposal cell at Kreher Park could accommodate all or a portion of the material removed from the filled ravine at the upper bluff area previously described for Alternatives S-3A (limited removal) and S-3B (unlimited removal). It could also accommodate the limited removal of contaminated soil from the former coal tar dump area. Additionally, on-site disposal could accommodate the disposal of dredged sediment from the inlet area. On-site disposal would need to be completed in combination with containment alternatives for shallow groundwater at Kreher Park described in Section 7.3, and/or in conjunction with sediment containment alternatives described in Section 8.3. Key elements of the conceptual design for limited and unlimited removal of material from the filled ravine at the upper bluff and limited removal of contaminated soil from the former coal tar dump area are described in Section 6.3.3 above.

Alternative S-4A includes limited removal and on-site disposal of material from the upper bluff and the former coal tar dump area. Between seven and nine feet of contaminated soil could be placed in a one acre disposal cell constructed at Kreher Park between Prentice Avenue and the former coal tar dump area. Alternative S-4B includes a larger disposal cell required for unlimited removal material at the upper bluff area. This would require placement of approximately six feet of contaminated soil in a disposal cell four acres in size. Alternative S-4A is shown on Figure 6-4A, and Alternative S-4B is shown on Figure 6-4B. The conceptual design for the construction of an on-site disposal facility at Kreher Park follows:

1. Site preparation will include clearing and grubbing of small trees and bushes near the south side of the former coal tar dump area.

2. A disposal cell for material excavated from the upper bluff area will be constructed at Kreher Park. Contaminated soil from the former coal tar dump area will also be placed in this disposal cell.
3. The disposal cell will include a liner and a cap The size and location of the disposal cell will depend on the volume of material removed from the filled ravine
4. Clean fill soil overlying the wood waste layer at Kreher Park will be removed for the construction of the disposal cell and used to backfill excavated areas. Fill soil outside the foot print of this area will be left in place.
5. Any groundwater seeping into the disposal cell during construction will be collected, temporarily placed in holding tanks, and treated by an on-site treatment system prior to discharge to the sanitary sewer[17].
6. Site restoration at the upper bluff will include backfilling with salvaged clean fill material and installation of a RCRA cap or new asphalt pavement over the excavated area south of St. Claire Street, the existing street, and the gravel covered courtyard area on the north side of the street. A RCRA class D (ch. NR 500) cap will then be placed over the backfilled former coal tar dump area.
7. Long-term operation and maintenance for the disposal cell will include the groundwater monitoring and periodic inspection and repair of all asphalt and soil caps.

This soil remedial alternative could be combined with containment alternatives evaluated for groundwater and sediment in Sections 7.3 and 8.3, respectively. If excavated soil and sediment are mixed, a larger disposal cell will be required.[18] The design of the liner and cap should be compatible with the groundwater remedial response selected for shallow groundwater at Kreher Park. The thickness of the disposal cell liner could be reduced if containment is selected as the final remedial response.

6.3.5 Alternative S-5 – Ex-situ Thermal Treatment

Thermal treatment physically separates volatile and some semi-volatile contaminants from excavated soil or sediment by using ambient air, heat, and/or mechanical agitation to volatilize contaminants from soil into a gas stream for further treatment. Thermal treatment is achieved by either low temperature thermal desorption (LTTD), high temperature thermal desorption (HTTD), or incineration. The type of thermal treatment selected will be based on RAOs for VOCs and PAHs in treated soil. Another consideration is the suitability of treated soil as backfill material; soil treated by LTTD will retain pre-treatment physical properties (i.e. organic content) whereas soil treated by HTTD and incineration will not. Soils thermally treated on site can be returned to the excavation as backfill. Clean fill will be needed to replace soils transported off site for treatment and disposal.

[17] If sediment removal is selected, on-site treatment equipment from sediment de-watering activities may also be utilized for the on-site treatment of groundwater seeping into the excavation during construction.

[18] A larger disposal cell would be needed for on-site disposal of sediment in an on-site confined disposal facility (CDF). The on-site disposal of an additional 134,000 cubic yards of sediment would require a CDF 8 acres in size with a waste thickness of approximately 13 feet. The on-site disposal of an additional 78,000 cubic yards of sediment would require a CDF 6 acres in size with a waste thickness of approximately 12 feet.

LTTD is highly effective for VOCs; PAH compounds can also be treated, but at a reduced effectiveness. HTTD is effective for PAH compounds, but is not as cost effective as LTTD for VOCs. Incineration is effective for both VOCs and PAH compounds, but treating contaminated soil at high temperatures (1,400 to 2,200 ºF) to volatilize and combust organic compounds would require significantly more effort than LTTD or HTTD. An on-site mobile incinerator would operate in a similar fashion as HTTD except the kiln would be direct-fired[19] and would cause some COPCs to be destroyed before the vapors reach the secondary combustion chamber. In addition, the gas flow rates are higher in an incinerator since the fuel and air combustion gases are included in the gases sent from the kiln to the secondary combustion chamber. Additional soil tests such as sieve analysis, soil fusion temperature, and soil heating value are generally needed to achieve proper incineration. Although mobile incinerators are available, most incineration is achieved at off-site facilities due to the substantial amount of equipment involved. Transportation costs, energy costs to sustain high temperatures, and regulatory compliance for incineration would be significantly higher than LTTD and HTTD costs. For this analysis we have assumed that on-site treatment will be completed by LTTD or HTTD, and that incineration will be completed at an off-site facility.

Alternative S-5A - Limited Removal and On-site Thermal Treatment

On-site thermal treatment will require excavation of contaminated material at the upper bluff area as previously described for the limited removal alternatives described above (Alternatives S-3A and S-4). Excavated soil could be transported off site, but most likely would be treated on site by a mobile unit. Debris must be separated by size from material suitable for thermal treatment and transported off site for disposal. Consequently, wood waste at Kreher Park[20] and fly-ash and cinders in the filled ravine at the upper bluff area must be separated from NAPL contaminated material encountered in these areas. Thermal treatment by LTTD or HTTD will be completed for suitable NAPL contaminated fill material, and contaminated material not suitable for thermal treatment will be transported off site for disposal. Fill material including fly ash and cinders that is not contaminated with VOC and PAH compounds will be returned to the excavation. Residual soil and groundwater contamination may remain, which may require natural attenuation and institutional controls for site closure if residual contaminants remain above RAOs.

Thermal treatment will be performed on suitable fill material from areas with the highest levels of contamination. This includes the former gas holder area at the upper bluff, the NAPL in the ravine and contaminated soil encountered above the wood waste layer at Kreher Park; the underlying wood waste layer would not be suitable for thermal treatment. The lateral extent of these excavations are shown on Figure 6-1. Key elements of the conceptual design for ex-situ thermal treatment of material removed from these areas follows:

[19] Medium and high temperature thermal desorption may also be direct-fired, but at a lower temperature than incineration.

[20] Some wood waste may be present at the former coal tar dump area.

1. A mobile unit and ancillary equipment will be set up at Kreher Park because inadequate space is available at the upper bluff area.
2. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath this building at the upper bluff area.
3. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
4. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.
5. Removal will include the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders) at the upper bluff area south of St. Claire Street. This area includes the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 and 9,400 cubic yards. Also included for removal will be soil containing NAPL in the ravine on the north side of St. Claire Street. This will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
6. Removal will also include the excavation of unsaturated and saturated zone soils at the former coal tar dump area. This includes approximately 5 feet of contaminated soil in an area approximately 260 feet by 100 feet, yielding approximately 4,800 cubic yards.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
8. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the on-site treatment system prior to discharge to the sanitary sewer.
9. Saturated and unsaturated zone material will be thermally treated to reduce contaminant mass and toxicity and returned to the excavation as back fill. Material unsuitable for thermal treatment will be transported off site for landfill disposal. Fill material not contaminated with VOC and PAH compounds will be returned to the excavation as backfill.
10. Site restoration at the upper bluff area will include the installation of new asphalt pavement as a surface barrier over the excavated area on both sides of St. Claire Street, and new asphalt pavement at the gravel covered courtyard area on the north side of the street. The existing street (inspected for water tightness and sealed or replaced as needed) and new asphalt pavement on the NSPW property will prevent exposure to fill material beneath St. Claire Street and the NSPW storage yard.
11. Site restoration at Kreher Park will include backfilling excavated areas with clean fill material and installation of a new RCRA Class D (ch. NR 500) cap over the excavated area.
12. Long-term operation and maintenance of backfilled areas will include groundwater monitoring, cap maintenance including the periodic inspection and repair of all asphalt and soil caps.

Alternative S-5B - Limited Removal and Off-site Incineration

Incineration will require excavation of contaminated material at the upper bluff area and the former coal tar dump area at Kreher Park as previously described for the other limited removal alternatives (Alternatives S-3A, S-4, and S-5A). Contaminated soil suitable for incineration would be transported off site to a licensed facility for treatment and disposal. Wood waste at Kreher Park and fly-ash and cinders in the filled ravine at the upper bluff area must be separated from contaminated soil selected for incineration. Debris will be separated by size from material suitable for incineration and transported off site for disposal, and fill material not contaminated with VOCs and PAHs will be returned to the excavation as backfill.

As with thermal treatment, incineration will be performed on suitable fill material from areas with the highest levels of contamination. This includes the former gas holder area at the upper bluff, the NAPL in the ravine and contaminated soil encountered above the wood waste layer at Kreher Park. The lateral extent of these excavations are shown on Figure 6-1. Key elements of the conceptual design for ex-situ thermal treatment of material removed from these areas follows:

1. All contaminated material will be separated from debris and transported off site for incineration and/or off-site disposal. Ancillary equipment needed to separate material suitable for incineration will be set up at Kreher Park because inadequate space is available at the upper bluff area.
2. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
3. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
4. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.
5. Removal will include the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders) at the upper bluff area south of St. Claire Street. This area includes the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 and 9,400 cubic yards. Also included for removal will be soil containing NAPL in the ravine on the north side of St. Claire Street. This will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
6. Removal will also include the excavation of unsaturated and saturated zone soils at the former coal tar dump area. This includes approximately 5 feet of contaminated soil in an area approximately 260 feet by 100 feet, yielding approximately 4,800 cubic yards.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.

8. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the existing on-site treatment system prior to discharge to the sanitary sewer.
9. Saturated and unsaturated zone material will be transported off site for incineration and subsequent off-site disposal. Material unsuitable for incineration will be transported off site for landfill disposal. Fill material not contaminated with VOC and PAH compounds will be returned to the excavation as backfill.
10. Site restoration will include backfilling the excavation with clean fill material and installation of new asphalt pavement as a surface barrier over the excavated area south of St. Claire Street to prevent contact with residual soil contamination. On the north side of St. Claire Street, fill soil (overlying NAPL contaminated soil) will be returned to the excavation, and clean soil will be used as to backfill the excavation to grade. Asphalt pavement will be then be placed over the entire gravel covered storage yard as a surface barrier to prevent exposure to fill material left in place on this side of the street. The existing street will be upgraded, as needed, to provide a surface barrier for this portion of the filled ravine.
11. Long-term operation and maintenance of backfilled areas will include groundwater monitoring, cap maintenance including the periodic inspection and repair of all asphalt caps.

6.3.6 Alternative S-6 – Limited Removal and On-site Soil Washing

Soil washing is a water-based process for mechanically scrubbing excavated soil to remove contaminants by dissolving or suspending them in the wash solution. Contaminated soil from the saturated and unsaturated zones will be treated by soil washing following removal by excavation. Contaminants are either removed by dissolving or suspending them in a wash solution, or reducing concentrations in smaller volumes of soil by gravity separation. Wastewater used for soil washing is treated on site prior to discharge. A bio-slurry reactor is a hybrid soil washing technique that is used to treat a slurry of wastewater and contaminated soil. An aqueous slurry is created by combining soil, sediment, or sludge with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. Upon completion of the process, the slurry is dewatered and the treated soil is disposed or returned to the excavation. Material processing equipment (mixing unit and batch tanks) and water treatment equipment will require room for setup near one of the excavation areas. A mobile unit will be used to treat (wash) soil on site. Treated soil will be returned to the excavation as backfill material. Semi-volatile organics and hydrophobic contaminants may require the addition of a surfactant or organic solvent. A bench or pilot-scale treatability test may be needed to determine the best operating conditions and wash fluid compositions for soil washing and or bio-slurry treatment.

On-site soil washing can also be applied to contaminated material in the upper bluff area, and limited areas at Kreher Park, as described for the limited removal alternatives previously described (Alternatives S-3A, S-4, S-5A, and S-5B). Man-made fill material (i.e. ashes, cinders, bricks, concrete, wood debris, and glass) is not suitable for soil washing and will require separation and off-site disposal. The presence of wood waste at Kreher Park and fly-ash and cinders in the filled ravine (on the north side of St. Claire Street in the upper bluff area) will

preclude the use of soil washing of debris from these areas. Consequently, soil washing will be used for contaminated fill soil removed from areas with high concentrations of VOCs and PAH compounds at Kreher Park and the upper bluff area. Residual soil and groundwater contamination may remain, which may require natural attenuation and institutional controls for site closure if contaminants remain above RAOs.

Limited removal and on-site soil washing will be limited to areas with the highest levels of contamination. This includes the former gas holder at the upper bluff area where NAPL has been encountered, and the former coal tar dump area at Kreher Park. The lateral extent of these excavations are shown on Figure 6-1. Key elements of the conceptual design for limited removal and ex-situ soil washing in the upper bluff area and Kreher Park are as follows:

1. Soil washing and ancillary equipment will be set up at Kreher Park because inadequate space is available at the upper bluff area.
2. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
3. Removal of existing asphalt pavement from the alley and courtyard area will also be required.
4. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.
5. Removal will include the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders) at the upper bluff area south of St. Claire Street. This area includes the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 and 9,400 cubic yards. Also included for removal will be soil containing NAPL in the ravine on the north side of St. Claire Street. This will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
6. Removal will also include the excavation of unsaturated and saturated zone soils at the former coal tar dump area. This includes approximately 5 feet of contaminated soil in an area approximately 260 feet by 100 feet, yielding approximately 4,800 cubic yards.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
8. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the on-site treatment system prior to discharge to the sanitary sewer.
9. Saturated and unsaturated zone material will be treated by soil washing to reduce contaminant mass and toxicity, and returned to the excavation as back fill. Material unsuitable for soil washing will be transported off site for landfill disposal.
10. Site restoration will include the installation of new asphalt pavement as a surface barrier over the excavated area south of St. Claire Street, and new asphalt pavement at the gravel covered courtyard area on the north side of the street. The existing street (inspected for

water tightness and sealed or replaced as needed) and new asphalt pavement on the NSPW property will prevent exposure to fill material beneath St. Claire Street and the NSPW storage yard.

11. Site restoration at Kreher Park will include backfilling with clean fill material, and installation of a new RCRA Class C or D cap or asphalt road or parking lot over the Kreher Park area.
12. Long-term operation and maintenance for the site will include groundwater monitoring and periodic inspection and repair of all asphalt caps.

Table 6-3 - Summary of Potential Remedial Alternatives for Soil

Soil Remediation	Alternative S-1	Alternative S-2	Alternative S-3A	Alternative S-3B*	Alternative S-4A/S-4B	Alternative S-5A	Alternative S-5B	Alternative S-6
	No Action	**Containment using Engineered Surface Barriers**	**Limited Removal and Off-site Disposal**	**Unlimited Removal and Off-site Disposal**	**Limited / Unlimited (from upper bluff) Removal and On-site Disposal**	**Limited Removal and On-site Thermal Treatment**	**Limited Removal and Off-site Incineration**	**Limited Removal and On-site Soil Washing**
Removal /Treatment Volume (cubic yards)								
Upper Bluff Area	0	35,000	7,675 to 9,550	35,000	7,675 to 35,000	7,675 to 9,550	7,675 to 9,550	7,675 to 9,550
Kreher Park	0	4,800	4,800	224,600	4,800	4,800	4,800	4,800
Removal /Treatment Method								
Upper Bluff Area	None	No treatment prior to capping.	No treatment prior to disposal.	No treatment prior to disposal.	No treatment prior to disposal.	On-site thermal treatment staged at Kreher Park.	Off-site incineration and disposal.	On-site soil washing staged at Kreher Park
Kreher Park	None							
Disposal Required								
Upper Bluff Area	No removal or treatment of contaminated soil.	No removal or treatment of contaminated soil.	Transport all material to off-site ch. NR 500 permitted landfill for disposal, or site and construct new nearby off-site landfill per ch. NR 500 requirements for disposal of all material removed from the Site.		Site and construct new disposal cell at Kreher Park for disposal of all excavated material.*	Transport debris not suitable for treatment to an off-site NR 500 landfill for disposal.	Transport debris not suitable for treatment to an off-site NR 500 landfill for disposal.	Transport debris not suitable for treatment to an off-site NR 500 landfill for disposal.
Kreher Park								
Excavation Dewatering Required								
Upper Bluff Area	No	No	Yes – utilize on- site treatment system.	Yes – utilize on-site treatment system.*	Yes – utilize on-site treatment system.*	Yes – utilize on-site treatment system.*	Yes – utilize on-site treatment system.*	Yes – utilize on-site treatment system.*
Kreher Park								
Backfill								
Upper Bluff Area	None	None	Clean fill from off-site source.	Clean fill from Kreher Park.	Clean fill from Kreher Park.	Return treated soil to excavation, and fill to grade with clean fill from an off-site source.	Clean fill from off-site location.	Return treated soil to excavation, and fill to grade with clean fill from an off-site source.
Kreher Park				Clean fill from off-site location as needed.				
Site Restoration								
Upper Bluff Area	None	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.
Kreher Park		Cap over former coal tar dump area.	Cap over former coal tar dump excavation area.	Restore Kreher Park to pre-removal elevations with	Cap over former coal tar dump excavation area and disposal cell.	Cap over former coal tar dump excavation area.	Cap over former coal tar dump excavation area.	Cap over former coal tar dump excavation area

Table 6-3 - Summary of Potential Remedial Alternatives for Soil

Soil Remediation	Alternative S-1	Alternative S-2	Alternative S-3A	Alternative S-3B*	Alternative S-4A/S-4B	Alternative S-5A	Alternative S-5B	Alternative S-6
	No Action	**Containment using Engineered Surface Barriers**	**Limited Removal and Off-site Disposal**	**Unlimited Removal and Off-site Disposal**	**Limited / Unlimited (from upper bluff) Removal and On-site Disposal**	**Limited Removal and On-site Thermal Treatment**	**Limited Removal and Off-site Incineration**	**Limited Removal and On-site Soil Washing**
				clean fill or restoration as wetland or shallow lakebed.				
Other Remedial Technologies Used								
Upper Bluff Area	MNA Instit. Cntrls. Surface Barriers Vertical Barriers	MNA Instit. Cntrls Vertical Barriers	MNA Instit. Cntrls Surface Barriers Vertical Barriers	MNA Institutional Cntrls	MNA Instit. Cntrls Surface Barriers Vertical Barriers CDF	MNA Instit. Cntrls Surface Barriers Vertical Barriers	MNA Instit. Cntrls Surface Barriers Vertical Barriers	MNA Instit. Cntrls Surface Barriers Vertical Barriers
Kreher Park				MNR Vertical Barriers				

* Disposal cell could be enlarged for on-site disposal of sediment.

** May include use of sediment de-watering treatment equipment if sediment removal is selected for off-shore contamination.

6.4 Detailed Analysis of Remedial Alternatives for Soil

Potential remedial alternatives for soil were evaluated in this section in accordance with the threshold criteria, primary balancing criteria, and modifying criteria described in Section 6.4.1 below.

6.4.1 Threshold Criteria

Threshold criteria, which relate to statutory requirements that each alternative must satisfy to be eligible for selection, include:

- Overall protection of human health and the environment; and
- Compliance with ARARs.

The "no action" alternative will not satisfy threshold criteria; it will not result in the protection of human health and the environment. The remaining potential remedial alternatives for soil (removal and off-site disposal and removal and ex-situ treatment) will result in a reduction in mass, toxicity, or mobility of contaminants, which will result in the overall protection of human health and the environment.

The "no action" alternative will not achieve compliance with ARARs. However, the remaining potential remedial alternatives for soil will achieve compliance with ARARs, which are summarized in Table E-1 in Appendix E. Remedial responses for soil were screened in the Alternative Screening Technical Memorandum, and responses that were retained for screening were further evaluated in this report. Remedial responses that would not protect human health and the environment or achieve compliance with ARARs were not retained for screening.

6.4.2 Balancing Criteria

The primary *balancing criteria*, which are the technical criteria upon which the detailed analysis is primarily based, include:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

A summary of the balancing criteria for each potential remedial alternative for soil follows.

6.4.2.1 Long Term Effectiveness and Permanence

Each remedial alternative is evaluated as to magnitude of long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. Table 6-4 presents an evaluation of the long-term effectiveness and permanence of each alternative.

Table 6-4 - Evaluation of Long-term Effectiveness and Permanence For Potential Soil Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative S-1 No Action	• Potential risk to human health or the environment would not be reduced.	• There are no remedial actions or controls associated with this alternative.
Alternative S-2 Containment using Engineering Surface Barriers	• Contaminants will remain in soil beneath a surface barrier that will prevent direct contact. • Surface barriers will also reduce infiltration and minimize leaching to groundwater.	• Surface barriers will effectively prevent direct contact with contaminated soil and reduce infiltration. • Reliability is high through maintenance of barriers and institutional controls; these can easily be implemented. • Most effective if used in conjunction with a remedial response for groundwater.
Alternative S-3A Limited Removal and Off-site Disposal	• Limited removal of source areas containing NAPL and elevated concentrations of VOCs and PAHs will minimize residual soil contamination. • Other contaminants (i.e. metals) and groundwater contamination may remain. • Site restoration will include surface barriers to prevent direct contact with subsurface residual contamination and reduce infiltration to minimize leaching to groundwater.	• Removal of shallow soil from filled ravine and former coal tar dump area with conventional earth moving equipment is highly reliable. • Removal of source areas containing NAPL and elevated concentrations of VOCs and PAH compounds would sufficiently reduce risk to human health and the environment. • Surface barrier maintenance will be required to maximize reliability of remedial response. Institutional controls could be easily implemented to prevent long-term exposure to residual subsurface contamination.
Alternative S-3B Unlimited Removal and Off-site Disposal	• This remedial response will results in the removal of contaminated and un-contaminated fill material. • Unlimited removal of all fill material will minimize potential for residual contamination. • Construction of an off-site landfill would likely be required for large volume of material.	• Removal of shallow soil from filled ravine with conventional earth moving equipment is highly reliable, but would require removal and replacement of buried utilities and section of city streets, which may be difficult to implement. • Significant contamination is present at base of fill at Kreher Park, but removal of fill material below lake level will be difficult to implement. • Kreher Park restoration may require placement of clean fill, or restoration of former lakebed as wetland area or shallow lakebed.

Table 6-4 - Evaluation of Long-term Effectiveness and Permanence For Potential Soil Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative S-4A Limited Removal and On-site Disposal	• Limited removal of source areas containing NAPL and elevated concentrations of VOCs and PAHs will minimize residual soil contamination. • Site restoration will include surface barriers over excavated area and over disposal cell to prevent direct contact with subsurface residual contamination and reduce infiltration to minimize leaching to groundwater. • Groundwater monitoring will likely be needed to evaluate on-going risk to human health and the environment	• Removal of shallow soil from filled ravine with conventional earth moving equipment is highly reliable. • Removal of source areas containing NAPL and elevated concentrations of VOCs and PAH compounds would sufficiently reduce risk to human health and the environment. • Surface barrier maintenance will be required to maximize reliability of remedial response. Institutional controls could be easily implemented to prevent long-term exposure to residual subsurface contamination.
Alternative S-4B Limited Removal and On-site Disposal	• This remedial response will results in the removal of contaminated and un-contaminated fill material. • Unlimited removal of all fill material will minimize potential for residual contamination. • Construction of an on-site landfill would likely be required for large volume of material.	• Removal of shallow soil from filled ravine with conventional earth moving equipment is highly reliable, but would require removal and replacement of buried utilities and section of city streets, which may be difficult to implement. • Kreher Park is the only area where there is adequate space for the on site construction of a disposal cell. • Construction of a disposal cell at Kreher Park may limit future site use of this area.
Alternative S-5A Limited Removal and On-site Thermal Treatment	• Limited removal of source areas containing NAPL and elevated concentrations of VOCs and PAHs will minimize residual soil contamination. • Other contaminants (i.e. metals) and groundwater contamination may remain. • Site restoration will include surface barriers over excavated area and over disposal cell to prevent direct contact with subsurface residual contamination and reduce infiltration to minimize leaching to groundwater. • Groundwater monitoring will likely be needed to evaluate on-going risk to human health and the environment	• Removal of shallow soil from filled ravine and former coal tar dump area with conventional earth moving equipment is highly reliable. • Thermal treatment/incineration is reliable technology. • Although other contaminants may remain, removal of source areas containing NAPL and elevated concentrations of VOCs and PAH compounds would significantly reduce risk to human health and the environment. • Minimal long-term maintenance and monitoring will be required to evaluate reliability. Institutional controls could be easily implemented to prevent long-term exposure to residual subsurface contamination and treated material placed as backfill, and contaminated material placed in disposal cell.
Alternative S-5B Limited Removal and Off-site Incineration		

Table 6-4 - Evaluation of Long-term Effectiveness and Permanence For Potential Soil Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative S-6 Limited Removal and On-site Soil Washing	• Limited removal of source areas containing NAPL and elevated concentrations of VOCs and PAHs will minimize residual soil contamination. • Other contaminants (i.e. metals) and groundwater contamination may remain. • Site restoration for limited removal will include surface barriers to prevent long-term exposure to subsurface residual contamination and reduce infiltration to minimize leaching to groundwater. • Groundwater monitoring will likely be needed to evaluate on-going risk to human health and the environment	• Removal of shallow soil from filled ravine and former coal tar dump area with conventional earth moving equipment is highly reliable, but residual contamination may remain in treated soil. • Long-term monitoring will be required following on-site placement of treated soil to evaluate reliability. • Minimal long-term surface barrier maintenance and monitoring will be required to evaluate reliability of remedial response. Institutional controls could be easily implemented to prevent long-term exposure to residual subsurface contamination and treated material placed as backfill.

6.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment

The remedial alternatives are evaluated for permanence and completeness of the remedial action in significantly reducing the toxicity, mobility, or volume of hazardous materials through treatment. Each alternative is evaluated based on the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. Table 6-5 presents a summary of this evaluation.

Table 6-5 - Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment For Potential Soil Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Removed, Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative S-1 No Action	None	None	None	Not applicable	Not applicable
Alternative S-2 Containment using Engineering Surface Barriers	No material treated; engineered surface barriers used to prevent direct contact.	None	No reduction in contaminant mass or toxicity, but will reduce infiltration and minimize mobility of contaminants leaching to groundwater.	Surface barriers could easily be removed.	Contaminated soil will remain in place beneath surface barriers placed over the filled ravine and former coal tar dump areas; the wood waste layer at Kreher Park will remain in place.
Alternative S-3A Limited Removal and Off-Site Disposal	No treatment prior to disposal at off-site landfill.	7,675 to 9,650 cubic yards removed from upper bluff area, and 4,800 cubic yards removed from the former coal tar dump area.	Removal of highly contaminated fill where NAPL is present will result in significant reduction of contaminant mass. Reduction of toxicity, mobility and volume reduction is expected to be high.	Off-site disposal would be irreversible.	Residual contamination may remain in the filled ravine and former coal tar dump area; the wood waste layer at Kreher Park will remain in place.
Alternative S-3B Unlimited Removal and Off-site Disposal	No treatment prior to disposal at off-site landfill.	35,100 cubic yards removed from the upper bluff area and 224,600 cubic yards removed from Kreher Park.	Removal of all fill material containing high and low levels of contamination will result in significant reduction of contaminant mass. Reduction of toxicity, mobility and volume reduction is expected to be very high.	Off-site disposal would be irreversible.	All fill soil containing high and low levels of contamination removed. The wood waste layer at Kreher Park will be removed. Little to no residual soil contamination would be expected.

Table 6-5 - Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment For Potential Soil Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Removed, Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative S-4A Limited Removal and On-site Disposal	No treatment prior to disposal at on-site disposal cell.	7,675 to 9,650 cubic yards removed from the upper bluff area. Nothing removed from Kreher Park, and 4,800 cubic yards removed from the former coal tar dump area.	Removal of highly contaminated fill will result in significant reduction of contaminant mass. Reduction of toxicity and mobility is expected to be high for the filled ravine. Although contaminated soil will be contained, on-site disposal will not result in reduction of volume of material. .	Material placed in disposal cell at Kreher Park would remain in place, or transported off-site at a later time.	Residual contamination may remain in fill at upper bluff area; the wood waste layer at Kreher Park will remain in place.
Alternative S-4B Unlimited Removal and On-site Disposal		35,100 cubic yards from the upper bluff consolidated with 4,800 cubic yards removed from the former coal tar dump area.			
Alternative S-5A Limited Removal and On- site Thermal Treatment	On-site thermal treatment to remove contaminants. Return treated soil to excavation.	7,675 to 9,650 cubic yards removed from upper bluff area, and 4,000 cubic yards removed from the former coal tar dump area.	Removal and thermal treatment of highly contaminated fill where NAPL is present will result in significant reduction of contaminant mass. Reduction of toxicity, mobility and volume is expected to be high.	Thermal treatment would be irreversible; treated soil would remain in place as back fill, or transported off site at a later time.	Residual contamination may remain in untreated fill at the upper bluff and at the former coal tar dump area; the wood waste layer at Kreher Park would remain in place.
Alternative S-5B Limited Removal and Off- site Incineration	Off-site incineration to treat contaminated soil. Clean fill used to back fill excavated areas.			Incineration would be irreversible.	

Table 6-5 - Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment For Potential Soil Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Removed, Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative S-6 Limited Removal and On-site Soil Washing	Soil washing to remove contaminants. Return treated soil to excavation.	7,675 to 9,650 cubic yards removed from upper bluff area, and 4,000 cubic yards removed from the former coal tar dump area.	Removal of highly contaminated fill will result in significant reduction of contaminant mass. Reduction of toxicity, mobility and volume reduction is expected to be high.	Soil washing would be irreversible; treated soil would remain in place as back fill, or transported off site at a later time.	Residual contamination may remain in untreated fill at the upper bluff and at the former coal tar dump area; the wood waste layer at Kreher Park would remain in place.

6.4.2.3 Short Term Effectiveness

The evaluation of short-term effectiveness is based on the degree of protectiveness of human health achieved during construction and implementation of the remedy. Potential implementation risks to the community and site workers and mitigation measures for addressing those risks are included in this evaluation. In addition, environmental impacts during implementation and the time required to achieve the RAOs must also be considered in the evaluation of this criterion. Table 6-6 summarizes the results of this evaluation.

Table 6-6 - Evaluation of Short Term Effectiveness for Potential Soil Remedial Alternatives

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative S-1 No Action	None	No additional impact to the environment	RAOs will not be achieved.
Alternative S-2 Containment using Engineering Surface Barriers	Actions to protect community during remediation will include restricted access to work areas to prevent direct contact, and perimeters monitoring to ensure airborne contaminants are not migrating from the work area. Action to protect site workers during remediation will include the use of earth moving equipment to handle contaminated soil in exclusion zones, personnel protection equipment for workers, and work zone monitoring for airborne contaminants.	Surface barrier will reduce infiltration and minimize leaching to groundwater, but long-term source for groundwater contamination will remain.	Direct contact exposure route can be eliminated in a short time frame, but contaminants will remain beneath surface barrier for an extended period of time.
Alternative S-3A Limited Removal and Off-site Disposal		Significant contaminant mass will be removed from highly contaminated areas where DNAPL is present. Residual contaminants may remain on site.	Site work can be completed in a short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs.
Alternative S-3B Unlimited Removal and Off-site Disposal		All fill material including contaminated and uncontaminated material will be removed from fill ravine and at upper bluff and Kreher Park; minimal residual contamination may remain.	Site work can be completed in a short time frame, and verification soil samples collected following removal of all material will be used to determine compliance with RAOs.
Alternative S-4A Limited Removal and On-site Disposal		Significant contaminant mass will be removed from highly contaminated areas where DNAPL is present. Residual contaminants may remain on site.	Site work can be completed in a short time frame, and verification soil samples collected following removal of all material will be used to determine compliance with RAOs. Long term monitoring will be required to ensure disposal cell compliance with RAOs.
Alternative S-4B Unlimited Removal and On-site Disposal		All fill material including contaminated and uncontaminated material will be removed from fill ravine and at upper bluff and coal tar dump area at Kreher Park; minimal residual contamination may remain in excavated areas.	Site work can be completed in a short time frame, and verification soil samples collected following removal of all material will be used to determine compliance with RAOs.

Table 6-6 - Evaluation of Short Term Effectiveness for Potential Soil Remedial Alternatives

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative S-5A Limited Removal and On-site Thermal Treatment	Actions to protect community during remediation will include restricted access to work areas to prevent direct contact, and perimeters monitoring to ensure airborne contaminants are not migrating from the work area. Action to protect site workers during remediation will include the use of earth moving equipment to handle contaminated soil in exclusion zones, personnel protection equipment for workers, and work zone monitoring for airborne contaminants.	Significant contaminant mass will be removed from highly contaminated areas where DNAPL is present. Residual contaminants may remain on site.	Site work can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs. Long-term monitoring may be needed for areas backfilled with treated soil.
Alternative S-5B Limited Removal and Off-site Incineration			Site work can be completed in a short time frame, and verification soil samples collected following removal of all material will be used to determine compliance with RAOs.
Alternative S-6 Limited Removal and onsite Soil Washing		Significant contaminant mass will be removed from highly contaminated areas where DNAPL is present. Residual contaminants may remain on site.	Site work can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs. Long-term monitoring may be needed for areas backfilled with treated soil.

6.4.2.4 Implementability

Implementability is based on the evaluation of technical feasibility, administrative feasibility, and the availability of services and materials. Technical feasibility considers the following factors:

- difficulties that may be inherent during construction and operation of the remedy;
- the reliability of the remedial processes involved;
- the flexibility to take additional remedial actions, if needed;
- the ability to monitor the effectiveness of the remedy;
- the availability of offsite treatment, storage, and disposal facilities; and,
- the availability of needed equipment and specialists.

Administrative feasibility considers permitting and regulatory approval and coordination with other agencies. Table 6-7 presents a summary of this evaluation.

Table 6-7. Evaluation of Implementability for Potential Soil Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative S-1 No Action	Additional remedial actions could be easily implemented.	Not applicable.	No permitting required, but will likely not be able to obtain regulatory approval.	None required.
Alternative S-2 Containment using Engineering Surface Barriers	Installation is technically feasible for areas where fill and/or subsurface contamination are present. Additional remedial actions could be easily implemented.	Reliable technology for elimination of direct contact exposure route and reduction of infiltration.	Regulatory approval likely if implemented with remedial response for shallow groundwater contamination.	Conventional construction equipment could be used for construction of surface barriers.
Alternative S-3A Limited Removal and Off-site Disposal	Excavation is feasible technology for remediation of contaminated soil. Likely that removal and off-site disposal of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass.	Highly reliable technology; most commonly used remedial technology for contaminated soil at MGP sites.	Regulatory approval likely. Selection of landfill for off-site disposal would be required.	Conventional earth moving and excavation de-watering equipment would be used. Groundwater would be treated on site with existing equipment.
Alternative S-3B Unlimited Removal and Off-site Disposal	Removal of all fill material from filled ravine is feasible, but excavation of saturated fill at Kreher Park below lake level may be difficult. A landfill may need to be sited and constructed for disposal of the large volume of contaminated soil.	Reliable technology; most commonly used for contaminated soil at MGP sites. However, removal of all fill material may not be needed to achieve compliance with RAOs.	Regulatory approval likely. Would require siting and construction of landfill for off-site disposal, and approval of restoration of Kreher Park to either pre-filling (i.e. wetland, or shallow lake bottom), or pre-removal conditions.	Conventional earth moving and excavation de-watering equipment would be used. Groundwater would be treated on site using equipment used for sediment remediation.

Table 6-7. Evaluation of Implementability for Potential Soil Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative S-4A and S-4B Limited Removal and On-site Disposal	Disposal cell construction at Kreher Park is technically feasible. Long-term maintenance and monitoring of disposal cell will likely be completed in combination with containment of Kreher Park using surface and vertical barriers walls (evaluated as a groundwater remedial alternative).	Reliable technology, but not commonly used for contaminated soil at MGP sites due to land-use limitations.	Regulatory approval likely. Would require siting and construction of disposal cell for on-site disposal.	Conventional earth moving, equipment and excavation de-watering equipment will be used. Groundwater will be treated on site with existing equipment.
Alternative S-5A Limited Removal and On-site Thermal Treatment	On-site thermal treatment is a feasible technology for remediation of contaminated soil at MGP sites. Likely that removal and on-site thermal treatment of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass.	Highly reliable technology; it is commonly used for contaminated soil at MGP sites. Would require separation and off-site disposal of debris not suitable for thermal treatment.	Regulatory approval likely. Discharge permits for air and waste water may be needed.	Conventional earth moving, thermal treatment and excavation de-watering equipment would be used. Groundwater would be treated on site with existing equipment.
Alternative S-5B Limited Removal and Off-site Incineration	Off-site incineration is technically feasible, but will be more costly than on-site thermal treatment. Likely that removal and off-site incineration of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass .	Highly reliable technology; but incineration may not be needed to achieve RAOs. Would require separation and off-site disposal of debris not suitable for incineration.	Regulatory approval likely. Selection of facility for off-site incineration would be required.	Incineration most commonly performed at off-site facilities due to specially equipment and required air permits.

Table 6-7. Evaluation of Implementability for Potential Soil Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative S-6 Limited Removal and onsite Soil Washing	Pilot test would be needed to evaluate reliability of soil washing. Likely that removal of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass	Pilot test will need to be completed to evaluate reliability of technology; technology not commonly used for contaminated soil at MGP sites.	Regulatory approval likely. Discharge permits for air and waste water may be needed.	Conventional earth moving, soil washing and excavation de-watering equipment would be used. Groundwater would be treated on site with existing equipment.

6.4.2.5 Cost

Preliminary estimated costs for potential soil remedial alternatives include estimated capital costs for site preparation, excavation, excavation de-watering, transportation and disposal, on-site treatment, and site restoration. Estimated costs for mobilization/demobilization, engineering, construction oversight, and contingency costs are estimated at 5, 15, 15, and 20-percent of capital costs, respectively. Annual operation, maintenance, and monitoring (OM&M) costs are not estimated for each alternative; it is assumed the OM&M following soil remediation will be completed concurrent with OM&M following groundwater remediation. Consequently, OM&M costs are included with potential groundwater remedial alternatives costs in Section 7.5.7. Additionally it is assumed that all work is contracted and the estimates do not account for possible economies of scale (i.e., completing all activities at the site concurrently). These cost estimates are developed primarily for the purpose of comparing remedial alternatives and not for establishing project budgets. Detailed cost estimates were prepared in accordance with the USEPA guidance document, *A Guide to Developing and Documenting Cost Estimates* (USEPA and USACE, 2000). Table 6-8 presents a summary of the cost evaluation. The details of these costs are presented in Appendix F1 Tables F1-1 through F1-10

Table 6-8. Evaluation of Cost for Potential Soil Remedial Alternatives

Alternative	Area of Concern	Capital Cost	Mob/Demob	Engineering	Construction Oversight	Contingency	Post Construction Maintenance[1]	Total
Alternative S-1 No Action	Upper Bluff/ Kreher Park	$0	$0	$0	$0	$0	$0	$0
Alternative S-2 Containment Using Engineered Surface Barriers	Upper Bluff	$105,556	$5,278	$15,833	$15,833	$21,111	$21,716	$163,611
	Kreher Park	$1,118,563	$55,928	$167,784	$167,784	$223,713		$1,755,488
Alternative S-3A Limited Removal and Off-site Disposal	Upper Bluff	$2,203,435	$110,172	$330,515	$330,515	$440,687	$0	$3,415,324
	Kreher Park	$973,848	$48,692	$146,077	$146,077	$194,770	$0	$1,509,464
Alternative S-3B Unlimited Removal and Off-site Disposal (backfill to existing grade)	Upper Bluff	$5,103,860	$255,193	$765,579	$765,579	$1,020,772	$0	$7,910,983
	Kreher Park	$22,591,722	$1,129,586	$3,388,758	$3,388,758	$4,518,344	$0	$35,017,169
Alternative S-3B Unlimited Removal and Off-site Disposal (restore Kreher Park as wetland)	Upper Bluff	$1,451,850	$72,593	$217,778	$290,370	$290,370	$0	$2,250,368
	Kreher Park	$1,054,203,	$52,710	$158,130	$210,841	$210,841	$0	
Alternative S-4A Limited Removal and On-site Disposal [2]	Upper Bluff	$1,451,850	$72,593	$217,778	$217,778	$290,370	$0	$2,250,368
	Kreher Park	$1,054,203	$52,710	$158,130	$158,130	$210,841	$0	$1,634,014
Alternative S-4B Unlimited Removal and On-site Disposal [3]	Upper Bluff	$1,788,580	$89,429	$268,287	$268,287	$357,716	$0	$2,772,299
	Kreher Park	$2,364,788	$118,239	$354,718	$354,718	$472,958	$0	$3,665,421
Alternative S-5A Limited Removal and Ex-situ Thermal Treatment	Upper Bluff	$3,036,291	$151,815	$455,444	$455,444	$607,258	$0	$4,706,250
	Kreher Park	$1,392,456	$69,623	$208,868	$208,868	$278,491	$0	$2,158,306
Alternative S-5B Limited Removal and Off-site Incineration	Upper Bluff	$5,228,016	$261,401	$784,202	$784,202	$1,045,603	$0	$8,103,424
	Kreher Park	$2,436,468	$121,823	$365,470	$365,470	$487,294	$0	$3,776,525
Alternative S-6 Limited Removal and Ex-situ Soil Washing	Kreher Park	$3,671,748	$183,587	$550,762	$550,762	$734,350	$0	$5,691,209
	Kreher Park	$1,711,848	$85,592	$256,777	$256,777	$342,370	$0	$2,653,364

1 Does not include groundwater monitoring costs, which are included with groundwater remedial alternatives.
2 Includes construction of a one acre disposal cell at Kreher Park.
3 Includes only construction of a four acre disposal cell at Kreher Park.

6.4.3 Modifying Criteria

The third group, the *modifying criteria*, includes:

- State/Support agency acceptance
- Community acceptance.

As previously discussed, these last two criteria are typically formally evaluated following the public comment period, although they can be factored into the identification of the preferred alternative to the extent practicable. With regard to community acceptance criterion, it should be noted that the agencies conducted an outreach session consisting of a "community workshop" in Ashland on October 25, 2007. A summary of that workshop as presented by USEPA is included in Appendix C.

6.5 Comparative Analysis of Retained Remedial Alternatives for Soil

In this section, as required by CERCLA and NCP regulations, the alternatives will undergo a comparative evaluation wherein the advantages and disadvantages of the alternatives will be concurrently assessed with respect to each criterion. The criteria considered as part of this comparative evaluation are defined in detail in the Comparative Alternatives Analysis tech memo and summarized in the Executive Summary of this report. Table 6-9 presents a summary of the comparative analysis.

Table 6-9 – Comparison of Potential Soil Remedial Alternatives

Criteria	Alt. S-1	Alt. S-2	Alt. S-3A	Alt. S-3B	Alt. S-4A	Alt. S-4B	Alt. S-5A	Alt. S-5B	Alt. S-6
	No Action	Containment using Engineered Surface Barriers	Limited Removal and Off-site Disposal	Unlimited Removal and Off-site Disposal	Limited Removal (from upper bluff) and On-site Disposal	Unlimited Removal (from upper bluff) and On-site Disposal	Limited Removal and On-site Thermal Treatment	Limited Removal and Off-site Incineration	Limited Removal and Ex-situ Soil Washing
Overall Protection of Human Health and the Environment	None	Low	High	High	Moderate	High	High	High	Moderate to High
Compliance with ARARs and TBCs	None	Low	High	High	Low to Moderate	Low to Moderate	High	High	Moderate to High
Long-term Effectiveness and Permanence	None	Low	High	High	Low to Moderate	Low to Moderate	High	High	Moderate to High
Reduction of Toxicity, Mobility and Volume through Treatment	None	Low	High	High	Low to Moderate	Low to Moderate	High	High	Moderate to High
Short-term Effectiveness	Low	High	High	High	Moderate	Moderate	High	High	High
Implementability	None	High	High	Low to Moderate	High	High	High	Low to Moderate	Moderate
Cost	Low	Low	Moderate	Very High	Moderate	Moderate	High	Very High	High
Agency Acceptance	None	Low	High	High	Low to Moderate	Low	High	High	Low to Moderate
Community Acceptance	None	Low	High	Low to Moderate	Low	Low	Moderate	High	Low to Moderate

6.5.1 Overall Protection of Human Health and the Environment

Alternative S-1 (no action) offers no additional protection for human health and the environment because no additional actions would be taken to address soil contamination at the Site. ***Alternative S-3B*** (unlimited removal and off-site disposal) offers the highest level of protection of human health and the environment in the long-term because all fill and contaminated soil would be removed. ***Alternative S-3A*** (limited removal and off-site disposal), ***Alternative S-5A*** (limited removal and on-site thermal treatment), and ***Alternative S-5B*** (limited removal and incineration) would also offer high levels of protection because these remedial responses would result in the removal of a significant contaminant mass. ***Alternative S-6*** (limited removal and treatment by soil washing) would offer moderate to high level of overall protection of if this technology can be implemented to effectively reduce contaminant concentrations. ***Alternative S-2*** (containment using engineered surface barriers) will eliminate the direct contact exposure route, but will provide a low level of overall protection because soil contamination will remain. ***Alternatives S-4A*** and ***S-4B*** (limited and unlimited removal and on-site disposal) will provide a moderate level of human health and the environment because highly contaminated material from the upper bluff area and the former coal tar dump area will be consolidated into a disposal cell at Kreher Park.

Although unlimited removal for ***Alternative S-3B*** (unlimited removal and off-site disposal) will provide high level of human health and environmental protection, limited removal for Alternatives S-3A, S-5A, S-5B, and S-6 will also provide adequate protection because these remedial responses will result in the removal of a significant mass of contamination. Although Alternatives S-2 and S-4 will result in the containment of contaminated materials, which will be inaccessible to humans or biota, thereby reducing risk, the overall level of protection are lower because there is no reduction on contaminant mass.

6.5.2 Compliance with ARARs and TBCs

Alternative S-1 (no action) will not achieve compliance with ARARs and TBCs. Implementation will require that engineering and construction actions be developed and completed in compliance with federal and state regulations. ***Alternatives S-2, S-4A,*** and ***S-4B*** (surface barriers, and limited and unlimited removal and on-site disposal) must be implemented with a groundwater remedial response to achieve compliance. If properly implemented, the remaining remedial responses could achieve compliance with ARARs and TBCs for soil.

6.5.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence considers long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. ***Alternative S-1*** (no action) will not provide any long-term benefit; no additional actions will be taken to address soil contamination at the Site. ***Alternative S-3B*** (unlimited removal and off-site disposal) will provide the highest effectiveness and permanence over the long term because all contaminated material and fill soil would be removed. ***Alternative S-3A*** (limited removal and off-site disposal), ***Alternative S-5A*** (limited removal and ex-situ thermal treatment), and

Alternative S-5B (limited removal and incineration) will also highly effective and permanent over the long term because these responses will result in the removal of a significant mass of contamination. ***Alternative S-6*** (limited removal and treatment by soil washing) will provide low moderate to high levels of effectiveness and permanence over the long term; effectiveness will depend upon the reduction in contaminant concentrations that can be achieved with this technology which cannot be determined without a treatability study. The long-term effectiveness of ***Alternatives S-4A*** and ***S-4B*** (limited and unlimited removal and on-site disposal) is considered low to moderate because contaminants will remain on site in a disposal cell constructed at Kreher Park. The long-term effectiveness of ***Alternative S-2*** (containment using engineered surface barriers) is considered low because constituents will remain at the site beneath the surface barriers. However, for ***Alternatives S-2***, ***S-4A***, and ***S-4B***, contaminated material will be contained and inaccessible to humans or biota, thereby reducing risk.

If properly implemented, the long-term effectiveness and permanence for all alternatives (except ***Alternative S-1)*** can be achieved for all active remedial responses for soil. Surface barriers (Alternative S-2) must be implemented in conjunction with a remedial response for groundwater to be more effective.

6.5.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

Reduction of toxicity, mobility, or volume of hazardous materials through treatment considers the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. ***Alternative S-1*** (no action) will not result in a reduction in the toxicity, mobility, or volume of contaminated soil. ***Alternative S-3B*** (unlimited removal and off-site disposal) will result in the highest degree of reduction of toxicity, mobility, and volume of impacted material because all contaminated soil and fill material will be removed. ***Alternative S-3A*** (limited removal and off-site disposal), ***Alternative S-5A*** (limited removal and ex-situ thermal treatment), and ***Alternative S-5B*** (limited removal and incineration) will also result in a high degree of reduction of toxicity, mobility, and volume of impacted material because these remedial responses will remove a significant contaminant mass. ***Alternative S-6*** (limited removal and treatment by soil washing) will result in a moderate to high degree of reduction of toxicity, mobility, and volume of contaminated soil, but will depend upon the reduction in contaminant concentrations that can be achieved with this technology. ***Alternatives S-4A*** and ***S-4B*** (limited and unlimited removal and on-site disposal) will offer a low to moderate reduction in the toxicity, mobility, and volume of contaminated soil at the Site. It will effectively reduce the toxicity and a significant volume of contaminated soil at the upper bluff area and former coal tar dump area, but this material will be placed in a disposal cell at Kreher Park, which although reduces the mobility of contaminants does not reduce the volume or toxicity at Kreher Park ***Alternative S-2*** (containment using engineered surface barriers) will not reduce the toxicity or and volume of contaminated soil in unexcavated areas, but it will limit the mobility of contaminants by reducing infiltration, which will minimize contaminant leaching to groundwater.

6.5.5 Short-term Effectiveness

Short-term effectiveness considers potential implementation risks to the community and site workers, environmental impacts, and time required to achieve RAOs. Implementation of ***Alternative S-1*** (no action) will not achieve RAOs or improve environmental impacts in the short-term. Because there is no remediation, there will be no exposure to the community and workers. The remaining alternatives will improve environmental impacts in the short-term, but require significant effort to protect the community and workers during remediation. Implementation of ***Alternative S-3B*** (unlimited removal and off-site disposal) will result in the most significant on and off-site disturbance and require the highest levels of effort for this protection. ***Alternatives S-4A*** and ***S-4B*** (limited removal and on-site disposal) will result in no off-site disturbance; site disturbance will be limited to the site, and will require a moderate level of effort for protection. ***Alternative S-2*** (containment using engineered surface barriers) will results in minimal on-site disturbance, and no off-site disturbance. Because the remaining alternatives include limited removal of highly contaminated soil, they will require high levels of effort for worker and community protection. If properly implemented, all alternatives, can achieve short term effectiveness for soil. Surface barriers (***Alternative S-2***) must be implemented in conjunction with a remedial response for groundwater to be more effective.

6.5.6 Implementability

Implementability considers technical feasibility, administrative feasibility, and the availability of services and materials. ***Alternative S-1*** (no action) will require the least amount of effort for implementability. Additionally, because no remedial action will occur, there will be no difficulty in implementing additional remedial actions at a later date. ***Alternative S-3B*** (unlimited removal and off-site disposal) will result in significant site disturbance, and will be the most difficult to implement. ***Alternative S-6*** (limited removal and treatment by soil washing) may require a pilot test to evaluate its implementability. The remaining limited removal alternatives are highly implementable.

6.5.7 Cost

Preliminary cost estimates for potential remedial alternatives for soil include site preparation, excavation, excavation de-watering, transportation and disposal, on-site treatment, and site restoration. There are no costs associated with ***Alternative S-1*** (no action) because none of these activities will be completed. For the upper bluff area, the ***Alternatives S-3B*** (unlimited removal and off-site disposal) and ***Alternative S-5B*** (limited removal and incineration) yielded the highest costs. ***Alternative S-6*** (limited removal and treatment by soil washing) yielded the next highest cost, following by ***Alternative S-5A*** (unlimited removal and on-site thermal treatment), ***Alternative S-3A*** (limited removal and off-site disposal), and. ***Alternatives S-4A*** and ***S-4B*** (limited and unlimited removal and on-site disposal) yielded lower costs for the upper bluff area. ***Alternative S-2*** (containment using engineered surface barriers) would be the lowest cost remedial response for soil in the upper bluff area, but would likely need to be completed in conjunction with a groundwater remedial response to be effective.

Alternative S-3B (unlimited removal and off-site disposal) also yielded the highest cost for Kreher Park. ***Alternative S-4B*** (unlimited removal and on-site disposal at Kreher Park) yielded the next highest cost followed by ***Alternative S-6*** (limited removal and treatment by soil washing), , ***Alternative S-5A*** (limited removal and on-site thermal treatment), ***Alternative S-2*** (containment using engineered surface barriers) ***Alternative S-5B*** (limited removal and off-site incineration), and ***Alternative S-4A*** (limited removal and on-site disposal), ***Alternative S-3A*** (limited removal and off-site disposal) yielded the lowest cost.

6.5.8 Summary

Based on this evaluation, unlimited removal and off-site disposal (***Alternative S-3B***) will provide the highest long-term benefit. However, this benefit is outweighed by the costs associated with this alternative, and potential short term and long term impacts during implementation. Although removal of all wood waste and fill soil from Kreher Park may be acceptable to the Agency, it may not be acceptable to the community if it results in the loss of future use for the park (i.e. restoration as shallow lakebed or wetland). Potential remedial alternatives requiring limited removal are more cost effective. Limited removal and off-site disposal (***Alternative S-3A***), limited and unlimited removal and on-site disposal (***Alternatives S-4 and S-4B***), and limited removal and thermal treatment (***Alternative S-5A***) will provide long-term benefits with the minimal short-term implementation issues. Off-site incineration (***Alternative S-5B***) could also provide long-term benefits with the minimal short-term implementation issues, but at a much higher cost. A pilot test will be needed to further evaluate the feasibility of limited removal and on-site soils washing (***Alternative S-6***) to ensure its effectiveness, but it could also provide long-term benefits with the minimal short-term implementation. Although containment using surface barriers (***Alternative S-2***) will prevent direct contact with surface contamination thereby reducing the risk to human health, it would need to be used in combination with other remedial alternatives for soil and groundwater for maximize effectiveness. The no action alternative (***Alternative S-1***) while costing little to nothing, will not provide any long-term protection, and should not be considered.

7.0 Development and Evaluation of Remedial Action Alternatives – Groundwater

7.1 Remedial Action Objectives for Groundwater

The general goal of RAOs is to protect human health and environmental receptors at risk from contaminants at the site. These objectives are subject to the nine Superfund criteria. As described in the RAO Tech Memo (URS 2007b) preliminary RAOs for groundwater are as follows:

- Protect human health by eliminating exposure (direct contact, ingestion, inhalation) to groundwater with COPCs in excess of regulatory or risk-based standards; reduce contaminant levels in groundwater to meet MCLs and State of Wisconsin Drinking Water Standards
- Protect the environment by controlling the off-site migration of contaminants in groundwater to surrounding surface water bodies which would result in exceedance of ARARs for COPCs in surrounding surface waters.
- Conduct NAPL removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water.

No COPCs were initially identified in the HHRA for groundwater because groundwater is not used as a potable water supply. However, currently there is no restriction on groundwater use in the area of known contamination. Exposure to contaminated groundwater and accompanying NAPLs can potentially occur via the following exposure scenarios:

- Construction worker exposure to shallow groundwater infiltrating trenches at Kreher Park; and
- Trespasser exposure to groundwater infiltrating the lower level of the former WWTP.

NAPL encountered in the Kreher Park fill, ravine fill, NSPW property and Copper Falls aquifer are a source for the dissolved phase plumes identified in groundwater in each unit at the Site. RAOs for NAPL within these units are based on ch. NR 708.13, WAC which states the following:

> *Responsible parties shall conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, lands or waters of the state. When required, free product removal shall be conducted, to the maximum extent practicable, in compliance with all of the following requirements:*

(1) *Free product removal shall be conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones using recovery and disposal techniques appropriate to the hydrologic conditions at the site or facility, and properly reuses or treats discharges of recovery byproducts in compliance with applicable state and federal laws.*

(2) *Free product removal systems shall be designed to abate free product migration.*

(3) *Any flammable products shall be handled in a safe and competent manner to prevent fires or explosions.*

Using the above criteria, alternatives for the removal of NAPL are further refined in this document.

7.2 Screening of Remedial Action Alternatives – Groundwater

7.2.1 Chemicals of Potential Concern – Groundwater

As with soil, screening focused on VOCs and PAHs contained in MGP tar waste as the primary COPCs.

7.2.2 Screening of Remedial Alternatives – Groundwater

Potential remedial alternative alternatives capable of preventing direct contact and ingestion of contaminated groundwater or reducing the toxicity and mobility of groundwater contamination at the Site are summarized in Table 7-1. Those retained after the Alternatives Screening Technical Memorandum (see Appendix A1) are shown in bold in Table 7-1.

Table 7-1 - Summary of Groundwater Technologies Reviewed (Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Option
No Action	**None**	**Not Applicable**
Institutional Controls	**Physical, land use, or legislative restrictions.**	Fencing **Groundwater use/Deed restriction** **Legislative action**
Monitored Natural Recovery	**Monitored Natural Attenuation**	Soil monitoring **Groundwater monitoring**
Containment	Deep well injection	Inject liquid waste into deep geologic formation below usable aquifers.
	Engineered Vertical Barrier	**Sheet piling and/or slurry wall** Concrete barriers Natural barrier
	Groundwater Extraction	**Down gradient extraction wells (retained for upper bluff and Kreher Park only)** **Subsurface interceptor trenches/drains**

Table 7-1 - Summary of Groundwater Technologies Reviewed (Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Option
In-Situ Treatment	**Biological Treatment**	Oxygen enhancement (air/ozone sparging) Oxygen enhancement with chemical oxidation Injection/Re-circulation wells/in well stripping
	Chemical Treatment	**Ozone sparging** **Chemical oxidation**
	Physical//Chemical Treatment	**Surfactant** **Permeable Reactive Barrier Walls**
	Thermal Treatment	Radio Frequency/Electromagnetic Heating **Electrical Resistance Heating** **Steam Injection** **Dynamic Underground Stripping** Hot Air Injection
Removal	**NAPL Excavation** **Groundwater Extraction**	**Removal of saturated zone soils** **Removal of NAPL and/or dissolved phase contaminants (conventional pumping)** **Multiphase vacuum recovery** **Surfactant injection with multiphase vacuum recovery**
Ex-Situ Treatment	**On-site Treatment** Off-site Treatment	**Gravity Separation** **Air Stripping** **Carbon Filtration**

7.3 Development of Potential Remedial Alternatives for Groundwater

Groundwater remedial technologies retained for screening were used to develop potential remedial alternatives for groundwater. Remedial alternatives for groundwater presented in this report are summarized in Table 7-2, included at the end of this section. A description of each remedial alternative follows.

7.3.1 Alternative GW-1 - No Action

The “no action” alternative for groundwater was retained as required by the NCP as a basis for comparing the other alternatives. The NCP at Title 40 Code of Federal Regulations (40 CFR §300.430(e)(6)) provides that the no-action alternative should be considered at every site. Implementation of no further action consists of leaving contaminated groundwater in place; no engineering, maintenance, or monitoring will be required.

7.3.2 Alternative GW-2 -Containment Using Engineered Surface and Vertical Barriers

Containment for groundwater contamination consists of the utilization of natural or man-made barriers to prevent potential exposure to or migration of contaminants with subsurface contamination. Containment alternatives retained for screening and evaluated in this report include engineered surface barriers, vertical barrier walls installed in the aquifer, and extraction

wells (barrier wells). Surface barriers eliminate the direct contact exposure pathway. They also can reduce contaminant leaching from the unsaturated zone, by restricting infiltrating water from contacting contaminated soil at areas where contaminated soil is present. Vertical barrier walls and barrier wells prevent the off-site migration of contaminants with groundwater. Engineered surface barriers, vertical barrier walls, and barrier wells are described below.

Engineered Surface Barrier

Engineered surface barriers are considered passive containment alternatives because the contaminated zone is not disturbed, and only minimal maintenance is required following implementation. Surface barriers include the following:

- Asphalt cap;
- Low permeability soil cap (i.e. 2 feet of clay with hydraulic conductivity of less than 10^{-7} cm/sec);
- Multi-layer cap with a minimum two-foot thick clay barrier, drainage layer, soil and vegetated top soil cover; and,
- Multi-layer cap with geomembrane (a minimum two-foot thick clay barrier, geomembrane, drainage layer, soil and vegetated top soil cover.

At the upper bluff area, asphalt caps over the filled ravine as surface barriers will be compatible with existing and future site use. At Kreher Park, a low permeability soil cap could be placed over the entire 11.6 acre parcel, but installation of a clay cap may require the removal of the marina parking lot, Marina Drive, and the former WWTP. To ensure the integrity of the clay cap, it may not be possible to maintain roads, parking lots, and buildings. Consequently, smaller surface barriers at select areas were also evaluated. These smaller surface barriers will be designed to be compatible with existing and future site use, and include asphalt pavement for the marina parking lot and a low permeability cap for the former coal tar dump. Asphalt pavement over the gravel covered marina parking lot will reduce infiltration at this area. A surface barrier over the former coal tar dump area will reduce contaminant leaching from the unsaturated zone if contaminated soil remains in place. If the WWTP is removed, a clay cap or asphalt pavement could be installed at this area. A surface barrier may not be needed at the remaining areas.

Multi-layer caps will be compatible with on-site and off-site disposal options for soil and the CDF for sediment. A multi-layer cap will also be compatible at areas of unexcavated soil, especially at Kreher Park. Single layer asphalt and low permeability caps will satisfy at a minimum satisfy 40 CFR Subtitle D requirements, and multi-layer caps will satisfy 40 CFR Subtitle C requirements. As with potential soil remedial alternatives (evaluated in section 6.0), surface barriers will be included as key elements of the potential groundwater and sediment remedial alternatives.

Barrier Wells

Barrier wells are considered active containment alternatives because long-term operation (groundwater extraction), maintenance, and monitoring will be required. Down gradient barrier wells were retained for groundwater at the upper bluff and for the saturated fill unit at Kreher Park. Properly engineered, these wells will prevent contaminants from migrating off site with groundwater. However, down gradient barrier wells were not considered for the Copper Falls aquifer. Regional groundwater flow conditions in the Copper Falls indicate that a potential stagnation zone beneath the center of Kreher Park has prevented the dissolved phase plume from migrating beyond the shoreline. Additional hydrogeologic and groundwater quality data will be required to ensure that contaminants will not migrate beyond the Kreher Park shoreline.

Well EW-4 was installed at the mouth of the filled ravine to prevent water discharging to the seep area at Kreher Park; it has been in operation since 2002. A final remedy for shallow groundwater in the ravine could include continued operation of EW-4, installation of additional extraction wells, or future operation of EW-4 along with a vertical barrier wall installed down gradient from the extraction well (use of EW-4 will reduce the hydraulic head behind the vertical barrier). An evaluation of the volume of groundwater discharging from the filled ravine and a capture zone analysis for EW-4 will be necessary to evaluate which alternative will be more effective. Continued use of EW-4 as a barrier well for the upper bluff, and barrier wells for shallow groundwater at Kreher Park are evaluated with Alternative GW-9 (removal using groundwater extraction).

Vertical Barrier Walls

Vertical barrier walls consist of a slurry wall or sheet piling installed around the perimeter of the contaminated groundwater zone. A slurry wall is a low permeability barrier constructed by placing a low permeability material (slurry) in a trench around the perimeter of the contaminated groundwater mass. Sheet piling will consist of inter-locking sheets of steel pilings that form a continuous wall installed around the perimeter of the contaminated groundwater mass. Vertical barrier walls are also considered active containment alternatives because contaminated material may be disturbed during construction, and/or long-term maintenance such as groundwater extraction from the contained area may be required.

Engineered vertical barrier walls were retained for further evaluation as potential containment alternatives for shallow contaminated groundwater encountered in the ravine fill at the upper bluff and at Kreher Park. However, vertical barrier walls would not be feasible for the underlying Copper Falls aquifer because this deep aquifer is confined by the Miller Creek Formation. Installation of a barrier wall for contaminants in the Copper Falls aquifer will require penetration of the Miller Creek Formation which will likely compromise the long-term integrity of this confining unit.

.For shallow groundwater, both types of vertical barriers could be anchored into the underlying low permeability Miller Creek Formation to create a barrier that will prevent contaminants in the shallow fill units from migrating off site with groundwater. However, because groundwater in the filled ravine discharges to Kreher Park, vertical barriers will be used to funnel groundwater from the filled ravine to Kreher Park, which will be enclosed by vertical barrier walls.

Engineered surface barriers will be used with vertical barriers to minimize groundwater recharge to contained areas from infiltration. At Kreher Park, vertical barriers may be also used in combination with containment or dredging alternatives evaluated for nearshore sediment described in Section 8.0. The location of the vertical barrier wall at Kreher Park is shown on Figure 7-1. Key elements for the conceptual design of a sheet pile vertical barrier wall around the perimeter of Kreher Park follows:

1. Site preparation will include clearing and grubbing of small trees and bushes along the bluff and near the former seep area as needed.
2. Although the former waste-water treatment plant will be located within the contained area, demolition of this dormant facility may be required.
3. A vertical barrier wall will be placed around the perimeter of Kreher Park. This vertical barrier will consist of a sheet pile wall anchored into the underlying Miller Creek Formation.
4. The sheet pile wall along the shoreline will be installed at an approximate depth of 25 feet below existing grade to allow the off-shore removal of sediment to a depth of ten feet adjacent to the sheet pile wall. The sheet pile wall on the south, east, and west sides of Kreher Park will be installed at an approximate depth of 16 feet below existing grade.
5. Surface barriers will be installed over the filled ravine to minimize groundwater recharge from infiltration, and the sheet pile wall on the south side of Kreher Park will terminate on the east and west flanks of the filled ravine to create a “funnel” for shallow groundwater discharge into Kreher Park.
6. A groundwater diversion trench will be installed between the remainder of the south wall and the upper bluff area to divert groundwater that currently seeps from the upper bluff area into the Kreher Park fill unit.
7. At Kreher Park, site restoration will include installation of new asphalt pavement over the marina parking lot to minimize infiltration in this area. Additionally, a low permeability soil cap will be placed over the former coal tar dump area, and if applicable, a soil cap over the disposal cell.
8. Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and restrict infiltration.
9. Long-term operation and maintenance of the facility will include the removal of contaminated groundwater, and annual inspection of surface barriers. A minimum of 15 groundwater extraction wells will be installed to remove groundwater and reduce the hydraulic head within the confined area. Contaminated groundwater will be conveyed to a treatment system constructed on-site. The treatment system will include an oil water separator, transfer pumps, and air stripper. This remediation equipment will be housed in a small on-site treatment building.

Institutional controls (i.e. deed restrictions) will likely be implemented as part of this remedial response to prevent exposure to groundwater contamination remaining within the contained area. Long-term operation and maintenance will include groundwater monitoring to confirm contaminants are not migrating from the contained area. This will include fluid level monitoring

and groundwater extraction to ensure the hydraulic head within the confined area remains at or below lake level.[21].

Although a cap for the entire Kreher Park area will result in significant site disturbance and additional implementation cost, long-term operation, maintenance, and monitoring (OM&M) costs may be lower if it can significantly reduce the volume of groundwater extraction and treatment that is required. To evaluate implementation and OM&M costs, annual groundwater recharge at Kreher Park from infiltration was evaluated for existing conditions, for partial caps (asphalt pavement for marina parking lot and clay cap for former coal tar dump area) with vertical barriers, and for a low permeability cap and vertical barriers for the entire park. Calculation and assumption are described in detail in Appendix D2, and results (the nearest 100 gallons) are summarized below.

Existing Conditions	3,685,000 (gallons)
Partial Cap	2,245,400
Entire Cap	892,900

As shown above, partial caps will reduce annual groundwater recharge from 3,685,000 gallons to 2,245,374, and a complete area cap will reduce annual recharge to 898,900 gallons. Partial caps will result in a 39-percent reduction in recharge, and capping all of Kreher Park will result in a 75 or 76-percent reduction in recharge. Estimated costs for partial caps are included as Alternative GW-2A, and estimated costs for capping all of Kreher Park and to further reduce the volume of groundwater extraction required is included as Alternative GW-2B.

7.3.3 Alternative GW-3 - In-situ Treatment Using Ozone Sparge

Ozone sparging is an in-situ chemical oxidation technology that can be used to oxidize and degrade contaminants in groundwater. Because ozone is a gas, it can be injected into the saturated zone as a gas via sparging. Sparging consists of injecting air or oxygen rich ozone into an aquifer as a gas through small diameter sparge wells. Commercially, ozone is generated by a high voltage discharge through air or oxygen in an ozone generator. Generally, yields are on the order of 1 to 3-percent ozone by volume in air and 2 to 6-percent ozone by volume in oxygen. In water, ozone decomposes to form free radicals. These free radicals are strong oxidizers and react with contaminants in water to form carbon dioxide and water. As an additional benefit, ozone treatment increases the dissolved oxygen level in the water when any un-reacted free radicals combine to form water and oxygen; the dissolved oxygen content in groundwater promotes biodegradation of contaminants.

[21] Groundwater recharge at Kreher Park results from seepage from the upper bluff area and infiltration. Groundwater seepage from the upper bluff area can be diverted, and infiltration into the contained area can be controlled by using surface barriers over the marina parking lot and former coal tar dump area. A cap could also be placed over the entire park to reduce infiltration, but all recharge can not be eliminated. Long-term groundwater extraction may be needed to reduce the hydraulic head within the contained area.

Ozone sparging is typically used for dissolved phase contamination, but is typically not used in areas where NAPL is present. If used for NAPL contamination, groundwater extraction will likely be needed because ozone/air injection may displace NAPL and/or cause a chemical reaction increasing the mobility of NAPL. This mobilized material is then recovered via extraction wells. Air/ozone sparging was retained for further evaluation as a potential in-situ treatment alternative for contaminated shallow groundwater encountered at the upper bluff and at Kreher Park, and in the underlying Copper Falls aquifer. The layout of an ozone sparge system for the shallow groundwater at the upper bluff and at Kreher Park is shown on Figure 7-2A. The layout of an ozone sparge system for the Copper Falls aquifer is shown on Figure 7-2B. Key elements for the conceptual design of an ozone sparging system for shallow groundwater at the upper bluff area and at Kreher Park, and for the Copper Falls aquifer follows:

1. All sparge wells will be installed in soil borings advanced with a hollow stem auger by a rotary drill rig.
2. Sparge wells will be installed on approximate 50-foot diameter centers, and one control panel will inject ozone into a cluster of 12 sparge wells. A pilot test will be necessary to obtain information for designing of the sparge well system.
3. One control panel will be needed for shallow groundwater in the filled ravine.
4. Eight control panels will be needed for shallow groundwater at Kreher Park.
5. Six control panels will be needed for groundwater in the underlying Copper Falls aquifer.
6. All air lines between the sparge wells and control panels will be buried in shallow trenches.
7. For the Copper Falls aquifer, the existing groundwater extraction system will be operated concurrent with the ozone sparge system to recover NAPL; treatment of contaminated groundwater and NAPL recovery is evaluated further with Alternative GW-9.

Although this technology can also be used for contaminated shallow groundwater in the ravine fill and at Kreher Park, buried structures (the former gas holders) and man made debris (wood waste, bricks, cinders, etc.) will interfere with installation and optimum delivery. Additionally, injecting into fill soil, which exhibits a wide range of physical characteristics (permeability in particular), may limit the effectiveness of this in-situ technology (experience with the SITE demonstration during 2006-2007 confirms these site conditions (Appendix B1).

The ozone sparge system may need to be operated for several years, and long-term groundwater monitoring will be required to evaluate the effectiveness of the sparging and subsequent natural attenuation. Institutional controls will also be utilized for this option.

7.3.4 Alternative GW-4 - In-situ Treatment using Surfactant Injection and Dual Phase Recovery

Physical/chemical treatment includes the use of surfactants to enhance the removal of NAPL. Surfactant injection is an in-situ injection technology. Surfactants are “surface active agents” that reduce the interfacial tension between NAPL and water by adsorbing at the liquid-liquid interface, which can result in an increase in the mobility of NAPL. Injection can also displace oil trapped within the aquifer media. Groundwater remediation using surfactant is a two phase

approach involving injection of surfactant and recovery of fluids. Surfactant is injected to displace or mobilize NAPL, which is then recovered slowly by groundwater extraction or rapidly by vacuum enhancement. Vacuum enhancement is also referred to as dual phase or multiphase extraction because an induced vacuum is used to remove air, water, and NAPL simultaneously.

Although this technology can also be applied to contaminated groundwater in the ravine fill and at Kreher Park, site conditions may prevent implementation and limit effectiveness. Buried structures (the former gas holders) and man made debris (wood waste, bricks, cinders, etc.) may prevent proper installation of injection/extraction wells. Additionally, fill soil, which exhibits a wide range of physical characteristics (permeability in particular), may limit the effectiveness of this in-situ technology. Consequently, it was not retained for screening as a shallow groundwater remedial response. For the Copper Fall aquifer, dual phase recovery was retained for screening. The layout of injection/extraction wells for the underlying Copper Falls aquifer is shown on Figure 7-3. Key elements for the conceptual design of surfactant injection and dual phase recovery system the Copper Falls aquifer follows:

1. A minimum of 30 small diameter injection/extraction wells will be installed in borings advanced below the Miller Creek / Copper Falls interface where NAPL has been identified. (Existing piezometers in this area will also be utilized).
2. Each well will be constructed with 2-inch diameter SCH 80 PVC well casing and screen. A sand pack will be placed around a well screen five feet in length.
3. Surfactant will be injected into wells where NAPL has been encountered to lower the interfacial tension that restricts the movement of non-mobile NAPL in the aquifer.
4. After allowing the surfactant to penetrate the formation for 24 to 48 hours, NAPL and groundwater is then removed by an induced vacuum and treated on site. Fluids will be removed from the injection/extraction wells by vacuum enhancement.
5. Multiple applications will be needed to remove NAPL to the extent practicable; for this evaluation it is assumed that a minimum of five applications of surfactant will be needed. Fluid levels will be checked one month after treatment, and the next application will be completed if NAPL remains. To remove a significant mass of mobile NAPL, it is assumed that fluids will be removed monthly for six months following the fifth application.
6. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.
7. A pilot test using existing piezometers MW-2AR, MW-4A, MW-10B, MW-13A, MW-15A, MW-19A, MW-21A, and MW-22A screened at the Miller Creek / Copper Falls interface should be completed prior to full scale remediation to determine if a mobile vacuum truck or fixed based system is needed for dual phase recovery. The pilot test will also be used to evaluate the mobile mass of NAPL that can be removed, the number of applications needed and the most efficient frequency of fluid removal between injections.

Surfactant injection and dual phase recovery can likely be completed within one year, but the existing groundwater remediation system will be operated for several more years. Treatment of contaminated groundwater and NAPL recovery is evaluated further with Alternative GW-9.

Long-term groundwater monitoring will be required to evaluate natural attenuation and institutional controls will be implemented as part of this option.

7.3.5 Alternative GW-5 - In-situ Treatment using Permeable Reactive Barrier Walls

Physical/chemical treatment also includes the use permeable reactive barrier (PRB) walls to treat contaminated groundwater migrating from source areas. PRB walls are limited to subsurface conditions where contaminants are found above a continuous aquitard at a depth within the vertical limits of trenching equipment. PRB walls are installed across the flow path of a contaminant plume, allowing the plume to passively move through the wall. There are two types of barriers, 1) permeable reactive barriers and 2) in-place bioreactors. Both allow the passage of water while restricting, via reaction with barrier materials, the movement of contaminants. Contaminants are degraded, adsorbed, or retained in/ by the barrier material.

PRB walls were not retained for the underlying Copper Falls aquifer; construction of the PRB would require penetration of the overlying Miller Creek Formation. The Miller Creek forms a confining unit for the Copper Falls aquifer, and construction will compromise the integrity of the confining unit. However, a PRB could be used as a remedial alternative for shallow groundwater. Instead of installing PRB walls in source areas, they are typically installed at down gradient locations to treat contaminated groundwater before it migrates off site. PRB walls are typically constructed as “gate” and “funnel” systems; gates are vertical barriers used to direct groundwater flow to the PRB wall, which functions as a funnel and treats groundwater before it leaves the site.

Because Kreher Park is filled lakebed, the lake is in hydraulic connection with shallow groundwater at Kreher Park. Vertical barriers can be used to prevent flow between Kreher Park and the lake. However, groundwater within the contained area may still be recharged by infiltration. Rather than extracting contaminated groundwater, shallow groundwater will be allowed to discharge from Kreher Park through the PRB wall. PRB walls are passive systems designed for long-term operation to control/ treat contaminants in-situ with normal groundwater migration. A sheet pile or slurry wall (vertical barrier) will be installed around the east, north, and south sides of Kreher Park to form the gate, and a down gradient PRB wall will be installed along the west side as the funnel. Rather than install another PRB wall for the filled ravine, a single PRB wall at the northwest perimeter of the park will treat shallow groundwater discharging from the entire site. The layout of the PRB wall, vertical barrier wall, and engineered surface barrier is shown on Figure 7-4. Key elements for the conceptual design of a PRB wall for shallow groundwater at the site follow:

1. Site preparation will include clearing and grubbing of small trees and bushes along the bluff and near the former seep area as needed.
2. Although the former waste-water treatment plant will be located within the contained area, demolition of this dormant facility may still be required as part of the overall remediation to accommodate future site use.

3. A vertical barrier wall will be placed on the north, east, and south sides of Kreher Park. This vertical barrier will consist of a sheet pile wall anchored into the underlying Miller Creek Formation.
4. The sheet pile wall along the shoreline will be installed at an approximate depth of 25 feet below existing grade to allow the off-shore removal of sediment to a depth of ten feet. The sheet pile wall on the south, east, and west sides of the Kreher Park will be installed at an approximate depth of 16 feet below existing grade.
5. A trench will be excavated on the west side of the Kreher Park for the PRB wall. The wall will be constructed with a porous layer of granular activated carbon to remove dissolved phase organic compounds prior to discharge.
6. The base of the PRB wall would be placed several feet below lake level, and the top of the PRB wall would be placed several feet above lake level. This will allow groundwater within the confined area to discharge as groundwater elevations in the contained area and lake levels fluctuate.
7. Monitoring wells will be installed on both side of the PRB wall, and water levels will be monitored to confirm that groundwater is flowing through the PRB wall.
8. Surface barriers will be installed over the filled ravine to minimize infiltration, and the sheet pile wall on the south side of Kreher Park will terminate on the east and west flanks of the filled ravine to create a “funnel” for shallow groundwater discharge into Kreher Park.
9. A groundwater diversion trench will be installed between the remainder of the south wall and the upper bluff area to divert groundwater seepage into the Kreher Park fill unit.
10. Site restoration will include installation of new asphalt pavement over the marina parking lot. A low permeability soil cap will be placed over the former coal tar dump area to minimize potential exposure to subsurface contamination and minimize leaching of contaminants from the unsaturated zone Regrading will be performed and a storm-water basin constructed within the confined area to manage storm-water and restrict infiltration.

The length and thickness of the PRB wall must be designed to allow adequate flow and treatment of contaminated groundwater discharging from the contained area. The thickness of the PRB wall increases retention time and treatment of contaminated groundwater. However, increasing the thickness of the PRB wall may reduce the volume of water that can pass through each linear foot of the wall. The length of the PRB wall can be increased to allow for increased flow through the wall, but increasing the length will increase the cost. Therefore an accurate estimate of the volume of water that will pass through the PRB wall is critical to the design. Discharge through the PRB wall will be influenced by 1) fluctuating lake levels, and 2) groundwater recharge from infiltration within the contained area. The PRB could function with or without impermeable surface barriers. However, because the length on the east side of the park is limited, surface barriers will likely be used to restrict groundwater recharge from infiltration, which will reduce the volume of groundwater passing through the PRB wall. A numerical flow model evaluating surface infiltration coupled with fluctuating lake levels may be needed to determine the length of PRB wall required.

Long-term operation and maintenance of the PRB wall will be minimal. Groundwater monitoring will be needed to evaluate the effectiveness of the PRB wall. The reactive material

used to construct the PRB may need to be replaced if NAPL migrates from the source area and permeates the PRB, or the reactive material is becomes saturated with contaminants removed from groundwater passing through the wall. Fluid levels will also be monitored to ensure the hydraulic head within the confined area remains at or slightly above lake level. Institutional controls will likely be implemented to prevent direct contact with subsurface contaminants within contained areas as part of this remedial option.

7.3.6 Alternative GW-6 – Treatment using Chemical Oxidation

Chemical oxidation introduces strong oxidizing chemicals such as permanganate and peroxide into the subsurface to degrade VOCs and PAH compounds to CO_2 and H_2O end products. Permanganate or peroxide could be injected as liquid reagents through boreholes, wells, or mixed with a backhoe in shallow trenches. Chemical oxidation has an added benefit of enhancing biodegradation by increasing oxygen concentrations in the subsurface. Chemical oxidation could be performed on saturated and unsaturated zone soils by injecting chemicals into the subsurface via borings or wells.

In-situ chemical oxidation could be used for unsaturated and saturated zone contamination at the upper bluff. However, existing conditions at the upper bluff area (the NSPW facility building and buried gas holders) and at Kreher Park (wood waste layer) may limit implementability. Mixing reagent in shallow trenches would be the most effective treatment method at Kreher Park because contamination is present at shallow depths at the former coal tar dump area, and would be easily accessible. Because in-situ chemical oxidation reactions can result in the generation of off-gases, primarily CO_2, passive venting or an active SVE system may be required to capture off-gases. The presence of NAPL may require multiple applications to lower contaminant concentrations to acceptable levels. Potential injection locations for in-situ chemical oxidation at the upper bluff and at Kreher Park are shown on Figures 7-5A, and 7-5B, respectively. Key elements for the conceptual design for in-situ chemical oxidation for shallow soil and groundwater at the site follow:

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
2. Between 200 and 300 injection borings will be advanced in the filled ravine using a direct push drill rig[22].
3. For this evaluation it is assumed that approximately 1,500 gallons of reagent will be injected into each boring.
4. A minimum of 10 passive vent wells will be installed in the filled ravine. Each well will be installed to an approximate depth of 20 feet with well screens 10 feet in length. Because the water table will intersect the well screen, these wells may also be used to recover fluids that rise to the surface in response to chemical reactions taking place in the subsurface. Recovered fluids will be placed in a holding tank and discharged to the on-site treatment system.

[22] Direct push was used to advance injection boring for the USEPA SITE pilot test completed at the Site in early 2007.

5. Site restoration at the upper bluff area will include replacement of existing asphalt pavement and new pavement over the footprint of the demolished building south of St. Claire Street. New pavement on the north of St. Claire Street will also be installed to prevent infiltration into this section of the filled ravine.
6. At Kreher Park, site preparation will include clearing and grubbing small trees and bushes along the bluff and near the former seep area as needed.
7. Chemical oxidation at Kreher Park will be completed above and in the wood waste layer where DNAPL is encountered and at the former coal tar dump area by mixing reagent in a shallow excavation.
8. Additionally, between 100 and 150 injection borings will be advanced at the former seep area and near TW-11 where DNAPL has been encountered. A direct push drill rig will be used to advance these borings, and approximately 1,500 gallons of reagent will be injected into each boring. Existing wells MW-7 and TW-11 will be used as passive vent wells in these areas.
9. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the former coal tar dump area to minimize potential exposure to subsurface contamination and minimize infiltration.
10. Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and restrict infiltration.
11. Multiple applications may be needed to reduce contaminant levels to the extent practicable. The estimated remedial costs included in this report assume two applications. The first application will be completed in a regular grid pattern over the treatment area, but additional applications will be completed within the treatment area as needed.

Implementation for the underlying Copper Falls would be more extensive; it may require groundwater extraction rather than soil vapor extraction. The USEPA's SITE program recently completed a demonstration pilot test to fully evaluate the implementability of this alternative at the Site. Additional data will be available in the near future following compilation of pilot test data. Chemical oxidation may also increase the mobility of NAPL recovered by extraction wells resulting in the removal of significant contaminant mass in a short time frame. Preliminary results from the recent SITE program pilot test indicate that injection into areas with NAPL contaminants resulted in an initial vigorous reaction followed by an increase in the mobility and recovery of NAPL. Additional data is currently being collected and will be available in the near future to evaluate NAPL recovery and improvements to groundwater quality. Potential injection locations for in-situ chemical oxidation for the underlying Copper Falls aquifer are shown on Figure 7-5C. Key elements for the conceptual design for in-situ chemical oxidation for the Copper Falls aquifer follow:

1. Between 250 and 500 injection borings will be advanced in the Copper Falls aquifer using a direct push drill rig.
2. For this evaluation it is assumed that approximately 1,500 gallons of reagent will be injected into each boring.
3. Existing extraction wells EW-1, EW-2, and EW-3 will continue to operate during and after reagent injection.

4. A minimum of 7 additional extraction wells will be installed in the Copper Falls aquifer in borings advanced with hollow stem auger using a rotary drill rig.
5. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.
6. Multiple applications may be needed to reduce contaminant levels to the extent practicable. The estimated remedial costs included in this report assume two applications. The first application will be completed in a regular grid pattern over the treatment area, but additional applications will be completed within the treatment area as needed.

Although chemical oxidation applications can be completed within a short period of time, the groundwater extraction system may be operated for several years; treatment of contaminated groundwater and NAPL recovery is evaluated further with Alternative GW-9. Long-term groundwater monitoring to evaluate natural attenuation and institutional controls will be included with this remedial response.

7.3.7 Alternative GW-7 - In-situ Treatment using Electrical Resistance Heating

Electrical resistance heating (ERH) technology uses electricity applied into the ground through electrodes to heat the formation. This mobilizes contaminants by heating contaminants and groundwater to boiling point, the steam and contaminants are then recovered with a SVE, groundwater extraction, or dual phase system. The ERH electrodes can be installed either vertically to about 100 feet or horizontally beneath buildings. ERH heats the contaminants up to 100 ^{0}C, which raises the vapor pressure of volatile and semi-volatile organic compounds in the soil. For soil and shallow groundwater, this enhances the recovery of volatilized contaminants by SVE. At these high temperatures (100 ^{0}C), ERH can also be used to dry soil, which can create fractures that increase soil permeability resulting in improved recovery of contaminants by SVE. At high temperatures, saturated zone soils can also be heated to high temperatures to create steam that strips contaminants from soil. Treatment of effluent vapors and dissolved phase groundwater contamination will be required before discharge of air and/or water.

Implementation of this technology for shallow soil and groundwater contamination could be completed simultaneously; passive soil venting and groundwater extraction will likely be required. Existing site buildings and buried structures at the upper bluff and the wood waste layer at Kreher Park will likely limit implementation of this alternative for soil and shallow groundwater. Building demolition and removal of the buried structures at the upper bluff area would enhance the implementability of ERH for the underlying Copper Falls aquifer. For shallow soil and groundwater at the upper bluff area and at Kreher Park, and for the underlying Copper Falls aquifer, ERH could be utilized with groundwater extraction to remove DNAPL. Rather than heat soils to create steam, the saturated zone will be heated to between 30°C and 40°C to decrease the viscosity and increase the mobility of NAPL, which is then removed via extraction wells or by a dual phase recovery system. Current Environmental Solutions (CES) reported over 5,000 gallons of product was recovered after the first three months of operation at a former MGP site in Illinois (*Enhanced Free Product Recovery Using Low Temperature In-Situ Heating - An Option For MGP Sites*, CES 2006).

Potential locations for ERH electrodes, passive vent wells, and extraction well for shallow soil and groundwater at the upper bluff and at Kreher Park are shown on Figures 7-6A and 7-6B, respectively[23]. Key elements for the conceptual design for ERH for shallow soil and groundwater at the site follow:

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access contaminated soil beneath the building in the upper bluff area.
2. Installation of a minimum of 200 electrodes at the filled ravine to heat the subsurface to 30° or 40° C to enhance DNAPL recovery.
3. A minimum of 10 passive vent wells will be installed at the filled ravine to allow vapors to escape, and a minimum of four extraction wells will be installed to recover fluids.
4. Treatment of effluent vapors and dissolved phase groundwater contamination will be required before discharge of air and/or water. Vapor-phase carbon adsorption will be used to treat vapors prior to discharge to the atmosphere. Water will be treated by the on-site treatment system prior to discharge to the sanitary sewer; this will require upgrades to the existing treatment system.
5. Site restoration will include replacement of existing asphalt pavement south of St. Claire Street and new pavement north of St. Claire Street to prevent infiltration into the underlying filled ravine.
6. At Kreher Park, site preparation will include clearing and grubbing of small trees and bushes along the bluff and near the former seep area as needed.
7. Installation of a minimum of 150 electrodes at the former seep, former coal tar dump, and TW-11 areas to heat the subsurface to 30° or 40° C to enhance DNAPL recovery.
8. A minimum of 10 passive vent wells and a minimum of four extraction wells will also be installed at the former coal tar dump area; the vent wells will allow vapors to escape and the extraction wells will be used to recover fluids.
9. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the disposal cell and former coal tar dump area to minimize potential exposure to subsurface contamination and minimize infiltration.
10. Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and restrict infiltration.

If a containment alternative is implemented for Kreher Park, treatment of shallow soil and groundwater will not be required. If removal of buried structures is required, ERH may not be as feasible for soil and shallow groundwater as are removal and ex-situ treatment alternatives described in Section 6.0

[23] The conceptual design presented in this FS Report uses passive vent wells to vent vapors, recovery wells to remove fluids, and electrodes to heat the plume to enhance NAPL recovery. Passive vent wells may not be needed. Additionally, ERH may also be accomplished by combining electrodes in the same boring as extraction wells, which will require groundwater extraction from numerous small diameter wells rather than from a few groundwater extraction wells. This issue can be addressed during the design phase.

Potential locations for ERH electrodes and SVE wells for deep groundwater contamination in the Copper Falls aquifer are shown on Figure 7-6C. Key elements for the conceptual design for ERH for shallow the Copper Falls aquifer follow.

1. Demolition of the center section of the NSPW service center will likely be required for shallow soil and groundwater remediation. Demolition of the center and west sections of the NSPW service center will be required to access the underlying Copper Falls aquifer.
2. Removal of the buried gas holders will improve the implementability of ERH for the underlying Copper Falls aquifer.
3. Installation of a minimum of 200 electrodes in the underlying Copper Falls aquifer to heat the subsurface.
4. A minimum of 12 additional extraction wells will be installed, and the three existing groundwater extraction wells would be used to remove contaminated groundwater.
5. Treatment of effluent vapors and dissolved phase groundwater contamination will be required before discharge of air and/or water. Vapor-phase carbon adsorption will be used to treat vapors prior to discharge to the atmosphere. Water will be treated by the on-site treatment system prior to discharge to the sanitary sewer; this will require upgrades to the existing treatment system.

For the purpose of evaluating ERH in this FS Report, we have assumed that groundwater will be extracted for six to 12 months while the ERH system is in operation. We have assumed groundwater extraction rates of 5 to 10 gallons per minute (gpm) for shallow groundwater in the filled ravine, 10 to 20 gpm for shallow groundwater at Kreher Park, and 15 to 20 gpm for the Copper Falls aquifer. This increased flow rate will require upgrades to the existing NAPL treatment system, but long term operation of the treatment system will not be required. ERH can be completed within a short period of time (i.e. several months); therefore we have assumed that continued operation of the groundwater extraction system will not be required. Long-term groundwater monitoring to evaluate natural attenuation and institutional controls will be included with this remedial response.

7.3.8 Alternative GW-8 - In-situ Treatment using Steam Injection (Including Contained Recovery of Oily Wastes (CROW) and Dynamic Underground Stripping (DUS) Processes)

Steam injection physically separates volatile and semi-volatile organic constituents from soil by thermal or mechanical energies. A passive or active SVE and/or groundwater extraction system will be needed to recover volatilized contaminants. Implementation for soil and shallow groundwater remediation can be completed simultaneously. Potential steam injection and recovery wells for shallow soil and groundwater at the upper bluff are shown on Figure 7-7A. Steam injection well location at the former coal tar dump area at Kreher Park are shown on Figure 7-7B. Key elements for the conceptual design for steam injection for shallow groundwater follow.

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access contaminated soil beneath the building in the upper bluff area.

2. Replacement of existing asphalt pavement south of St. Claire Street and new pavement north of St. Claire Street will be required.
3. Installation of a boiler for generation of steam for injection.
4. A minimum of nine steam injection wells and four steam recovery wells will be installed at each area (the filled ravine and the former coal tar dump area).
5. Treatment of effluent vapors and/or dissolved phase groundwater contamination will be required before discharge of air and/or water. Vapor phase carbon may be used to treat vapors prior to discharge to the atmosphere. Water will be treated by the on-site treatment system prior to discharge to the sanitary sewer; this may require upgrades to the existing treatment system.

The Contained Recovery of Oily Wastes (CROW) process is a patented hybrid thermal flushing process that uses steam injection. For the CROW process, hot water is injected with steam to mobilize NAPL toward recovery wells, which then convey the mixture to separators along with an on-site treatment system. This innovative technology has been successfully used at coal tar sites as full-scale remedial applications. Limitations to the technology include groundwater injection and recharge, groundwater chemistry, site accessibility, and utility access. Potential steam injection and recovery wells for shallow soil and groundwater using the CROW method will be similar to the steam injection layout shown on Figures 7-7A and 7-7B.

As shown during the SITE demonstration, injection into the confined Copper Falls aquifer will require high pressures. This will reduce the effectiveness of steam and hot water injection for the deep groundwater. High pressures that could hydraulically fracture the Copper Falls and Miller Creek formations[24]. Alternatively, a patented hybrid steam injection process called Dynamic Underground Stripping (DUS) could be applied for the underlying Copper Falls aquifer. This technology involves groundwater extraction and treatment of contaminated fluids mobilized by heating via a combination of technologies. This process will consist of steam injection; electrical heating; underground imaging; and collection and treatment of effluent vapors, NAPL, and contaminated groundwater. These technologies are utilized as follows:

- Steam injection at the periphery of the contaminated area heating permeable zone soils, which then vaporizes volatile compounds bound to the soil causing contaminant migration to centrally located vapor/groundwater extraction wells;
- Electrical heating of less permeable clays and fine-grained sediments vaporizing contaminants causing migration into the steam zone;
- Underground imaging, primarily Electrical Resistance Tomography (ERT) and temperature monitoring, which delineates the heated area and tracks the steam fronts daily to monitor cleanup, and
- Treating effluent vapors, NAPL, and impacted groundwater as needed before discharge.

Hydrous Pyrolysis/Oxidation (HPO) is a process sometimes completed after contaminants are removed during the DUS phase. HPO consists of steam and air injection, which creates a heated,

[24] The Miller Creek is the confining unit for the Copper Falls, and this unit is thinnest where it was dissected by the former ravine near the former MGP. Fracturing the Miller Creek could create future breaches in the Copper Falls.

oxygenated zone in the subsurface. After the injection is terminated the steam condenses causing contaminated groundwater to migrate to the heated zone where it mixes with the condensed steam and oxygen. Although this may destroy some microorganisms impeding natural biodegradation, HPO enhances biodegradation of residual contaminants by stimulating other microorganisms (called thermophiles) that thrive at high temperatures. A pilot test will be needed to evaluate the effectiveness of HPO after DUS.

Potential steam injection and recovery wells for deep groundwater contamination in the Copper Falls aquifer are shown on Figure 7-7C. Key elements for the conceptual design for DUS for the Copper Falls aquifer follow.

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access the underlying Copper Falls aquifer at the upper bluff area.
2. A minimum of 12 steam injection wells will be installed in the Copper Falls aquifer at the upper bluff area.
3. A minimum of 9 recovery wells will be installed in the Copper Falls aquifer at the upper bluff area.
4. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.

For the purpose of evaluating steam injection technologies in this FS Report, we have assumed that the groundwater will be extracted for three to six months with steam injection is performed. We have assumed groundwater extraction rates of 5 to 10 gallons per minute (gpm) for shallow groundwater in the filled ravine, 10 to 20 gpm for shallow groundwater at Kreher Park, and 15 to 20 gpm for the Copper Falls. This increased flow rate will require upgrades to the existing NAPL treatment system, but long term operation of the treatment system will not be required. Although steam injection or DUS can be completed within a short period of time, long-term groundwater monitoring will be required to evaluate natural attenuation and institutional controls as final remedial responses.

A pilot test will likely be necessary prior to a full application of DUS at the Site. Information developed for the 2006-2007 SITE ISCO demonstration (injection rates, aquifer chemistry where applicable) will be utilized in the full analyses of this option in the design phase.

7.3.9 Alternative GW-9 – NAPL Removal using Groundwater Extraction Wells

Groundwater extraction uses water as a carrier to remove both NAPL and dissolved phase contamination. Groundwater extraction can be implemented for shallow groundwater contamination encountered at the upper bluff area and Kreher Park as well as the underlying Copper Falls aquifer. The existing interim groundwater extraction interim system currently extracts groundwater from one well installed at the mouth of the filled ravine, and groundwater and DNAPL from three low flow wells installed in the underlying Copper Falls aquifer. Continued operation of this system was evaluated as Alternative GW-9A, and enhanced groundwater extraction was evaluated as Alternative GW-9B. Enhanced removal at the upper bluff area will include installation of additional low flow extraction wells in the Copper Falls aquifer to increase DNAPL removal rates, and continued operation of existing wells EW-1, EW-2, and EW-3. This will also include continued operation of EW-4. However, an evaluation of the volume of groundwater discharged from the filled ravine along with a capture zone analysis for this well will also be required to evaluate utilization of EW-4 for shallow groundwater containment (i.e. barrier wells).. Potential extraction well locations for the Copper Falls aquifer are shown on Figure 7-8A. Key elements for enhanced groundwater and NAPL extraction in the upper bluff area follow.

1. A minimum of 12 extraction wells will be installed in the Copper Falls aquifer.
2. Installation of lateral piping between each extraction well and the existing treatment building.
3. Replacement of existing asphalt pavement south of St. Claire Street and new pavement north of St. Claire Street will be installed to reduce infiltration into the ravine fill.
4. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.

The groundwater extraction system at the upper bluff area may be operated for an extended period of time. Long-term groundwater monitoring will be required to evaluate natural attenuation and institutional controls will also be implemented as part of this option. Continued operation of the existing groundwater extraction system (Alternatives GW-9A) was also evaluated with Alternatives GW-3 (ozone sparge) and GW-4 (dual phase recovery and surfactant injection). Based on the historical operation of the existing system, a combined groundwater extraction rate of two to three gallons per minute (gpm) was used to evaluate long term operation and maintenance costs. The addition of seven additional extraction wells was evaluated as Alternative GW-6 (chemical oxidation), and Alternative GW-9B included the addition of 12 extraction wells. Additional wells would result in an increase of the combined flow rate to 10 to 15 gpm, which will require an upgrade to the existing treatment system.

Horizontal extraction wells will be used at Kreher Park because shallow groundwater is encountered in a widespread thin fill unit, and fill material has variable permeability in this area. A potential horizontal well configuration for shallow groundwater extraction contamination at Kreher Park is shown on Figure 7-8B. Key elements for the conceptual design for shallow groundwater extraction at Kreher Park follow.

1. Horizontal wells consisting of perforated pipe will be installed in trenches penetrating the saturated fill unit.
2. One trench will transcend the length of the Kreher Park. Lateral trenches will be installed to dissect the former coal tar dump area and the former open sewer area.
3. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require installation of a treatment system at Kreher Park
4. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the former coal tar dump area to prevent potential exposure to subsurface contamination and minimize infiltration.

Groundwater extraction at Kreher Park will require installation of an on-site treatment system that will require operation for an extended period of time. Long-term groundwater monitoring will be required to evaluate natural attenuation and institutional controls will also be implemented as part of this option. For the purpose of evaluating groundwater extraction at Kreher Park, a pumping rate of 50 gallons per minute was used. This flow rate will exceed the estimated annual recharge rate and induce an inward hydraulic gradient at Kreher Park.

Table 7-2.Summary of Potential Groundwater Remedial Alternatives

Alternative	Upper Bluff Area	Kreher Park	Copper Falls Aquifer	Other Groundwater Remedial Technologies Used
Alternative GW-1 No Action	• No removal or treatment of groundwater performed.			• Not applicable
Alternative GW-2A Containment Using Engineered Surface and Vertical Barriers	• Install asphalt pavement as surface barrier over filled ravine. • Install asphalt pavement as surface barrier over filled ravine.	• Install barrier wall around perimeter of Kreher Park fill to prevent off-site migration of contaminants with groundwater. • Install asphalt pavement over marina parking lot, and low permeability soil cap in the former coal tar dump area, or cap the entire park.	• Not evaluated because installation of a vertical barrier wall may jeopardize the integrity of the overlying confining unit.	• Monitored natural attenuation • Institutional controls • Groundwater extraction from contained areas with on site treatment.
Alternatives GW-2B Containment Using Engineered Surface and Vertical Barriers		• Install barrier wall around perimeter of Kreher Park fill to prevent off-site migration of contaminants with groundwater. • Install clay cap meeting ch. NR 500 requirements over the entire park; would require demolition of WWTP.		
Alternative GW-3 In-situ Treatment using Ozone Sparge	• Install sparge wells in the filled ravine south of St. Claire Street.	• Install sparge wells throughout Kreher Park.	• Install of sparge wells in the impacted portion of Copper Falls aquifer. • Continue to operate existing groundwater remediation system to collect NAPL. •	• Monitored natural attenuation • Institutional controls • Groundwater extraction and NAPL recovery with on site treatment.
Alternative GW-4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	• Not evaluated because existing conditions (buried gas holders and variable permeability of fill material) may impede effectiveness.	• Not evaluated because existing conditions (wood waste layer and variable permeability of fill material) may impede effectiveness.	• Install a minimum of 30 injection/extraction wells, inject surfactant, and remove fluid monthly for a minimum of one year. • Continued operation of existing NAPL recovery system.	• Monitored natural attenuation • Institutional controls • Groundwater extraction and NAPL recovery with on site treatment.

Table 7-2.Summary of Potential Groundwater Remedial Alternatives

Alternative	Upper Bluff Area	Kreher Park	Copper Falls Aquifer	Other Groundwater Remedial Technologies Used
Alternative GW-5 In-situ Treatment using Permeable Reactive Barrier Walls	• Groundwater from ravine would continue to discharge to Kreher Park. Groundwater discharging from Kreher Park would then pass through a PRB wall for treatment prior to leaving the park.	• Install vertical barrier wall on north, south, and east sides to contain shallow groundwater contamination in the park. • Install PRB wall constructed of GAC on west side of Kreher Park to remove dissolved phase contaminants from groundwater prior to discharge from Park.	• Not evaluated because installation of a PRB wall may jeopardize the integrity of the overlying confining unit.	• Monitored natural attenuation • Institutional controls • Containment using surface and vertical barrier walls
Alternative GW-6 In-situ Treatment using Chemical Oxidation	• Inject reagent through borings advanced into the DNAPL area within the filled ravine south of St. Claire Street. • Install passive vent/recovery wells to vent off-gases and recover fluids • Modify existing treatment system, and treat recovered fluid on site.	• Mix reagent in shallow trench excavated at former coal tar dump area. • Inject reagent through borings advanced into DNAPL areas in former seep area and near well TW-11.	• Inject reagent through borings advanced into the underlying Copper Falls aquifer. • Install additional groundwater extraction wells to collect NAPL. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Soil vapor extraction • Groundwater extraction • Containment using surface and vertical barrier walls
Alternative GW-7 In-situ Treatment using Electrical Resistance Heating	• Install array of electrodes in filled ravine to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and vent wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install array of electrodes above wood waste layer at the former coal tar dump area to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and vent wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install array of electrodes in the underlying Copper Falls aquifer to enhance the migration of NAPL. • Install additional groundwater extraction wells and vent wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Soil vapor extraction • Groundwater extraction • Dual Phase Recovery • Treat air stream from vapor prior to discharge. • Treatment of SVE condensate prior to discharge. • Containment using surface and vertical barrier walls

Table 7-2.Summary of Potential Groundwater Remedial Alternatives

Alternative	Upper Bluff Area	Kreher Park	Copper Falls Aquifer	Other Groundwater Remedial Technologies Used
Alternative GW-8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)	• Install steam injection wells in filled ravine to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and vent wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install steam injection wells above wood waste layer at former coal tar dump area to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and vent wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install steam injection wells in the underlying Copper Falls aquifer to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and vent wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Soil vapor extraction • Groundwater extraction • Treat air stream from vent wells prior to discharge. • Treatment of vapor condensate prior to discharge. • Dual Phase Recovery • Containment using surface and vertical barrier walls
Alternative GW-9A Removal using Existing System Groundwater Extraction System	• Continue to operate EW-4 as down gradient barrier well for shallow groundwater contamination in filled ravine. • Continue to operate existing treatment system.	• No groundwater extracted from Kreher Park.	• Continue to operate EW-1, EW-2, and EW-3.	• Monitored natural attenuation • Institutional controls • Containment using surface and vertical barrier walls • Ozone sparge • Surfactant Injection
Alternative GW-9B Removal using Enhanced Groundwater Extraction System		• Install horizontal wells in saturated fill unit. • Construct building at Kreher Park for groundwater treatment equipment. • Treat contaminated groundwater on site	• Install additional extraction wells to recover contaminated groundwater and NAPL. • Continue to operate EW-1, EW-2, and EW-3. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Containment using surface and vertical barrier walls • Ozone sparge • Surfactant Injection • Chemical oxidation • Electrical resistance heating • Dynamic underground stripping

7.4 Detailed Analysis of Retained Remedial Action Alternatives for Groundwater

Potential remedial alternatives for groundwater were evaluated in this section in accordance with the threshold criteria, primary balancing criteria, and modifying criteria described in Section 7.4.1 below.

7.4.1 Threshold Criteria

Threshold criteria, which relate to statutory requirements that each alternative must satisfy to be eligible for selection, include:

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).

The "no action" alternative will not satisfy threshold criteria; it will not result in the protection of human health and the environment. Containment technologies (surface and vertical barriers) will prevent exposure to contaminants and prevent the off-site migration of contaminants with groundwater. The remaining potential remedial alternatives for groundwater will result in a reduction in mass, toxicity, and mobility of contaminants, which will result in the overall protection of human health and the environment.

The "no action" alternative will not achieve compliance with ARARs. However, the remaining potential remedial alternatives for groundwater will achieve compliance with ARARs as summarized in Table E-2 in Appendix E.

7.4.2 Balancing Criteria

The primary *balancing criteria*, which are the technical criteria upon which the detailed analysis is primarily based, include:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

7.4.2.1 Long Term Effectiveness and Permanence

Each remedial alternative is evaluated as to magnitude of long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. Table 7-3 presents an evaluation of the long-term effectiveness and permanence of each alternative.

Table 7-3. Evaluation of Long-term Effectiveness and Permanence for Potential Groundwater Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk			Adequacy and Reliability of Controls		
	Filled Ravine	Kreher Park	Copper Falls	Filled Ravine	Kreher Park	Copper Falls
Alternative GW-1 No Action	• Potential risk to human health or the environment, if any, would not be reduced.			• There are no remedial actions or controls associated with this alternative.		
Alternative GW-2A and GW-2B Containment Using Engineered Surface and Vertical Barriers	• Contamination will remain in the contained area. Surface barriers will prevent direct contact with subsurface contamination, and vertical barriers will prevent off-site migration, which will reduce long-term potential risk to human health and the environment outside the contained area. • Institutional controls could be implemented to prevent exposure to residual subsurface contamination in contained area		• Containment will not be effective for the Copper Falls; it will not reduce risk levels for this underlying aquifer.	• Surface barriers would be effective at preventing exposure to subsurface contaminants, and vertical barriers would be reliable for preventing off-site migration for shallow groundwater, in the filled ravine and at Kreher Park. • Long-term OM&M will be required to ensure containment ensure contaminants are not migrating from the contained area.		• Containment using surface or vertical barriers would not be reliable for underlying confined aquifer.
Alternative GW-3 In-situ Treatment using Ozone Sparge	• In-situ ozone sparge is used to degrade saturated zone contaminants in place; residual soil contamination may remain. • Fill material may prevent or limit ozone injection and mixing. • Institutional controls could be implemented to prevent exposure to residual subsurface contamination in contained area			• Reliable technology for degrading dissolved phase contaminant mass in place. • Can also be used to enhance recovery of NAPL via groundwater extraction.		
Alternative GW-4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	• It may not be possible to inject surfactant into all areas, which could result in significant untreated residual contaminant mass remaining in place.		• Multiple surfactant injections may be required to remove NAPL. • Institutional controls could be implemented to prevent exposure to residual subsurface contamination in contained area	• Would not be adequate or reliable due to wide range of permeability of fill material.		• Surfactant injection would increase mobility of NAPL that could be removed by vacuum extraction and/or operation of groundwater extraction wells, which would reduce long-term OM&M.

Table 7-3. Evaluation of Long-term Effectiveness and Permanence for Potential Groundwater Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk			Adequacy and Reliability of Controls		
	Filled Ravine	Kreher Park	Copper Falls	Filled Ravine	Kreher Park	Copper Falls
Alternative GW-5 In-situ Treatment using Permeable Reactive Barrier Walls	• Contamination will remain in the contained area. Surface barriers will prevent direct contact with subsurface contamination. Vertical barriers will prevent off-site migration, which will reduce long-term potential risk to human health and the environment outside the contained area. • PRB wall will be used to remove contaminants from groundwater discharging from contained area. • Institutional controls could be implemented to prevent exposure to residual subsurface contamination in contained area		• Containment will not be effective for the Copper Falls; it will not reduce risk levels for this underlying aquifer.	• Surface barriers would be effective at preventing exposure to subsurface contaminants, and vertical barriers would be reliable for preventing off-site migration for shallow groundwater, in the filled ravine and at Kreher Park. • Long-term monitoring will be required to ensure contaminants are removed from groundwater passing through the PRB wall.		• Containment using surface or vertical barriers would not be reliable for underlying confined aquifer.
Alternative GW-6 In-situ Treatment using Chemical Oxidation	• Removal of significant volume of NAPL will reduce long-term potential risk to human health and the environment at the Site. • Site restoration will include surface barriers to prevent long-term exposure to shallow groundwater contamination. • Natural attenuation monitoring for shallow groundwater and deep groundwater in the underlying Copper Falls aquifer may be needed to evaluate on-going risk to human health and the environment.			• Would be effective for Copper Falls aquifer, and could also be used for shallow groundwater contamination • In-situ treatment could be completed in relatively short time frame, but long-term operation, maintenance, and monitoring will be required to ensure reliability of containment. • Institutional controls could be implemented to prevent long-term exposure to residual subsurface contamination. • Long-term operation, maintenance, and monitoring will be required to ensure reliability of containment. • Institutional controls could be implemented to prevent long-term exposure to residual subsurface contamination.		
Alternative GW-7 In-situ Treatment using Electrical Resistance Heating						
Alternative GW-8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)						
Alternative GW-9A and GW-2B Removal using Groundwater Extraction						

7.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment

The remedial alternatives are evaluated for permanence and completeness of the remedial action in significantly reducing the toxicity, mobility, or volume of hazardous materials through treatment. Each alternative is evaluated based on the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. Table 7-4 presents a summary of this evaluation.

Table 7-4. Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Groundwater Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative GW-1 No Action	None	None	None	Not applicable	Not applicable
Alternative GW-2A and GW-2B Containment using Engineered Surface and Vertical Barriers	No treatment prior to containment of shallow groundwater encountered in shallow fill unit at Kreher Park. Not feasible for Copper Falls aquifer.	No treatment but the fill unit at Kreher Park, which is approximately 10.5 acres in size, and is an average of 12 feet thick, will be contained. No treatment for Copper Falls aquifer.	No reduction in contaminant mass, but containment will prevent off-site migration of and exposure to shallow soil and groundwater. No reduction for Copper Falls aquifer.	No treatment. Contained fill at Kreher Park will remain on site. Will not influence implementation of any remedial alternative for Copper Falls.	All fill material, including the wood waste layer and contaminated soil in the former coal tar dump area would remain on site within the contained area. Does not address contamination in Copper Falls aquifer.
Alternative GW-3 In-situ Treatment using Ozone Sparge	Inject ozone to oxidize and destroy contaminants. Can also be used to displace NAPL for recovery via groundwater extraction.	Can be used to oxidize and destroy contaminants in shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Can reduce dissolved phase contamination concentrations by 50 to 75%. Can also enhance NAPL recovery.	Ozone sparge is a chemical oxidation reaction, and is irreversible.	Ozone sparge is a chemical oxidation process that degrades contaminant to CO_2 and H_2O end product
Alternative GW-4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	Injection of a surfactant to enhance NAPL removal by vacuum enhanced recovery.	Surfactant injection is intended to enhance removal of NAPL.	Significant removal of NAPL can be expected, but multiple applications may be needed.	Removal of NAPL is irreversible. Surfactant is removed concurrent with NAPL; no lasting impacts from surfactant injection.	Not intended for dissolved phase contamination, but removal of NAPL will remove source of dissolved phase contamination.
Alternative GW-5 In-situ Treatment using Permeable Reactive Barrier Walls	Install a PRB wall to treat dissolved phase contaminants in shallow aquifer by adsorption onto GAC material used to construct PRB as groundwater passes through it. Not feasible for Copper Falls aquifer.	Contaminants from contained area at Kreher Park are treated as they pass through the wall. No treatment for Copper Falls aquifer.	Significant reduction of dissolved phase contaminants passing through PRB wall from confined area at Kreher Park can be expected. No reduction for Copper Falls aquifer	Removal of contaminants from groundwater will be irreversible, but contained fill at Kreher Park will remain on site. Will not influence implementation of any remedial alternative for Copper Falls.	All fill material, including the wood waste layer and contaminated soil in the former coal tar dump area would remain on site within the contained area. Does not address contamination in Copper Falls aquifer.
Alternative GW-6	Inject liquid reagent to	Can be used for shallow	Significant reduction in	Chemical oxidation is an	Chemical oxidation destroys

Table 7-4. Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Groundwater Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
In-situ Treatment using Chemical Oxidation	oxidize and destroy contaminants. Can also be used to increase mobility and displace NAPL that could be recovered by groundwater extraction.	groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	dissolved phase contamination, and increase in the mobility of NAPL can be expected.	irreversible reaction, but it can result in a permanent change to the aqueous geochemistry of the aquifer.	contaminant to CO_2 and H_2O end products by chemical oxidation.
Alternative GW-7 In-situ Treatment using Electrical Resistance Heating (ERH)	Install electrodes in contaminated zone to heat aquifer to decrease viscosity and increase solubility and mobility of NAPL that is recovered by groundwater extraction or soil vapor extraction.	Can be used for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Significant removal of mobile and immobile NAPL and dissolved phase contaminants can be expected.	ERH is a thermal treatment process that increases mobility of NAPL; no lasting impacts from thermal treatment.	Removal of NAPL will remove source for dissolved phase contamination.
Alternative GW-8 In-situ Treatment using Dynamic Underground Stripping (DUS) / Steam Injection	Inject steam into contaminated zone to heat aquifer and increase solubility and mobility of NAPL that is recovered by groundwater or soil vapor extraction.	Can be used for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Significant removal of mobile and immobile NAPL and dissolved phase contaminants can be expected.	DUS / steam injection is a thermal treatment process that increases mobility of NAPL; no lasting impacts from thermal treatment.	Removal of NAPL will remove source for dissolved phase contamination.
Alternative GW-9A and GW-9B Removal using Groundwater Extraction	Utilizes groundwater as a carrier to remove NAPL and dissolved phase contaminants.	Can be used for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Significant removal of mobile NAPL and dissolved phase contaminants can be expected over an extended period of time.	Treatment of extracted groundwater will be irreversible.	Will removed mobile NAPL, but immobile NAPL may also be removed as source for dissolved phase contamination.

7.4.2.3 Short Term Effectiveness

The evaluation of short-term effectiveness is based on the degree of protectiveness of human health achieved during construction and implementation of the remedy. Potential implementation risks to the community and site workers and mitigation measures for addressing those risks are included in this evaluation. In addition, environmental impacts during implementation and the time required to achieve the RAOs must also be considered in the evaluation of this criterion. Table 7-5 summarizes the results of this evaluation.

Table 7-5. Evaluation of Short Term Effectiveness for Potential Groundwater Remedial Alternatives

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative GW-1 No Action	None	No additional impact to the environment	RAOs will not be achieved.
Alternative GW-2A and GW-2B Containment Using Engineered Surface and Vertical Barriers	Actions to protect community during remediation will include restricted access to work areas to prevent direct contact, and perimeter monitoring to ensure airborne contaminants are not migrating from the work area. Action to protect site workers during remediation will include the use of earth moving equipment to handle contaminated soil in exclusion zones, personnel protection equipment for workers, and work zone monitoring for airborne contaminants.	All fill material will remain at Kreher Park along with fill material at upper bluff area, but containment will prevent contaminant migration from contained area. No impact to Copper Falls aquifer.	Containment construction can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs. Long-term operation, maintenance, and monitoring will be needed for Kreher Park.
Alternative GW-3 In-situ Treatment using Ozone Sparge		Will reduce dissolved phase contaminant concentrations and enhance NAPL removal in shallow and deep plumes.	In-situ treatment can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs
Alternative GW-4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery		Will enhance NAPL removal.	
Alternative GW-5 In-situ Treatment using Permeable Reactive Barrier Walls		All fill material will remain at Kreher Park along with fill material at upper bluff area, but PRB will prevent contaminant migration from contained area. NAPL will impact performance of the PRB. No impact to Copper Falls aquifer	
Alternative GW-6 In-situ Treatment using Chemical Oxidation		Will reduce dissolved phase contaminant concentrations and enhance NAPL removal in shallow and deep plumes.	
Alternative GW-7 In-situ Treatment using Electrical Resistance Heating			
Alternative GW-8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)			
Alternative GW-9A and GW-9B Removal using Groundwater Extraction		Will remove dissolved phase and NAPL contaminants and prevent off-site migration of contaminants with groundwater.	Long-term operation, maintenance, and monitoring of groundwater extraction system will be required Monitoring will be used to ensure compliance with RAOs

7.4.2.4 Implementability

Implementability is based on the evaluation of technical feasibility, administrative feasibility, and the availability of services and materials. Technical feasibility considers the following factors:

- difficulties that may be inherent during construction and operation of the remedy;
- the reliability of the remedial processes involved;
- the flexibility to take additional remedial actions, if needed;
- the ability to monitor the effectiveness of the remedy;
- the availability of offsite treatment, storage, and disposal facilities; and,
- the availability of needed equipment and specialists.

Administrative feasibility considers permitting and regulatory approval and coordination with other agencies. Table 7-6 presents a summary of this evaluation.

Table 7-6. Evaluation of Implementability for Potential Groundwater Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative GW-1 No Action	Additional remedial actions could be easily implemented. No other relevant technical issues.	Not applicable.	No permitting required, but will likely not be able to obtain regulatory approval.	None required.
Alternative GW-2A and GW-2B Containment Using Engineered Surface and Vertical Barriers	Well suited for Kreher Park Miller Creek formation is shallow; not suited for confined Copper Falls aquifer. Wood waste layer may result in minor installation problems. Unlikely that additional remedial action for shallow groundwater will be required.	Containment is a reliable Containment technology will prevent exposure and contaminant migrations via shallow groundwater.	Regulatory agency and community approval likely.	Specialized and conventional equipment and materials required are commercially available.
Alternative GW-3 In-situ Treatment using Ozone Sparge	Installation of sparge wells may be difficult in shallow groundwater areas due to buried structures and wood waste layer. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology for dissolved phase contamination. Can also be used to enhance NAPL recovery.	Minimal permitting requirements. Regulatory agency approval likely.	Convention drilling and trenching equipment will be used. Would require specialized equipment that is commercially available.
Alternative GW-4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	Buried structures and wood waste may prevent installation of sparge points. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology for enhanced NAPL recovery.	Will require permit for injection. Regulatory approval likely.	Convention drilling equipment and vacuum truck will be used. Will use commercially available surfactant.
Alternative GW-5 In-situ Treatment using Permeable Reactive Barrier Walls	Well suited for Kreher Park Miller Creek formation is shallow; not suited for confined Copper Falls aquifer. Wood waste layer may result in minor installation problems. Unlikely that additional remedial action for shallow groundwater will be required.	Reliable passive system, but will require long-term monitoring to evaluate effectiveness.	Regulatory agency and community approval will be required for construction. Regulatory approval likely.	Conventional construction equipment would be used. Material used to construct the PRB wall is commercially available.
Alternative GW-6 In-situ Treatment using Chemical Oxidation	Injection into areas with buried structures and wood waste may be difficult in shallow groundwater. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology for dissolved phase contamination, and can be used to enhance NAPL recovery.	Will require permit for injection. Regulatory agency approval likely.	Conventional drilling equipment used for injection Would use commercially available oxidizers.

Table 7-6. Evaluation of Implementability for Potential Groundwater Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative GW-7 In-situ Treatment using Electrical Resistance Heating	Installation of wells or electrodes may be difficult in shallow groundwater areas due to buried structures and wood waste layer. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology to enhance NAPL recovery.	Minimal permitting requirements. Regulatory agency approval likely.	Highly specialized equipment available through vendors specializing in application of remedial technology.
Alternative GW-8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)			Will require permit for injection. Regulatory approval likely.	
Alternative GW-9A and GW-9B Removal using Groundwater Extraction	Installation of wells may be difficult in shallow groundwater areas due to buried structures and wood waste layer. Can be easily used in combination with containment and several in-situ treatment technologies.	Reliable technology, but must be operated for an extended period of time.	Minimal permitting requirements. Regulatory agency approval likely.	Conventional drilling and trenching equipment will be used. Treatment equipment is commercially available.

7.4.2.5 Cost

Estimated costs for potential groundwater remedial alternatives include estimated capital costs for site preparation, implementation, and site restoration. Estimated costs for mobilization/demobilization, engineering, construction oversight, and contingency costs are estimated at 5, 15, 15, and 20-percent of capital costs, respectively. Annual operation, maintenance, and monitoring (OM&M) costs are estimated for each alternative. Additionally it is assumed that all work is contracted and the estimates do not account for possible economies of scale (i.e., completing all activities at the site concurrently). These cost estimates are developed primarily for the purpose of comparing remedial alternatives and not for establishing project budgets. A summary of potential groundwater remedial alternatives for groundwater is included in Table 7-7. The details of these costs are presented in Appendix F2 Tables F2-1 through F2-12

Table 7-7. Evaluation of Cost for Potential Soil Remedial Alternatives

Alternative	Area of Concern	Capital Costs	Mob/Demob	Engineering	Construction Oversight	Contingency	Post Construction OM&M	Total
Alternative GW-1 No Action	$0	$0	$0	$0	$0	$0	$0	$0
Alternative GW-2A Containment Using Engineered Surface and Vertical Barriers	Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
	Kreher Park	$4,237,768	$211,888	$635,665	$635,665	$847,554	$2,504,757	$9,073,298
Alternative GW-2B Containment Using Engineered Surface and Vertical Barriers	Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
	Kreher Park	$6,030,852	$301,543	$904,628	$904,628	$1,206,170	$1,469,226	$10,817,047
Alternative GW-3 In-situ Treatment using Ozone Sparge	Copper Falls	$763,000	$38,150	$114,450	$114,450	$152,600	$694,704	$1,877,354
	Filled Ravine	$133,000	$6,650	$19,950	$19,950	$26,600	$63,550	$269,700
	Kreher Park	$1,009,000	$50,450	$151,350	$151,350	$201,800	$84,050	$1,648,000
Alternative GW-4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	Copper Falls	$479,800	$23,990	$71,970	$71,970	$95,960	$682,404	$1,426,094
Alternative GW-5 In-situ Treatment using Permeable Reactive Barrier Walls	Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
	Kreher Park	$3,650,174	$182,509	$547,526	$547,526	$730,035	$397,088	$6,054,858
Alternative GW-6 In-situ Treatment using Chemical Oxidation	Copper Falls	$2,017,500	$100,875	$302,625	$302,625	$403,500	$2,596,420	$5,723,545
	Filled Ravine	$1,333,333	$66,667	$200,000	$200,000	$266,667	$67,363	$2,134,029
	Kreher Park	$1,352,389	$67,619	$202,858	$202,858	$270,478	$94,308	$2,190,510
Alternative GW-7 In-situ Treatment using Electrical Resistance Heating	Copper Falls	$4,439,200	$221,960	$665,880	$665,880	$887,840	$123,000	$7,003,760
	Filled Ravine	$2,852,633	$142,632	$427,895	$427,895	$570,527	$51,250	$4,472,832
	Kreher Park	$2,949,628	$147,481	$442,444	$442,444	$589,926	$71,750	$4,643,673
Alternative GW-8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)	Copper Falls	$4,637,200	$231,860	$695,580	$695,580	$927,440	$123,000	$7,310,660
	Filled Ravine	$1,698,333	$84,917	$254,750	$254,750	$339,667	$51,250	$2,683,667
	Kreher Park	$1,581,111	$79,056	$237,167	$237,167	$316,222	$71,750	$2,522,472
Alternative GW-9A Existing Groundwater Extraction System	Filled Ravine	$0	$0	$0	$0	$0	$2,220,466	$2,220,466
	Copper Falls	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
Alternative GW-9B Enhanced Groundwater Extraction System	Copper Falls	$284,500	$14,225	$42,675	$42,675	$56,900	$5,978,656	$6,419,631
	Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
	Kreher Park	$966,278	$48,314	$144,942	$144,942	$193,256	$17,392,454	$18,890,185

7.4.3 Modifying Criteria

The third group, the *modifying criteria*, includes:

- State/Support agency acceptance
- Community acceptance.

As previously discussed, these last two criteria are typically formally evaluated following the public comment period, although they can be factored into the identification of the preferred alternative to the extent practicable. With regard to community acceptance criterion, it should be noted that the agencies conducted an outreach session consisting of a "community workshop" in Ashland on October 25, 2007. A summary of that workshop prepared by USEPA is included in Appendix C.

7.5 Comparative Analysis of Retained Remedial Alternatives for Groundwater

In this section, as required by CERCLA and NCP regulations, the alternatives will undergo a comparative evaluation wherein the advantages and disadvantages of the alternatives will be concurrently assessed with respect to each criterion. The criteria considered as part of this comparative evaluation are defined in Section 7.2. Table 7-8 presents a summary of the comparative analysis.

Table 7-8 – Comparison of Potential Groundwater Remedial Alternatives

Criteria	Alt. GW-1 No Action	Alt. GW-2 Containment using Surface and Vertical Barriers	Alt. GW-3 In-situ Treatment using Ozone Sparge	Alt. GW-4 In-situ Treatment using Surfactant Injection	Alt. GW-5 In-situ Treatment using Permeable Reactive Barrier Walls	Alt. GW-6 In-situ Treatment using Chemical Oxidation	Alt. GW-7 In-situ Treatment using Electrical Resistance Heating	Alt. GW-8 In-situ Treatment using Dynamic Underground Stripping/Steam Injection	Alt. GW-9 Removal using Groundwater Extraction Wells
Overall Protection of Human Health and the Environment	None	Moderate	Moderate	High	Moderate	High	High	High	Moderate
Compliance with ARARs and TBCs	None	High	High	High	High	High	High	High	High
Long-term Effectiveness and Permanence	None	Low	High	High	Low	High	High	High	Moderate
Reduction of Toxicity, Mobility and Volume through Treatment	None	Moderate	Low	Moderate	Moderate	High	High	High	Moderate
Short-term Effectiveness	None	Very High	High	High	High	High	High	High	High
Implementability	None	Very High	High	High	Very High	High	High	High	High
Cost	None	Very High	Low	Low	Very High	High	Very High	High	Low
Agency Acceptance	None	High	High	High	High	High	High	High	High
Community Acceptance	None	Moderate	High	High	High	High	High	High	High

7.5.1 Overall Protection of Human Health and the Environment

Alternative GW-1 (no action) offers no additional human health and the environment because no additional actions would be taken to address groundwater contamination at the Site. ***Alternatives GW-2*** and ***GW-5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) offer an overall moderate level of protection because contaminants will be left on site. These materials will be contained and inaccessible to humans or biota, thereby reducing risk, but offer no protection for the underlying Copper Falls aquifer. ***Alternative GW-9*** (removal using groundwater extraction wells) can be used for shallow and deep groundwater, but offers a moderate level of protection of human health and the environment in the long-term because operation will require an extended period to achieve RAOs. The remaining alternatives offer high levels of protection because each technology will result in the removal of a significant contaminant mass, NAPL in particular, from the subsurface.

7.5.2 Compliance with ARARs and TBCs

Alternative GW-1 (no action) will not achieve compliance with ARARs and TBCs. Compliance with ARARs and TBCs could be achieved for the remaining remedial alternatives for groundwater. Implementation will require that engineering and construction actions be developed and completed in compliance with federal and state regulations.

7.5.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence considers long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. ***Alternative GW-1*** (no action) will not provide any long-term benefit; no additional actions will be taken to address groundwater contamination at the Site. ***Alternatives GW-2*** and ***GW-5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) offer low levels of effectiveness and permanence over the long term. Although risk will be reduced by containment of contaminated material, contaminants will be left on site. Additionally, both are limited to shallow groundwater; neither is feasible alternative for the underlying Copper Falls aquifer. ***Alternative GW-9*** (removal using groundwater extraction wells) will provide a moderate level of effectiveness and permanence over the long term; operation will be required for an extended period to achieve RAOs. The remaining alternatives have high levels of effectiveness and permanence over the long term because each technology will result in the removal of a significant contaminant mass, NAPL in particular, from the subsurface.

7.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Reduction of toxicity, mobility, or volume of hazardous materials through treatment considers the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. ***Alternative GW-1*** (no action) will not result in a reduction in the toxicity, mobility, or volume of contaminated groundwater. ***Alternatives GW-2***

and ***GW-5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) will not result in the toxicity or volume of contaminant mass. However, both will reduce contaminant mobility for shallow groundwater, but not for the Copper Falls. ***Alternative GW-9*** (removal using groundwater extraction wells) will result in a reduction in the toxicity, mobility, and volume of contaminant mass, but operation will be required for an extended period to achieve RAOs. Implementation of the remaining in-situ treatment alternatives will result in the highest degree of reduction of toxicity, mobility, and volume of impacted groundwater. However, amount of volume reduction will vary for each of the remaining in-situ treatment alternatives.

7.5.5 Short-term Effectiveness

Short-term effectiveness considers potential implementation risks to the community and site workers, environmental impacts, and time required to achieve RAOs. Implementation of ***Alternative GW-1*** (no action) will not achieve RAOs or improve environmental impacts in the short-term, but it will pose any implementation risks to the community and workers during remediation. The short-term effectiveness for the remaining alternatives is considered high. Each alternative can achieve RAOs and will reduce environmental impacts in the short-term by removing contaminant mass or preventing the off-site migration of contaminants. Containment, in-situ, and removal technologies evaluated in this report will require minimal effort to protect the community and workers during remediation.

7.5.6 Implementability

Implementability considers technical feasibility, administrative feasibility, and the availability of services and materials. ***Alternative GW-1*** (no action) will require the least amount of effort for implementability. Additionally, because no remedial action will occur, there would be no difficulty in implementing additional remedial actions at a later date. ***Alternatives GW-2*** and ***GW-5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) have a very high degree of implementability. The remaining alternatives have a high degree of implementability. However, buried structures in the upper bluff area and the wood waste layer at Kreher Park may limit the effectiveness of in-situ treatment for shallow and deep groundwater in these areas. Removal of the buried structures concurrent with remedial alternatives evaluated for soil in Section 6.0 may ease implementation of the in-situ treatment and removal alternatives for the Copper Falls. If removal and disposal (on- or off site) or on-site treatment is selected as a remedial response for soil, or if containment is selected for shallow groundwater, in-situ treatment and or removal will not be necessary for soil and shallow groundwater contamination, but one or more of the in-situ or removal technologies evaluated in this report will be required for the Copper Falls aquifer.

7.5.7 Cost

Preliminary cost estimates for potential remedial alternatives for groundwater include site preparation, implementation of the remedial response, and site restoration. There are no costs associated with ***Alternative GW-1*** (no action) because none of these activities will be completed. For shallow groundwater, ***Alternatives GW-2*** and ***GW-5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) have high installation costs. Annual OM&M cost for ***GW-2*** are high due to long term groundwater recovery and disposal costs, but low for ***GW-5***, which relies on in-situ treatment. Cost for implementation of the in-situ treatment ***Alternatives GW-6*** (chemical oxidation), ***GW-7*** (ERH), and ***GW-8*** (steam injection) area also high with low annual OM&M costs[25]. ***Alternatives GW-3*** (ozone sparging) has low implementation and annual OM&M costs. Implementation costs for ***Alternatives GW-9*** are the lowest, but have high annual OM&M cost for continued operation, which may be required for an extended period of time.

For the Copper Falls aquifer, in-situ treatment ***Alternatives GW-6*** (chemical oxidation), ***GW-7*** (ERH), and ***GW-8*** (steam injection) implementation costs area high. ***GW-6*** has high OM&M cost, and ***GW-7*** and ***GW-8*** have low OM&M annual costs. In-situ treatment ***Alternatives GW-3*** (ozone sparging), and ***GW-4*** (surfactant injection) implementation costs area low, but have high annual OM&M costs. As with shallow groundwater, implementation costs for ***Alternatives GW-9*** are the lowest, but have high annual OM&M cost for continued operation, which may be required for an extended period of time.

7.5.8 Summary

Groundwater remedial alternatives evaluated in this report include no action, containment, in-situ treatment, and removal technologies identified in the Alternative Screening Technical Memorandum (URS, revised May 2007). No Action (***Alternative GW-1***) was also retained as required by the NCP as a basis for comparing the other alternatives. Containment alternatives include ***Alternatives GW-2*** (containment using surface and vertical barriers) and ***Alternatives GW-5 (***in-situ treatment using PRB walls). If implemented, ***Alternatives GW-5*** would be used with ***Alternatives GW-2*** to minimize long-term treatment of shallow groundwater. The remaining in-situ treatment alternatives include the following:

- ***Alternative GW-3*** - In-situ Treatment using Ozone Sparge;
- ***Alternative GW-4-*** In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery;
- ***Alternative GW-6*** - In-situ Treatment using Chemical Oxidation;
- ***Alternative GW-7*** - In-situ Treatment using Electrical Resistance Heating; and,
- ***Alternative GW-8*** - In-situ Treatment using Dynamic Underground Stripping /Steam Injection.

[25] These in-situ remedial alternatives are limited to the coal tar dump area. Significantly higher costs would be expected if implemented for all of Kreher Park.

Removal technologies evaluated for groundwater include dual phase recovery and removal using extraction wells. Dual phase recovery was evaluated with ***Alternative GW-4*** (in-situ treatment using surfactant injection) and removal using groundwater extraction wells (***Alternative GW-9)*** was evaluated as a stand alone remedial technology. However, all in-situ remedial technologies evaluated may require groundwater extraction is some capacity.

Containment is not a feasible remedial alternative for the underlying Copper Falls aquifer. The remaining groundwater remedial alternatives could be used for shallow groundwater in the upper area and Kreher Park and for the Copper Falls aquifer. Buried structures in the upper bluff area and the wood waste layer at Kreher Park may limit the effectiveness of in-situ treatment in these areas. If removal and disposal (on or off-site) or on-site treatment is selected as a remedial response for soil, or if containment is selected for shallow groundwater, in-situ treatment and or removal will not be necessary for soil and shallow groundwater contamination. However, one or more of the in-situ or removal technologies evaluated in this report will be required for the Copper Falls aquifer.

8.0 Development and Evaluation of Remedial Action Alternatives – Sediment

8.1 Remediation Action Objectives for Sediment

As described in the RAO Technical Memorandum (Appendix A to the Remedial Investigation; URS 2007b), in general, the goals of remedial action for sediment are to prevent human ingestion or direct contact with sediments having COPCs which pose an unacceptable risk to human health. Similarly, for ecological receptors, the general goal is to prevent direct contact with or ingestion of sediments or of prey having levels of COPCs that would pose an unacceptable risk to populations of ecological receptors or individuals of protected species.

Remedial action objectives for sediment include:

- Protect human health by eliminating exposure (direct contact, ingestion, inhalation, fish ingestion) to sediment with COPCs in excess of regulatory or risk-based standards;
- Conduct NAPL removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water; and
- Protect populations of ecological receptors or individuals of protected species by eliminating exposure (direct contact with sediment or ingestion of sediment or prey) to sediment with COPCs that would pose an unacceptable risk.

With the exception of iron, the cumulative risks estimated for the human health recreational receptor exposures to sediments were below EPA's target risk levels.

For ecological receptors, USEPA set the sediment PRG at 2295 µg PAHs/g Organic Carbon (OC) or 9.5 ug PAH/g dwt at 0.415% OC based upon their "best professional judgment". In addition, USEPA directed that, "if the final depth of sediments will be less than 6 feet, the PRG for any active remedial intervention will be adjusted downward as based upon ultraviolet light (UV) extinction coefficients measured in Site waters. In addition, sediments in greater than 6 feet of water having a concentration equal or less than 2,295 ug PAH/g OC (9.5 ug PAH/g dwt at 0.415% OC) and sediments in 6 feet or less of water having a concentration greater than a UV-adjusted PRG will be monitored to assure that there are no unacceptable impacts to benthic community and that the levels of PAHs in surface sediments decrease over time to 1340 ug PAH/g OC (5.6 ug PAH/g dwt at 0.415% OC)."

8.2 Screening of Remedial Action Alternatives – Sediment

8.2.1 Chemicals of Potential Concern – Sediment

The screening of sediment alternatives focuses on PAHs as the primary COPC. VOCs and metals are also COPCs but the PRG is based on PAHs because PAHs are the "risk-drivers" and VOCs and metals co-exist with the PAHs.

8.2.2 Screening of Remedial Alternatives – Sediment

General response actions, technologies and process options for sediment are summarized in Table 8-1. Those retained after the Alternatives Screening Technical Memorandum (see Appendix A1) are shown in bold in Table 8-1.

Table 8-1 - Summary of Sediment Technologies Reviewed
(Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999)
(Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Options
No Action	**None**	**Not Applicable**
Institutional Controls	**Physical, engineering or legislative restrictions**	Consumption advisories **Access restrictions** Dredging moratorium
Natural Recovery	**Reduction of toxicity, volume or mobility of contaminant by naturally occurring biological, chemical or physical processes**	**Sedimentation** **Resuspension and transport** **Mixing**
Containment	**Subaqueous capping**	**Thin layer cap** **Sand cap** **Composite cap** Engineered materials (cement) cap **Armored cap**
	Confined Disposal Facility	**Sheet pile** **Combination of sheet pile and slurry wall** **Impervious cap** **Groundwater management**
Removal	**Dredging**	**Hydraulic dredging** **Mechanical dredging** **Barge-mounted backhoes or excavators**
	Excavation in the dry	**Excavator, sheetpiling, etc. for specific areas**
In-situ Treatment	Biological	*In-situ* slurry oxidation *In-situ* aerobic biodegradation *In-situ* anaerobic biodegradation
	Chemical	*In- situ* slurry oxidation Aqua MecTool oxidation *In-situ* oxidation Electrochemical oxidation
In-situ Treatment (Cont)	Physical Extractive process	Sediment flushing SVE/thermally enhanced SVE/bioventing Air sparge
	Physical-immobilization	Air sparge MecTool stabilization Vitrification Imbiber beads Ground freezing

Table 8-1 - Summary of Sediment Technologies Reviewed
(Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999)
(Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Options
Ex-situ Treatment	Biological	Land farming/composting Biopiler Fungal degradation Slurry phase biological treatment Enhanced biodegradation
	Chemical	Acid extraction Solvent extraction Slurry extraction Reduction/oxidation
	Chemical/Physical	Dehalogenation **Sediment washing** Radiolytic dechlorination
	Physical	**Separation** **Hydrocyclone** Solidification
	Thermal	**Incineration** **High temperature thermal desorption** **Low temperature thermal desorption** Pyrolysis High-pressure oxidation
Dewatering	**Mechanical**	Centrifugation **Belt press** **Filter press** Geobag
	Gravity	**Settling on-barge** **Settling dewatering impoundments** Solidification
Disposal	**On-site disposal**	Level bottom cap Confined aquatic disposal (CAD) **Confined disposal facility** Nearshore biofiltration cell **Upland confined fill** **Beneficial re-use**
	Off-site disposal	Dedicated new upland landfill **NR 500 landfill (county, private, industrial landfills)** **Upland confined fill (commercial/industrial)** **Upland fill (residential/clean)**

8.3 Development of Potential Remedial Alternatives for Sediment

Remedial technologies retained for screening were used to develop potential remedial alternatives for sediment. A summary of each remedial alternative follows. A detailed description of each alternative can be found in the Comparative Analysis Technical Memorandum (URS 2007c).

8.3.1 Alternative SED-1: No Action

The no-action alternative was retained as a baseline against which other technologies are compared. The no-action alternative assumes no cleanup or long-term monitoring, and is not expected to meet the RAOs. No action requires no planning, maintenance, or monitoring. Under this alternative, it is anticipated that natural mechanisms, such as dispersion, biodegradation, etc., would eventually reduce concentrations of VOC and PAH and NAPL; however, no monitoring would be performed to determine if these mechanisms are indeed taking place, nor would any method of evaluating potential risk to human health and the environment be enacted.

8.3.2 Alternative SED-2: Sediment Containment within a Confined Disposal Facility

8.3.2.1 Introduction

Alternative SED-2 would consist of sediment removal followed by disposal and containment within a CDF combined with institutional controls and monitored natural recovery. This alternative is illustrated in Figure 8-1 and consists of the following components:

1) Determine the area of sediment containing significant wood debris and NAPL material to be covered by and contained within a CDF (currently this is estimated to be about seven acres of lake bed);
2) Construct CDF around pre-determined sediment area as well as upland portions of the Site that are impacted by wood material mixed with coal tar wastes;
3) Remove sediment containing concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC located outside the CDF footprint and place within CDF area;
4) Place any other impacted soils from upland areas into CDF; and
5) Monitor sediment areas outside of CDF where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed.

Equipment that may be used for implementation of this alternative includes:

- Dredging equipment – for removing sediment from the lakebed
  - Hydraulic
  - Mechanical
- Excavation/construction equipment – for construction of portions of the CDF and dewatering basins
  - Traditional
  - Long-stick

    - Barge equipped with crane, pile driving hammer
    - Barge equipped with crane and carriage lift for placement of stone and barges loaded with blasted rock/cut limestone
- Transportation equipment – for moving sediment from the dredge to the CDF
    - Barge
    - Piping
- Water treatment equipment
    - Piping to lake or WWTP for treatment of water and collected fluids,
    - Water treatment system
        - Oil/water separator
        - Sand filtration
        - Activated carbon adsorption
- Monitoring equipment – to evaluate effectiveness of remedy
    - Groundwater monitoring wells
    - Piezometers for water level measurements
    - Sediment sampling devices
    - Surface water sampling devices

This alternative was described in detail in the Comparative Analysis of Alternatives Technical Memorandum which is attached to this FS as Appendix A2. Attachment 3 to that technical memorandum provided information on the state of the practice on using CDFs for permanent storage of contaminated sediments. Some of that information is summarized again in the following sections.

8.3.2.2 Concept

A CDF alternative would meet the sediment PRGs at less cost than anticipated for some of the other alternatives. In addition to being a less expensive, virtually site-wide remedy, this alternative is designed to avoid the potential risks from volatilization of VOCs during debris removal and dredging and excavation of sediment and soil. The CDF would be designed to cover most the areas of the offshore sediment that are impacted by NAPL as well as areas with the most wood debris. Sediment with unacceptably elevated levels of SVOCs and VOCs, including NAPL, as well as areas in Kreher Park that are impacted by wood material mixed with coal tar wastes, would remain in place and be incorporated into the CDF.

The design of the CDF would be compatible with the recreational nature of the nearshore area and incorporate features that will enhance both recreational use of the area, including an expansion of the marina, as well as wildlife usage. Figures 8-2 and 8-3 illustrate this concept.

The CDF would be constructed over approximately seven acres of lake bed and 13 acres of upland. The elevation at the lake boundary will be approximately 609' NGVD in order to prevent wave overtopping. This elevation was estimated using wave height analysis based upon a 100 year return wave height and period, using 100 year still water level and water depth and bottom slope (See Appendix G). This elevation will be confirmed during Remedial design. The

top of the CDF would be fairly level, although there would be a provision for drainage and "blending" with upland topography.

As conceived, there would be open areas designed as grassland habitat and managed for wildlife, and other areas designed and managed for recreational use by the public, i.e., boaters, fishers, birdwatchers, etc. There would also be the option for the City of Ashland to incorporate elements of an expanded marina similar to those envisioned in the Ashland Waterfront Development Plan.

8.3.2.3 Rationale and Precedent

A comprehensive discussion on the use of CDFs for disposal of contaminated sediments and precedent for CDFs in the Great Lakes by Dr. Mike Palermo was originally provided in detail in the Comparative Analysis of Alternatives Technical Memorandum which is attached to this FS as Appendix A2. Attachment 3 to that memorandum provided information on the state of the practice on using CDFs for permanent disposal of contaminated sediments. CDFs are one of the most commonly considered alternatives for contaminated sediments from navigation projects and are also an option commonly considered and more recently used for disposal of contaminated sediments dredged for purposes of sediment remediation (USACE 2003, USEPA 2005).

Design of CDFs has evolved over the years based on research and field experience. CDFs have combined design features and processes common to wastewater treatment, landfills, dams, and breakwaters. The designs for existing CDFs in the Great Lakes have focused primarily on retention of sediment solids and physical stability of the dikes in the high-wave and ice-prone environment of the Great Lakes. In-water CDFs in the Great Lakes, (e.g., Duluth-Superior Harbor - Erie Pier) have dikes that resemble a breakwater made of stone, gravel and other materials. Large armour stones are typically placed on the outside face of the dike to protect against the erosive effects of waves and ice. The inner core of the dike is often constructed with sand and gravel, sometimes in discrete layers. The dike, which is initially permeable, encircles the disposal area where the dredged material is placed. The sediment particles and contaminants bound to the particles settle out in the disposal area and excess water passes back through the dike. As the facility becomes filled, the dikes become less permeable, and water must be removed by overflow weirs, filters in the dikes, or pumping. Upland CDFs are designed with earthen dikes that resemble a levee or berm. The dikes are most often constructed with soil excavated from the disposal site, and the sides seeded to prevent erosion (Miller 1998).

Development of a comprehensive technical basis for CDF design aspects related to management of contaminated sediments began in the mid-1970s with the USACE research programs initially authorized by the River and Harbor Act of 1970 (P.L.91-611). These efforts included evaluation of sedimentation and consolidation processes in CDFs; weir design; CDF effluent and leachate control; equipment and techniques for dewatering and reclamation; and beneficial reuse of material in CDFs. The first guidelines for designing, constructing, and managing (CDFs) to maximize service life and minimize adverse environmental impacts were developed (Palermo, Montgomery, and Poindexter 1978), and these guidelines were subsequently updated and

expanded in the USACE Engineer Manual *Confined Disposal of Dredged Material* (USACE 1987).

USACE and USEPA subsequently developed a Technical Framework for dredged material management (USACE 2004) that included full consideration of CDF contaminant transport pathways and controls, and developed a supporting sediment testing manual that provided detailed testing and evaluation procedures for CDF contaminant pathways (USACE 2003). An expanded Engineer Manual *Dredging and Dredged Material Management* (USACE in publication) has also been developed that will include guidance on design of contaminant control measures for CDFs. Collectively, these developments have resulted in a comprehensive technical basis for design of CDFs used for placement of contaminated sediments resulting from both navigation and sediment remediation projects.

Field experience and the availability of technically-based design procedures for CDF contaminant pathway evaluations and controls has led to increased consideration and use of CDFs for a number of sediment remediation projects – over 40 have been constructed on the Great Lakes alone (USACE 2003). As a result, USEPA recognized CDFs as an option for disposal of contaminated sediments at CERCLA sites in its Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA 2005):

> "CDFs are engineered structures enclosed by dikes and specifically designed to contain sediment. CDFs have been widely used for navigational dredging projects and some combined navigational/environmental dredging projects but are less common for environmental dredging sites, due in part to siting considerations. However, they have been used to meet the needs of specific sites, as have other innovative in-water fill disposal options, for example, the filling of a previously used navigational waterway or slip to create new container terminal space (e.g., Hylebos Waterway cleanup and Sitcum Waterway cleanup in Tacoma, Washington). In some cases, new nearshore habitat has also been created as mitigation for the fill."

Table 1 in Attachment 3 to Appendix A2 summarizes the locations, and readily available information on volumes, surface areas, filling operations and contaminant control measures for a total of 29 CDFs used for placement of sediments from remediation projects. A large number of additional CDFs have been used for placement of contaminated sediments from navigation dredging projects (with a number of CDFs used for highly contaminated dredged sediments), but these CDFs were not included in the summary in Table 1 in Attachment 3 to Appendix A2. A total of 22 of the CDFs are in-water nearshore or island sites, with many constructed by enclosing berths, slips, or areas adjacent to other confining structures such as breakwaters. These include several CERCLA projects in the Seattle/Tacoma, WA area to include: Blair Waterway, Milwaukee Waterway, and Eagle Harbor CDFs. The Waukegan Harbor site in Illinois is a similar nearshore CERCLA CDF created by enclosing 3 acres of Lake Michigan waters by a sheet pile wall structure. The Menominee River site in Marinette WI is similar to the Waukegan Harbor site in that approximately two acres of contaminated sediment was enclosed by a sheet pile structure and capped.

As part of a project very similar in design to what is being proposed for the Ashland site, the Hamilton Harbor, Canada CDF will be constructed as a nearshore CDF for disposal of sediments contaminated with elevated levels of PAHs and NAPL from Hamilton Harbor, a project conducted under the Canadian Cleanup Fund (similar to the U.S. CERCLA program). Several other sites in Table 1 in Attachment 3 to Appendix A2 are placements of contaminated sediments from remediation projects in existing CDFs in the Great Lakes. These placements were made in dedicated cells constructed within the larger existing CDFs. In addition to the CDFs actually used for remediation placements to date, several large CDFs are now in the feasibility or design stages for large-scale CERCLA sediment remedies. These include the Onondaga Lake, NY upland CDF that would enclose a 160 acre site for placement of over 2.3 million cubic yards of contaminated sediment and two large nearshore CDFs: the Terminal 4 CDF site that would be created by enclosure of a 14 acre slip on the Willamette River near Portland, OR, and the Consolidated Slip CDF that would be created by enclosure of a 4 acre berthing area in the Port of Los Angeles. These precedent sites represent a range of sediment characteristics and site conditions and contribute to an ongoing and potentially increasing experience base for use of CDFs as sediment remedy alternatives, including construction of nearshore CDFs in coastal, riverine and lake environments.

8.3.2.4 Site-specific Elements of a CDF Design

There are several site-specific factors that will be considered during Remedial Design. These include the physical characteristics of the Site as well as the results of the Treatability Studies that were conducted in support of this FS (See Section 4.0 and Appendices B2, B3 and B4.

Site Characteristics

Based upon core logs the stratigraphy of the offshore area that will be the focus of remedial efforts consists of:

1. contaminated wood layer
2. sand layer: Miller Creek beach deposit
3. silt layer: Miller Creek silt deposit
4. clay layer: Miller Creek clay deposit
5. sand layer: Copper Falls formation.

The wood layer is generally thicker nearshore and therefore would be confined within the CDF footprint. Covering areas of the sediment where there is the most wood debris significantly reduces the amount of wood debris that will require removal, handling and disposing. Although the wood and sediment that would be underlying the CDF have different consolidation properties, based upon the Multiphase Testing (Appendix B4) this characteristic would not materially affect long term consolidation behavior of the CDF cap.

Since NAPL was observed in the wood layer and in the Miller Creek sand and silt layers, the potential for NAPL mobility within the CDF will be considered in Remedial Design using the

results from the Multiphase Testing. In addition, collection and removal of NAPL during placement of dredge materials into the CDF will be addressed during Remedial Design.

The potential for transport of NAPL due to ebullition also will be evaluated during Remedial Design. Both the Cap Flux Test (Appendix B2) and the Multiphase Testing (Appendix B4) provided information on this transport mechanism.

The geotechnical capacity of Miller Creek clay layer also will have to be addressed during Remedial Design since it is anticipated that sheet piling will be keyed into this layer. More core sampling and analysis along the proposed wall location likely will be needed to support Remedial Design.

In addition, since several of these sediment layers potentially have elevated levels of VOCs, including benzene, naphthalene and methylnaphthalene, control of emissions from these sediments also will be evaluated during Remedial Design.

The CDF cap and sheet pile enclosure of the CDF also will include the area in Kreher Park. As a result groundwater flow characteristics up gradient of the CDF as well as the thickness of the Miller Creek clay formation will need to be considered in the design and placement of hydraulic controls and the sheet pile or slurry wall.

Implications of Treatability Studies

As discussed in Section 4.0 several treatability studies have been conducted to support remedial alternatives screening for sediment. The following sections briefly discuss the implications of these studies to the design and construction of the CDF.

Ebullition and Related NAPL Transport

Based upon the Cap Flux Test (Appendix B2) sediments at 20° C and higher generated gas and test the rate of gas generation and ebullition increased with higher temperatures and over longer testing periods. However, the capped columns did not show that the NAPL was transported through the caps even after six months of testing. The practical result of this testing indicates that while it is unlikely NAPL transport via ebullition will be a problem at ambient Site temperatures it will be prudent to include a gas collection and relief system in design of the CDF cap as a precaution.

NAPL Mobility

Since the results of the Multiphase Testing (Appendix B4) indicated that there is insufficient flow from consolidation during initial capping to mobilize NAPL, there is little likelihood that NAPL will be collected in a cap dewatering drainage system.

Consolidation of Sediments

The results of the Multiphase Testing (Appendix B4) indicated that consolidation times are expected to be shorter than 17 days. This is much less time than will be required for dredging, dredge material deposition and CDF cap placement which is estimated to take about 180 days. Because of this it will not be necessary to split up the dredging and capping time into two years to accommodate consolidation.

Air Emissions

Bench scale air emissions testing (Appendix B3) was conducted to simulate VOC and odor emissions from various operations that would take place during this remedial alternative. Based upon results of this testing it was concluded that under some conditions VOCs potentially would be transported to locations where the public would be exposed to VOCs above relevant health criteria. As a result, engineering controls and response action plans will have to be developed as part of Remedial Design.

8.3.2.5 Implementation of Remedy

Mobilization/Demobilization

This includes mobilization and demobilization of all the equipment and facilities needed to implement this alternative. This is estimated to be 5% of the remedial costs.

Construction of CDF

As previously discussed the CDF would be constructed over approximately seven acres of lake bed and 13 acres of upland. The elevation of the CDF at the lake boundary will be approximately 609' NGVD in order to prevent wave overtopping. Sealed sheet piling will be used to enclose the CDF and prevent contaminant migration. The method of sealing will be evaluated for water-side and soils areas during Remedial Design and it will be determined whether maintaining a lower gradient inside the containment areas is needed. It is expected that sheet piling will be utilized around the entire site although it is possible a slurry wall will be used in some upland areas, particularly where overburden is thin at the base of the bluff. A barge mounted pile driver will be used to drive pilings in the water. The CDF is intended to contain all of the sediment and groundwater in an essentially watertight enclosure. On the lake side of the wall a protective stone dike will be constructed against the sheet piling as a barrier to storms and ice movement. The extent of this armored dike will be determined in Remedial Design. Other considerations included in the construction cost estimate are placement and disposal of the hydrocarbon booms to collect NAPL that may be released during dredging and placement activities. This might include booms around the dredge where NAPL potentially may be released during dredging. Booms also will be deployed in CDF water areas until final capping activities are started.

Sediment Removal

Sediment removal under this alternative is less complex because a design objective for the CDF is that it will cover most of the areas that contain the majority of the wood debris and NAPL. This will avoid the need for substantial debris removal and with it the potential for release of VOCs and NAPL. Removal of sediment outside of the footprint of the CDF under this alternative likely will be accomplished with a hydraulic dredge. Although this will result in a need to treat more dredge water, hydraulic dredging will minimize volatilization and resuspension. Some modern hydraulic dredges should be able to achieve 20% solids content (v/v) with careful control when dredging in areas that are relatively debris-free.

Under this alternative, volatilization associated with dredging and dredge material dewatering may be an issue, but it expected to be less than for Alternatives SED-3, SED-4 and SED-5 since the areas that will be dredged have relatively low levels of contaminants.

Areas outside of the footprint of the CDF with concentrations of total PAHs greater than the sediment PRG of 9.5 µg PAH/g dwt at 0.415% OC will be dredged and pumped directly to the CDF. Under this scenario approximately 74,000 CY of sediment exceeding the PRG would be dredged from the approximately nine acre area outside of the CDF and disposed in the CDF. After dredging is completed, six inches of clean sediment would be placed on areas that are dredged. This would help in covering any dredging residuals as well as providing a better habitat for recruitment of benthic macroinvertebrates and for spawning of fish.

Performance Objectives for Dredging Residuals and Dredging-Related Resuspension

Dredging performance objectives will be developed for allowable rates of sediment resuspension during dredging based upon water quality standards that are protective of ecological receptors. These will be used for operational control of dredging. Typically, performance objectives for resuspension are two or three-tiered and specify how dredging operations need to be modified if the action levels are exceeded.

Dredging performance objectives also will specify goals for residual concentrations of contaminants in surface sediments for areas that have been dredged. Typical performance objectives for dredging residual would be based upon the comparison of surface-weighted average concentrations (SWAC) to the sediment PRG. These performance objectives would specify whether re-dredging is necessary and in some cases when a thin layer cap would be applied to meet performance objectives.

Volatilization and Odor Control

While volatilization is expected to be considerably less than for full scale dredging (Alternative SED-4), dry excavation (SED-5) or even Alternative SED-3, if volatiles are released, they may disperse beyond the immediate vicinity of dredging operations, within the CDF water areas and onshore treatment operations, depending upon ambient weather conditions (Appendix B3). With

the proximity of a relatively large population in Ashland, this presents the real possibility of unacceptable exposure unless engineering controls are designed.

Controls for minimization of volatile releases are available for onshore operations; however, volatilization control for operations on the water would have to be investigated further during a pilot scale project, since tenting over working dredges on the water is difficult and would add complexity to maintaining efficient dredge production rates. Engineering controls for volatilization are discussed at greater length under the Alternative SED-4.

It is possible that remedial construction workers would have to wear Class C PPE.

Silt Curtains and Hydrocarbon Booms

Engineering controls for minimizing release and dispersal of dissolved or free phase contaminants to water beyond the Site while dredging are well developed and would likely consist of redundant turbidity barriers and booms. These turbidity barriers may be surrounded by modular wave dampening barriers if necessary. Temporary sheet piling will also be considered if redundant turbidity barriers and booms are not effective. This aspect of a dredging remedy can also be evaluated and optimized though a pilot scale project.

Again, this alternative will minimize the release and dispersal of dissolved or free phase contaminants to water beyond the Site since the CDF will cover the areas that have the highest levels of VOCs and NAPL.

Sediment Dewatering

Prior to dewatering, the dredge material will be processed to separate wood from sediment. This can be achieved through processes that separate sediment by screening, gravity settling, and floatation. Screening would likely take place on the dredge if the material is mechanically dredged and hydraulically transported to the CDF. No other dewatering will be needed except for dredge dewatering of the debris stockpile in the barge before placing debris in the dumpster for disposal. Dredging of the area outside the CDF will allow the sequential filling of several cells within the CDF while allowing the other cells to settle the suspended solids. From this settling area, the excess water will be drawn off for treatment and discharge back to the lake. Any NAPL that floats in the cells will be skimmed from the surface, run through an oil/water separator and contained for off-site disposal (Figure 8-1). Evaluation of these operations will be further detailed in Remedial Design and may require additional treatability testing.

Wastewater Treatment

Water treatment potentially would include addition of polymers and alum to help settle fine particles in the CDF. Testing will be needed to determine solids settling rates, and if necessary, the effects chemical aides have on consolidation. Water would be pumped off at a rate approximately equal to the sediment placement into the CDF within certain design limits for head differential across the sheet pile wall. The system would include pumping the clear water

near the surface of the CDF to a bag or sand filter or other cartridge filters, an oil/water separator and through an activated carbon filter bed (Figure 8-1). The treated water meeting the substantial requirements of an NPDES permit would be discharged to Lake Superior or to the WWTP. The cost for water treatment also includes operating a skimmer in the CDF to control any floating NAPL.

As an alternative to direct placement of sediments in the CDF using hydraulic dredging, hydraulic transportation from mechanically dredged sediments also may be considered. This would include a screen on a hopper at the dredge that would discharge to a high solids slurry pump. Make-up water that is pumped from CDF after settling would be mixed with the sediments to a 15%-20% solids level and hydraulically conveyed in a pipe through a discharge nozzle into the CDF. This nozzle could be a tremy type design to minimize velocity at the discharge and also minimize suspension of fines in the CDF water. Use of a tremy also would allow more controlled placement and help reduce water settlement treatment in the CDF and may also help with preventing segregation of the dredged sediment placement and thus facilitate consistent consolidation. A cumulative estimated flow of about 40 million gallons will be re-circulated to the dredge using only settlement and polymer treatment in the CDF prior to pumping back to the dredge. A total of approximately 17 million gallons of wastewater resulting from sediment dewatering and the recirculating system will get fully treated and discharged to the lake or WWTP.

Ancillary Solid Wastes

Waste such as personal protective equipment (PPE), construction debris and other types of solid wastes generated during the conduct of remedial activities can be disposed at a local solid waste landfill. The quantity generated will depend on the remedial alternative. PPE will be evaluated and handled in accordance with USEPA guidance document to handle investigation derived waste (USEPA 2007).

CDF Closure

Closure of the CDF after all dredging is complete will include construction of a CDF cap over the entire contained area. The CDF cap will meet Chapter NR 504.07, WAC design and construction specifications. Cap construction will include placing a one to two-foot sand cap on the dredged sediments to begin the consolidation process as well as provide a support layer over the water area. According to the Multiphase Testing (Appendix B4) results, this consolidation will allow the release of the pore water and gas from ebullition to rise to the surface without any significant transport of the contaminants. Multiphase Testing (Appendix B4) predicts that should NAPL be present, it will not be mobilized.

The cap will be placed in one-half to one foot lifts to facilitate even consolidation. After sufficient consolidation, additional sand will be placed in areas that are lower due to differential settlement. Settlement characteristics will be further evaluated during Remedial Design and placement techniques, such as the use of a tremy, will be considered to optimize even settlement, A sand drainage layer is part of the initial sand support layer, followed by a two foot compacted

clay layer underlying a 40 mil HDPE liner. Drainage wells or wicks will be used to facilitate removal of water produced from additional consolidation in the drainage layer below the HDPE liner. This lower drainage layer will be sloped to allow removal of any gas accumulation and vented at the drainage wells and will be further evaluated in design. Another geotextile drainage layer or 1 x 10^{-3} cm/sec hydraulic conductivity sandy soil will be added above the HDPE liner to collect the storm water seepage. A two and one half-foot compacted layer additional foot of fill (sand) of local soils for a drainage and plant rooting will be placed on top of the HDPE liner with an overlying layer 0.5 ft top soil that will be seeded for grass or planted with shrubbery. A conceptual cross section of the CDF cap is provided in Figure 8-4.

Long term performance and consolidation of the cap has been evaluated in the DECON Modeling and bench testing conducted during the Multiphase Testing (Appendix B4) and these results will be considered during Remedial Design. Drainage wells will be used to monitor moisture levels and used for removal of any additional water infiltration should this occur above acceptable levels over the long term. A plan view illustrating conceptual detail below the clay is provided in Figure 8-5. Since consolidation times of the sediments in the CDF are predicted to be rapid by the DELCON model (Appendix B4) consolidation pore water infiltration should be minimal within the CDF.

On the land side of this cap in Kreher Park, the cap will be designed to meet the same requirements of Chapter NR 504.07, WAC and will be vegetated or paved on top. Up gradient groundwater will be passively diverted around the CDF through use of drainage tiles and/or the use of the existing hydraulic control system for the Filled Ravine. A means to discharge water to storm drainage systems would be a part of the hydraulic control plan for the CDF. The CDF cap will also include plantings to enhance evapotranspiration and absorb drainage from the hillside and a drainage layer shown in Figure 8-6. This should minimize the volume of run-off water that needs to be collected.

Any plantings on the cap will comply with the revegetation requirements specified in the Chapter NR 504.07, WAC criteria unless otherwise approved by WDNR.

Wetland Mitigation

Interaction with WDNR would be needed to identify appropriate mitigation/restoration projects to compensate for permanent loss of shallow water lake bed. Appropriate projects might include wetlands/river restoration, granting access across NSPW property adjacent to rivers or conveyance of land that has relevant environmental value. For purposes of this FS Report evaluation we have included $1.5 million for compensatory restoration.

Monitoring

The magnitude and nature of monitoring will include the following:

- baseline monitoring;
- implementation monitoring;

- verification monitoring;
- operation and maintenance monitoring; and
- long-term monitoring to verify achievement of PRGs.

As part of the Remedial Action Plan, the following monitoring programs would be developed.

Baseline Monitoring

The database of information from all Site studies will be reviewed to ascertain whether an adequate statistical database is available to provide the basis for determining whether performance criteria are achieved. Based upon this review additional baseline sampling may be necessary.

Implementation Monitoring

Monitoring during implementation of the remedy will be conducted to ensure that remediation is being conducted in accordance with the Remedial Action Plan and that all project design specifications including performance of the contractor and environmental controls are met.

Verification Monitoring

Of particular importance to removal alternatives, verification monitoring determines whether performance criteria established for environmental media cleanup levels are met. This will be especially important for those areas outside the dredge perimeter which will be monitored to evaluate natural recovery.

Operations and Maintenance Monitoring

An operations and maintenance monitoring plan will be developed as part of the Long Term Monitoring Plan and will include several aspects of CDF performance including:

a. Contaminant transport from the CDF;
b. Verification of hydraulic control; and
c. Physical integrity of CDF.

Long-term Monitoring

Long-term monitoring is primarily focused on verifying the continuing achievement of PRGs. It is of particular importance if any PRG is to be met through natural recovery mechanisms. Contingency plans will be implemented in instances where expected results of remediation, PRGs, are not met.

8.3.2.6 Cost

The cost for this alternative is estimated at approximately $35,000,000. Various cost elements are summarized in Table 8-2.

Table 8-2 - Cost Summary – Alternative SED-2: CDF

Task	Estimated Cost*
Mob/Demob & Miscellaneous	$1,200,000
Construct CDF	14,400,000
Dredge	5,100,000
Compensatory Mitigation	1,500,000
Long Term Monitoring	700,000
Total Estimated Cost	**$37,000,000**

*Only Total Cost includes oversight and administration, engineering and contingency.

8.3.3 Alternative SED-3: Subaqueous Capping

8.3.3.1 Introduction

Alternative SED-3 would consist of sediment and debris removal, subaqueous capping, dewatering, consolidation, and off-site disposal with or without on-site treatment, combined with MNR. The shallow nature of nearshore portions of the Site requires that some dredging be completed prior to capping so that the cap remains subaqueous and doesn't interfere with navigation or recreational boating. In addition, because of the location, the cap would have to be armored to resist erosion from waves or ice damage. A four foot depth was selected as a conceptual basis for costing because the requirements of cap design, i.e., prevention of contaminant transport and armoring to prevent ice damage, would likely require a cap of four feet thickness. The actual cap depth will be evaluated during Remedial Design and the dredge depth adjusted accordingly.

Costs estimates have been prepared for four options under this alternative:

Alternative SED-3A: Mechanical Dredging and Capping, No Decontamination of Sediment
Alternative SED-3B: Mechanical Dredging and Capping, Thermal Treatment of Sediment
Alternative SED-3C: Hydraulic Dredging and Capping, No Decontamination of Sediment
Alternative SED-3D: Hydraulic Dredging and Capping, Thermal Treatment of Sediment

This alternative is illustrated in Figure 8-7 and consists of the following components:

1) Determine the area of sediment containing significant wood debris and free-phase material with concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC;
2) Remove approximately the top four feet of sediment in these areas using one or more of the following means from barge-based or land-based platforms:
    a. hydraulic dredging;
    b. mechanical dredging; and/or

   c. excavation.
3) In areas where PAH levels do not exceed 9.5 ug PAH/g dwt at 0.415% OC at depths greater than approximately six feet, all sediment exceeding 9.5 ug PAH/g dwt at 0.415% OC will be removed. This is approximately the areas depicted in Figure 8-8.
4) Dewater dredged sediment on site using a settling pond and mechanical separation followed by on-site treatment of sediment and liquid or off-site disposal of untreated sediment;
   a. If sediment is treated using thermal desorption or incineration it would be sent for off-site disposal at a solid waste or other landfill after treatment;
   b. If sediment is not treated on site but only stabilized, it would be sent to a NR 500 permitted landfill for off-site disposal;
   c. Wastewater would be treated using flocculation, clarification, sand filtering, and carbon filtering and discharged to the Ashland WWTP. Alternatively it could be discharged directly to Lake Superior if it met DNR surface water criteria;
5) Construct subaqueous armored cap over dredged area (Figures 8-8 and 8-9); and
6) Monitor sediment areas outside of cap where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed.

Subaqueous capping would make use of a variety of materials, including some that would be reactive with site contaminants to contain contaminants in situ, e.g. organo-clays or activated carbon. A properly designed cap would significantly decrease contaminant mobility and isolate the contaminants from the overlying water column, thus preventing exposure to ecological receptors or humans by covering the sediment.

Equipment that may be used for implementation of this alternative includes:

- Dredging equipment – for removing sediment from the lakebed
  - Hydraulic
  - Mechanical
  - Excavation equipment (long stick excavators)
- Excavation equipment – for construction of dewatering basins
  - Traditional
- Transportation equipment – for dredging and moving sediment from the dredge to the dewatering basins
  - Barge
  - Piping
- Dewatering equipment – for removing water from sediment prior to treatment or disposal
  - Settling ponds
  - Mechanical dewatering equipment
- Treatment equipment
  - LTTD
  - HTTD
  - Incinerator
  - Water treatment system
    - Flocculation

        - Clarification
        - Sand filtration
        - Carbon filtration
        - Oil/water separator
    - Solidification
- Disposal equipment
    - Piping to lake or WWTP for treated water
    - Transport to disposal location
        - Rail
        - Truck
        - Barge
- Monitoring equipment – to evaluate effectiveness of remedy
    - Groundwater monitoring wells
    - Piezometers for water level measurements
    - Sediment sampling equipment
    - Surface water sampling equipment

8.3.3.2 Concept

The subaqueous capping alternative was selected for consideration because implementation of this alternative would meet the RAOs through capping of sediment that poses potential risk to human health and the environment. The cap would be designed to prevent access to impacted sediment with concentrations greater than 9.5 ug PAH/g dwt at 0.415% OC, as well as minimize migration of VOCs, SVOCs and NAPL from within the sediment to surface water and unimpacted areas.

As previously stated, up to four feet of wood debris and sediment would be removed from the cap area prior to constructing the cap in order that the finished project depths approximate existing bathymetry. Figure 8-8 provides a plan view of the cap location.
Sediment removal under this alternative would be conducted with excavators, mechanical dredges and/or hydraulic dredges. In some nearshore areas, caissons could be constructed to enable dewatering nearshore areas, which would allow use of shore-based excavators to remove sediment. The efficacy of this latter approach could be determined during a pilot scale project.

Engineering controls would need to be implemented to minimize volatilization of VOCs during dredging. This can best be evaluated during a pilot scale project. During dredging operations, turbidity curtains and floating hydrocarbon booms or sheet piling, if necessary, would be deployed to minimize dispersal of suspended sediments or floating free phase.

The subaqueous cap would be constructed over approximately seven and one-half acres of lake bed. Following construction, there would be no restrictions on usage of the capped area. Areas outside the cap area that are dredged would be covered with six inches of clean sediment to encourage recruitment of benthic organisms.

8.3.3.3 Rationale and Precedent

Subaqueous capping reduces risk associated with impacted sediment by eliminating the possibility of contact with sediment through removal and containment. In order to allow continued use of the area for water recreation, sufficient thickness of sediment would be removed to allow the cap to be placed without changing the elevation of the lake bottom in the area being capped.

Subaqueous caps have been constructed at numerous locations across the U.S. including at over 15 Superfund sites (USEPA 2005). Capping has also been used at sites where contaminants, including NAPL, similar to those found in Site sediments are found. These Superfund sites include McCormick and Baxter Site in Portland, Oregon where approximately 20 acres of creosote containing sediment was capped and Pine Street Canal in Vermont. Of particular relevance is the McCormick and Baxter Superfund Site where granular organoclay and organoclay blankets in the cap were used to manage NAPL migration as well as gas release.

Appendix G provides a summary of capping projects that have been implemented or were planned as of 2002.

USEPA addresses capping as a viable response action for CERCLA sites in its latest contaminated sediment guidance (EPA Sediment Guidance: USEPA 2005). The science and engineering of designing caps started over 25 years ago and since then much has been written about it. As discussed in the EPA Sediment Guidance,

> "The majority of this work has been performed by, or in cooperation with, the U.S. Army Corps of Engineers (USACE). Comprehensive technical guidance on in-situ capping of contaminated sediment can be found in the EPA's Assessment and Remediation of Contaminated Sediment (ARCS) Program Guidance for In-Situ Subaqueous Capping of Contaminated Sediments (U.S. EPA 1998d) and the Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document (U.S. EPA 1994d), available through EPA's Web site at http://www.epa.gov/glnpo/sediment/iscmain. Additional technical guidance is available from the USACE's Guidance for Subaqueous Dredged Material Capping (Palermo et al. 1998a)."

8.3.3.4 Site-specific Elements of a Subaqueous Cap Design

There are several site-specific factors that will be considered during Remedial Design. These include the physical characteristics of the Site as well as the results of the Treatability Studies that were conducted in support of this FS (See Section 4.0 and Appendices E, F, and G).

Site Characteristics

The site sediment characteristics were described in the Cap Flux Testing report (Appendix B2). The substrate in the Site area includes layers of contaminated wood, sand and silt. The wood

layer that is generally located near the sediment surface would be a large percentage of the top four feet of dredged material in this area. The wood layer is thicker nearshore and thinner further offshore. Sand and silt layers would comprise the sediment types below and mixed with this wood layer.

Since NAPL was observed in the wood layer and in the Miller Creek sand and silt layers, the potential for NAPL mobility within the subaqueous cap will be considered in design using the results from the Multiphase Testing. In addition, collection and removal of NAPL during placement of dredge materials into the dewatering system will be addressed during Remedial Design.

The potential for transport of NAPL due to ebullition also will be evaluated during Remedial Design. Both the Cap Flux Test (Appendix B2) and the Multiphase Testing (Appendix B4) provided information on this transport mechanism.

In addition, since the several layers of sediment potentially have elevated levels of VOCs, including benzene, naphthalene and methylnaphthalene, control of emissions from these sediments also will be evaluated during Remedial Design.

Implications of Treatability Studies

As discussed in Section 4.0 several treatability studies have been conducted to support remedial alternatives screening for sediment. The following sections briefly discuss the implications of these studies to the design and construction of the subaqueous cap.

Ebullition and Related NAPL Transport

Based on the Cap Flux Test (Appendix B2) sediments at 20° C and higher generated gas. Based upon this test the rate of gas generation and ebullition increased with higher temperatures and over longer testing periods. However, the capped columns did not show that the NAPL was transported through the caps even after six months of testing. Further, the results of the Multiphase Testing (Appendix B4) indicated that NAPL would not be mobilized by the cap during consolidation.

Consolidation of Sediments

Based upon the results of two of the treatability studies there is expected to be some consolidation of the cap after placement. Minimal consolidation was measured during Cap Flux testing, however, the DELCON modeling conducted as part of the Multiphase Testing (Appendix B4) indicated that most of the compressibility of the cap would occur where there is still a wood layer beneath the cap. Under a four-foot cap up to 0.29 ft of consolidation is estimated. The data from these tests will be used in the capping design.

Contaminant Transport

Upward groundwater flow at the site is not expected to be significant based upon hydraulic evaluations conducted during the RI (URS 2006) due to the presence of the Miller Clay barrier to the Copper Falls aquifer. However, some contaminated groundwater may be discharged from the Kreher Park area along the shore line. To account for this potential the Cap Flux testing (Appendix B2) was conducted with an upward gradient through the sediment and caps. Even with this head applied none of the caps detected significant transport of contaminants from the underlying sediments into the cap. These data will be used in designing the caps during Remedial Design.

Air Emissions

The air emissions testing (Appendix B3) concluded that under some conditions VOCs potentially would be transported to locations where the public would be exposed VOCs above relevant health criteria. Odor was also shown to be potentially a concern in these areas. Emissions under this alternative were predicted to be similar for dredging in this alternative as for Alternative SED-4, only of shorter duration. As a result, engineering controls and response action plans will have to be developed as part of Remedial Design.

8.3.3.5 Implementation of Remedy

Mobilization/Demobilization

This includes mobilization and demobilization of all the equipment and facilities needed to implement this alternative. This is estimated to be 5% of the remedial costs.

Sediment Removal

Under this alternative, sediment overlying areas with large quantities of wood debris and areas containing NAPL would be dredged to a depth of approximately four feet. In some areas dredging will go deeper if it is judged more cost efficacious to dredge the extra depth rather than cap. This will be determined as part of Remedial Design based upon verification sampling.

Sediment removal under this alternative would be conducted with excavators, mechanical dredges and hydraulic dredges. Excavators and/or mechanical dredges would be used to remove debris from the targeted areas. In some places near shore caissons could be constructed to enable dewatering, which would allow use of shore-based excavators to remove sediment. The efficacy of this latter approach will be determined during a pilot scale project.

After removal of debris, hydraulic dredges would be employed to dredge sediments above the PRG. The dredge slurry will be pumped to an onshore dewatering and treatment facility. Engineering controls likely will need to be implemented to minimize volatilization of VOCs during dredging. Engineering controls for dredging are discussed at greater length in Section 8.3.4. The potential for volatilization can best be evaluated during a pilot scale project.

Performance objectives for dredge residuals and resuspension and control of volatilization and odor would be as discussed for Alternative SED-2 (Section 8.3.2.).

Sediment Dewatering

Dewatering includes screening operations to remove large wood debris and operation of the plate and frame filter presses for dewatering (in the case of hydraulic dredging) prior to final sediment treatment. Also included in this alternative is about a four acre pond system and stockpile area built at Kreher Park area with a lined earthen dike. A layout drawing of the site sediment processing area is shown in Figure 8-10. Costs are included in the sediment treatment category discussed later. Volumes of dredged sediment slurries are estimated to be 13,000,000 gallons for mechanical dredging and 70,000,000 gallons for hydraulic dredging. No VOC controls have been included in costs at this time. However, based upon the results of the treatability studies they may be needed due to the naphthalene and benzene emissions.

Wastewater Treatment

Water treatment includes sand filtration, oil/water separators, carbon filtration and related testing for discharge. Discharge will be to the Lake Superior or City of Ashland WWTP. Quantities range from about 7,790,000 gallons under mechanical dredging options to 70,000,000 gallons for hydraulic dredging. Costs for this are included in the sediment treatment category discussed in the next section. Most of the systems are closed and should have minimal impact on air emissions or have emission controls.

Sediment Treatment

Sediment treatment includes either stabilization for direct disposal at a ch. NR 500 permitted landfill, or alternatively thermal treatment to destroy the organics before landfilling (Figure 8-7). Both processes have the potential to create some emissions. However, this potential is much lower during dewatering operations unless there is an upset in the operations. The sediment treatment volumes are the same for all mechanical and hydraulic dredging options since they would all achieve the same dewatered feed volume of approximately 38,000 cy. The volume and weight after treatment is higher for stabilization since the process would add 10% more weight. Weight is estimated at 58,000 tons. On the other hand, thermal treatment would reduce the water weight and not require stabilization. This process would generate approximately 37,000 tons for disposal, including 5% moisture added to control dust and facilitate handling. HTTD was assumed to be the most cost effective thermal method and is the basis for the cost estimates. However additional design testing would be needed to evaluate this choice.

Sediment handling costs that include sediment dewatering, water treatment and sediment treatment are shown in Table 8-3. The major differences in cost are due to water treatment costs for hydraulic dredging and difference in stabilization versus thermal treatment costs.

Sediment Disposal

The disposal process will include the loading of sediment following drying and treatment/stabilization at the Site, and transportation to a commercial/industrial landfill or NR 500 permitted landfill. Several scenarios were evaluated for this option, assuming a sediment quantity of 78,000 cy based upon the sediment PRG. These scenarios were discussed in the CAATM (Appendix A2). For purposes of cost estimation it is assumed one cubic yard of sediment will weigh 1.5 tons.

Other Disposal Alternatives

As previously discussed, NSPW also may initiate siting of a ch. NR 500, WAC landfill in the Ashland area for solid materials removed from the Lakefront Site. This disposal option is dependent on the material volume. An analysis of siting a landfill in accordance with ch. NR 500 WAC in the Ashland area is discussed in Appendix I.

Wood Waste

There is the potential for generating a substantial quantity of wood waste if sediments are removed. The wood waste ranges in size from sawdust and chips to timber. Potentially, the larger debris could be burned as fuel at the NSP Bayfield Power Plant located in Ashland. Some additional maintenance at the plant would be required to accommodate the wood debris but this is considered a viable option at this time and will evaluated further during Remedial Design.

Ancillary Solid Wastes

Waste such as PPE, construction debris and other types of solid wastes generated during the conduct of remedial activities can be disposed of at a local municipal landfill. This management method will be used in all remedial alternatives. The quantity generated will depend on the remedial alternative. PPE will be evaluated and handled in accordance with USEPA guidance document to handle investigation derived waste (USEPA 2007).

Construction of Subaqueous Cap

A subaqueous cap will be designed for placement over the area that has been dredged to four feet but still has sediments beneath this depth exceeding the sediment PRG. Dredging to four feet will provide sufficient depth for placement of an armored cap while not decreasing the lake bottom depth. Cap material considered in this application would be natural sand, organoclays and/or carbon or other amendments to adsorb contaminants, as well as armoring to resist erosion. A cross section of a conceptual cap is depicted in Figure 8-9.

As presently conceived, the cap will consist of first installing organoclay blankets over the area to be capped. As an alternative, a geotexile with activated carbon or bentonite sandwiched between a needle point punched mat may be installed. This will require first placing a 6-9 inch sand layer for protection from debris and levelling the surface. After installing the organoclay blanket, a two and one-half foot sand cover then would be placed over the area to be capped using a spreader barge, clam shell dredge or excavator on a barge. The sand cover would be

added in 6-12" lifts to allow for consolidation of the underlying sediments to account for differential settlement. The sand cap would provide containment and allow the sediments to gain strength and stability with the consolidation from the cap load. In areas where the water is less than six feet deep armoring using gravel, cobble or stone rip rap would be added for wave and ice protection depending upon the water depth and anticipated erosion forces. A post capping bathymetric survey would be conducted to assure proper coverage and as a baseline for future measurements.

Monitoring

Monitoring options for this alternative would be the same as those listed in Section 8.3.2, with the exception that the monitoring plan would be geared toward monitoring the effectiveness of a subaqueous cap rather than a CDF.

8.3.3.6 Cost

The total cost for this alternative ranges from approximately $38, 321,000 to $59,223,000 depending upon whether the sediment is mechanically or hydraulically dredged and whether thermal treatment is needed. Cost elements are summarized in Table 8-3.

Table 8-3. - Cost Summary – Alternative SED-3: Dredge/Cap.

Task	Estimated Cost*			
	SED-3A	SED-3B	SED-3C	SED-3D
	Mechanical Dredge - No Treatment	Mechanical Dredge - Thermal Treatment	Hydraulic Dredge - No Treatment	Hydraulic Dredge - Thermal Treatment
Mob/Demob & Miscellaneous	$900,000	$1,100,900	$1,100,000	$1,300,000
Dredge & Sediment Handling[1]	11,700,000	10,200,000	11,100,000	10,200,000
Cap	2,500,000	2,500,000	2,500,000	2,500,000
Water Treatment	1,700,000	1,700,000	6,200,000	6,200,000
Transport and Disposal	2,700,000	1,800,000	2,700,000	1,800,000
Long Term Monitoring	700,000	700,000	700,000	700,000
Total Estimated Cost	**$30,100,000**	**$34,500,000**	**$36,400,000**	**$41,700,000**

* Only Total Cost includes oversight and administration, engineering and contingency.
1: Sediment handling includes screening, dewatering, treatment and/or stabilizing if necessary.

8.3.4 Alternative SED- 4: Removal

8.3.4.1 Introduction

Alternative SED-4 would consist of removal, dewatering, consolidation, and off-site disposal with or without on-site treatment, combined with MNR. Under this alternative, the greatest amount of sediment would be removed, treated and disposed.

Costs estimates have been prepared for four options under this alternative:

Alternative SED-4A: Mechanical Dredging, No Decontamination of Sediment
Alternative SED-4B: Mechanical Dredging, Thermal Treatment of Sediment
Alternative SED-4C: Hydraulic Dredging, No Decontamination of Sediment
Alternative SED-4D: Hydraulic Dredging, Thermal Treatment of Sediment

This alternative, illustrated in Figure 8-11, consists of the following components:

1) Determine sediment with concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC;
2) Remove these sediments using one or more of the following means from barge-based or land-based platforms:
    a. hydraulic dredging;
    b. mechanical dredging; and/or
    c. excavation.
3) Dewater dredged sediment on site using a settling pond and mechanical separation followed by on-site treatment of sediment and liquid and/or off-site disposal of untreated sediment;
    a. If sediment is treated using thermal desorption or incineration it would be sent for off-site disposal at a solid waste or other landfill after treatment;
    b. If sediment is not treated on site but only stabilized, it would be sent to a NR 500 permitted landfill for off-site disposal;
    c. Wastewater will be treated using flocculation, clarification, sand filtering, and carbon filtering and discharged to the Ashland WWTP. Alternatively it could be discharged directly to Lake Superior if it met DNR surface water criteria;
4) Monitor sediment areas outside of cap where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed.

Equipment that may be used for implementation of this alternative includes:

- Dredging equipment – for removing sediment from the lakebed
    - Hydraulic
    - Mechanical
    - Excavation equipment (long stick excavators)
- Excavation equipment – for construction of dewatering basins
    - Traditional

- Transportation equipment – for dredging and moving sediment from the dredge to the dewatering basins
    - Barge
    - Piping
- Dewatering equipment – for removing water from sediment prior to treatment or disposal
    - Settling ponds
    - Mechanical dewatering equipment
- Treatment equipment
    - LTTD
    - HTTD
    - Incinerator
    - Water treatment system
        - Flocculation
        - Clarification
        - Sand filtration
        - Carbon filtration
        - Oil/water separator
    - Solidification
- Disposal equipment
    - Piping to lake or WWTP for treated water
    - Transport to disposal location
        - Rail
        - Truck
        - Barge
- Monitoring equipment – to evaluate effectiveness of remedy
    - Groundwater monitoring wells
    - Piezometers for water level measurements
    - Sediment sampling equipment
    - Surface water sampling equipment

8.3.4.2 Concept and Precedent

Removal by dredging is generally the presumptive remedy for contaminated sediment if cost and/or risk factors don't result in other alternatives being favored. Removal of contaminated sediment with dredges or excavators has been successfully implemented at a number of contaminated sediment sites.

Removal is technically feasible for the Site, although several issues would have to be addressed in the design of a dredging alternative, including control of the release of free-phase product and dispersal and volatilization of VOCs during dredging activities, as well as management of dredging residuals and handling of a substantial amount of wood debris. Some aspects of the Site are more disposed to the use of mechanical dredges or excavators (e.g., debris removal), while other aspects favor hydraulic dredges, (e.g., capture of free phase and minimization of volatilization).

Under this alternative, sediments greater than 9.5 ug PAH/g dwt at 0.415% OC would be removed regardless of depth. In some areas, sediments as deep as ten feet would be removed. Sediment removal under this alternative would be conducted with excavators, mechanical dredges and hydraulic dredges. In some nearshore areas, caissons could be constructed to enable dewatering nearshore areas, which would allow use of shore-based excavators to remove sediment. The efficacy of this latter approach could be determined during a pilot scale project.

Engineering controls would need to be implemented to minimize volatilization of VOCs during dredging. This can best be evaluated during a pilot scale project. During dredging operations, turbidity curtains and floating hydrocarbon booms or sheet piling, if necessary, would be deployed to minimize dispersal of suspended sediments or floating free phase. Site restoration would include placing six inches of clean sediment on areas that have been dredged.

8.3.4.3 Implementation of Remedy

Mobilization/Demobilization

This includes mobilization and demobilization of all the equipment and facilities needed to implement this alternative. This is estimated to be 5% of the remedial costs.

Sediment Removal

Under this alternative, sediments greater than 9.5 ug PAH/g dwt at 0.415% OC would be removed regardless of depth. In some areas, sediments as deep as ten feet would be removed. The removal alternative would likely feature all three removal technologies, use of mechanical dredging and/or excavation to remove debris and hydraulic dredging once a sufficient amount of debris is removed[26]. Debris close to shore might also be removed by long-armed excavators operating from shore or even from temporary piers made from modularized barges. To minimize volatilization of VOCs and SVOCs and dispersion of free phase, the dredging operation would likely employ modular pontoon barges or scows that are configured in such a manner that turbidity “skirts” can be placed around them. Debris removal and dredging will take place in the “hole” made by the arrangement of pontoons or scows. Various equipment including boom cranes, ladder cranes, hydraulic heads or excavators would operate off of these platforms depending upon their effectiveness. In areas where the presence of debris doesn’t interfere with hydraulic dredging, hydraulic pumps on excavators might be used. The scows or pontoon barges would be moved around using either a tug or wires connected to the shore. Anchor spuds could not be used in the free phase areas as they may disturb the sediments and release free phase and buried contaminants.
Once dredged or excavated, debris and the sediment/debris mixture can be passed through “grizzlies” to separate out large wood into hoppers or scows with mud locks. Water can be added to the sediment and moved hydraulically to dewatering and treatment areas.

[26] Various hydraulic equipment such as cutterhead dredges can deal with a certain amount of wood debris provided it is relatively soft. A cutterhead dredge can crush the wood debris into smaller pieces and hydraulically move it with the sediment to separation and treatment facilities.

Under this alternative, engineering controls would need to be implemented to minimize volatilization of VOCs during dredging. Approaches to control volatilization are discussed further below. The need for and design of engineering controls for volatilization would need to be evaluated during a pilot scale project. During dredging operations, turbidity curtains and floating hydrocarbon booms would be deployed to minimize dispersal of suspended sediments or floating free phase. If necessary, sheet piling would be deployed to minimize dispersal of suspended sediments or floating free phase.

Performance objectives for dredge residuals and resuspension and control of volatilization and odor would be as discussed for Alternative SED-2 (Section 8.3.2). The potential for unacceptable volatilization is substantially greater for this alternative since more areas where levels of NAPL and volatile VOCs are greater would be dredged. Based upon the results of the Air Emissions Treatability Study (Appendix B3) volatiles are expected to disperse beyond the immediate vicinity of dredging operations and onshore treatment operations, depending upon ambient weather conditions. With the proximity of a relatively large population in Ashland, this presents the real possibility of unacceptable exposure unless volatiles can be controlled. Controls for minimization of volatile releases are available for onshore operations; however, volatilization control for operations on the water would have to be investigated further during a pilot scale project, since tenting over working dredges on the water is difficult and would add complexity to maintaining efficient dredge production rates. Beyond controls that can be employed by the dredge operator to minimize exposure of sediment to air there is little precedent for implementing engineering controls for volatilization at the dredge platform. Dredging areas with a high potential for release of volatiles during cooler periods of the year or when winds are predominantly offshore also may help minimize transport of volatiles to residential areas. However, it is likely that dredging will be shut down in the colder months of the year and wind directions in the Ashland area are variable and sometimes unpredictable.

Table 8-4 summarizes controls that are available for the activities associated with a removal remedy. At Stryker Bay Site on the St. Louis River similar impacts from volatile emissions were anticipated so several additional engineering controls were evaluated. The controls evaluated and the results of the evaluation are summarized below in Table 8-5.

After dredging is completed, six inches of clean sediment would be placed on areas that are dredged. This would help in covering any dredging residuals as well as providing a better habitat for recruitment of benthic macroinvertebrates and for spawning of fish. In addition, because this alternative would result in substantial changes to the bathymetry of the nearshore waters at the Site, approximately 30,000 of clean fill will have to be placed in the nearshore areas to partially restore pre-dredge bathymetry.

Table 8-4 Potential Engineering Controls

Remedial Activity	Engineering Control Options
Debris removal using clamshell dredge	1) Dredge within area surrounded by turbidity screens or modular barges to prevent dispersal of resuspended sediment and subsequent volatilization. 2) Dredge with a bucket designed to hold large debris, e.g. logs, but to let sediment escape underwater. 3) Keep debris underwater until in immediate area of trash handling system. However, a majority of the emissions are caused by the contaminant dissolved phase and at the air/ water interface.
Sediment dredging	1) Operator controls: Don't overfill bucket, etc. 2) Dip buckets before bringing out of water in order to dislodge mud. 3) Use drip pans and wash tanks to catch any loose sediment and to wash sediment off of dredge bucket. 4) Utilize hydraulic dredging after debris removal. However, an increased dissolved phase will exist in the dewatering ponds. 5) To the extent practicable, dredge most highly impacted areas during cooler weather or during periods when winds are predominantly offshore.
Conveyance of dredge material to sediment treatment facilities	1) Avoid storing sediment in open barges, even temporarily. 2) Use closed circuit conveyance system. 3) Avoid storage of material in open piles while awaiting sediment or water treatment.
Sediment and water treatment	1) Store material in enclosed facilities where practicable. 2) Use negative air pressure with storage facilities where necessary. Air should be drawn from work areas and the air filtered. 3) Use covered areas or bladders (e.g. geotubes) for sediment settling. 4) Conduct water treatment, e.g. presses or hydrocyclones, in enclosed facilities where necessary. 5) Use floating covers on dewatering ponds or on CDF water surface. 6) Use a tremy for underwater discharge of sediment slurries to minimize mixing during placement in a CDF or deep impoundment.
Sediment transport	All trucks, rail cars or barges used to transport sediment for disposal should be properly lined and sealed.

Table 8-5. Alternatives for Controlling Volatilization Evaluated at Stryker Bay*

Engineering Control for Volatile Emissions from Dredging	Effectiveness
Dredging under poly cover	1) Difficult to conduct dredging activities within a covered area and reduces production. 2) Difficult to maintain a cover while on the water under a range of weather conditions.
Covering water surface with balls	Have been used in pond conditions, but they can also create films where NAPL is present and increase the surface area for volatilization. Balls also can escape from containment curtains in dredging areas due to wind and waves.
Foam blankets	Dissipate rapidly in windy and wavy conditions and are hard to maintain.
Water spray curtains	Used as a boundary for sensitive areas near shoreline, but causes increased humidity and subject to disruption from winds.

*Personal communication, Hubert Huls, URS.

Sediment Dewatering

Dewatering is similar to Alternative SED-3 and includes screening to remove large wood debris and operation of plate and frame filter presses for dewatering (if hydraulic dredging is used) prior to final sediment treatment. Also included is about a four acre pond system and stockpile area built on the Kreher Park area built with a lined earthen dike (Figure 8-10). Costs for that are included in the sediment treatment category discussed later. Volumes of dredged sediment slurries are estimated at 21,900,000 gallons for mechanical dredging and 131,700,000 gallons for hydraulic dredging. No VOC controls have been included in costs at this time. However, they may be needed due to naphthalene and benzene emissions. Since the dredging and dewatering are greater volumes than in Alternative SED-3, the emissions will also be last longer.

Wastewater Treatment

Water treatment is also similar to Alternative SED-3 and includes sand filtration, oil/water separators, carbon filtration and related testing for O&M and discharge. Discharge will be to the City of Ashland WWTP or to Lake Superior if it meets WDNR water quality criteria. Estimated treatment quantities range 13,400,000 gallons for mechanical dredging to 121,000,000 gallons for hydraulic dredging. Costs are included in the sediment treatment category discussed later. Most of the systems are closed and should have minimal impact on air emissions.

Sediment Treatment

Sediment treatment is the same as for Alternative SED-3, however the volumes are larger. Sediment treatment includes either stabilization for disposal in a NR 500 permitted landfill or alternatively, thermal treatment before land filling in a solid waste landfill. Both processes have the potential to create some emissions in handling the dewatered sediment feed to the

stabilization or thermal treatment systems. However, there is likely much lower emissions associated with sediment treatment than with the dewatering operations unless there is an upset in the operations. The sediment treatment volumes are the same for all mechanical and hydraulic dredging options since they would all achieve the same dewatered feed volume of approximately 64,000 cy. The volume and weight after treatment is higher for stabilization (99,000 tons) since it would add 10% more weight. Thermal treatment would reduce the water weight and with no added material would result in approximately 58,500 tons for disposal. HTTD is again assumed to be the most cost effective thermal method and is the basis for cost estimates for thermal treatment at this time. However additional design testing would be needed to evaluate this choice.

Sediment handling costs include sediment dewatering, water treatment and sediment treatment as shown in Table 8-6. Major cost differences are due to water treatment costs for hydraulic dredging and difference in stabilization versus thermal treatment costs.

Sediment Disposal

The disposal options under this alternative are the same as for Alternative SED-3 (Section 8.3.3). There is just more sediment to dispose.

Other Disposal Alternatives

As previously discussed, NSPW also may initiate siting of a NR 500 permitted landfill in the Ashland area for solid materials removed from the Lakefront Site. This disposal option is dependent on the material volume. An analysis of siting an upland NR 500 permitted landfill in Ashland is presented in Appendix I.

Wood Waste

Under this alternative there is the potential for generating a substantial quantity of wood waste. The wood waste ranges in size from sawdust and chips to timber. Potentially, the larger debris could be burned as fuel at the NSP Bayfield Power Plant located in Ashland. Some additional maintenance at the plant would be required to accommodate the wood debris but this is considered a viable option at this time and will evaluated further during remedial design.

Ancillary Solid Wastes

Waste such as personal protective equipment (PPE), construction debris and other types of solid wastes generated during the conduct of remedial activities can be disposed of at a local municipal landfill. The quantity generated will depend on the remedial alternative. Personal protective equipment (PPE) will be evaluated and handled in accordance with USEPA guidance document to handle investigation derived waste (USEPA 2007).

Monitoring

Monitoring options for this alternative would be the same as those listed in Section 8.3.2 with the exception of those elements relating to CDF or cap performance.

8.3.4.4 Cost

The total cost for this alternative ranges from approximately $42,152,000 to $82,496,000 depending upon whether the sediment is mechanically or hydraulically dredged and whether thermal treatment is needed. Cost elements are summarized in 8-6.

Table 8-6 - Cost Summary – Alternative 4: Dredge All

Task	Estimated Cost*			
	SED-4A	SED-4B	SED-4C	SED-4D
	Mechanical Dredge - No Treatment	Mechanical Dredge - Thermal Treatment	Hydraulic Dredge - No Treatment	Hydraulic Dredge - Thermal Treatment
Mob/Demob & Miscellaneous	$1,300,000	$1,500,000	$1,600,000	$1,900,000
Dredge & Sediment Handling	18,600,000	16,000,000	17,600,000	16,000,000
Water Treatment	2,300,000	2,300,000	10,100,000	10,100,000
Transport and Disposal	4,600,000	3,000,000	4,400,000	3,000,000
Long Term Monitoring	700,000	700,000	700,000	700,000
Total Estimated Cost	**$41,200,000**	**$48,900,000**	**$51,600,000**	**$61,100,000**

* Only Total Cost includes oversight and administration, engineering and contingency.
1: Sediment handling includes screening, dewatering, treatment and/or stabilizing if necessary

8.3.5 Alternative SED-5 – Dry Excavation

8.3.5.1 Introduction

Alternative SED-5 would consist of diverting water away from the targeted sediment area by construction of a barrier around the area to be remediated, removing standing water from the isolated area, continually pumping seepage from lake and groundwater to maintain conditions as dry as possible; and removing sediment using conventional earth moving technology. The remaining elements of this alternative are the same as in Alternative SED-4 and include, dewatering and consolidation of sediment and off-site disposal with or without on-site treatment. Under this alternative, the same amount of sediment as in Alternative SED-4 would be removed, treated and disposed.

This alternative, illustrated in Figures 8-12 through 8-18, consists of the following components:

1) Determine sediment with concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC and areas where significant wood debris has been deposited;
2) A wave attenuation flotation device and sheet piling (alternatively a stone breakwater) would be constructed in the bay along the proposed alignment at 3,000N (approximate location);
3) Steel sheet pile containment wall would be constructed along 2,900N (approximate alignment.
4) Lake water within the containment will be removed with 2- 500 gpm, stand-alone pumps. Lake water pumped from within the containment will be managed/treated by an adsorbent liquid phase activated carbon system sized to adequately remove contaminants of concern. The untreated lake water will be tested to provide contaminant mass loading data and the carbon will be changed out and regenerated based upon the contaminant load. The treated effluent will be discharged directly to Lake Superior following laboratory testing that shows compliance with WDNR water quality criteria.
5) Variable rate discharge pumps will be used to assist with dewatering sediments. Wastewater obtained from sediment dewatering will be managed/treated with filtration of the solids followed by contaminant adsorption with liquid phase activated carbon filters. The wastewater will flow through bag or sand filters and will then flow into a liquid phase activated carbon system sized to remove contaminants of concern from the water. The wastewater will be tested to estimate the contaminant mass loading on the carbon, and the carbon will be changed out and regenerated on an as needed basis. In addition, the effluent will be tested to show compliance with WDNR water quality criteria, and discharged to the lake. Alternatively, if surface water criteria are not initially met, the water will be contained and re-treated, and the system will be adjusted to fully treat the water.
6) Wood debris and sediment will be prepared for loading and disposal by one of the following methods: Stabilizing wet, fine grained (silt and clay) sediments with reagents such as Type C flyash and/or Portland cement and excavation of wood debris and granular (sand and gravel) sediments on an asphalt pad to allow drainage of fluids by gravity flow.
7) Sediment excavation/stabilization/dewatered will be performed with heavy equipment such as a crane with drag-line and/or tracked excavator and/or wheeled conveyor and displacement with a bull dozer. It is anticipated that all of the sediment volume will be disposed off-site or thermally treated.
8) Monitor sediment areas outside of cap where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed.
9) Groundwater removed from the trench system that parallels the sheetpile wall on the land side will be treated with filtration, oil/water separation followed by treatment with liquid phase activated carbon. As with the other water that will enter the activated carbon system, water will be treated to comply with WDNR water quality criteria.

Equipment that may be used for implementation of this alternative includes:

- Construction of wave attenuation floatation device or breakwater and lakeside containment wall
    - Barge equipped with crane, pile driving hammer and steel sheet piles with interlock seal
    - Barge equipped with crane and carriage lift for placement of stone and barges loaded with blasted rock/cut limestone, or barges equipped with crane for placement of wave attenuation device and dead-man
    - Hydrocarbon collection booms
- Construction of landside containment wall
    - Crane, pile driving hammer and sheet piles with interlock seal
    - Hydrocarbon collection booms
- Dewatering equipment – for removing water from bay, groundwater collection trench and sediment
    - Trailer mounted 500 gpm pumps
    - Variable rate (10-100 gpm) sump pumps
    - Sump pump for collection of drained sediment fluids from asphalt drainage pad
    - Mechanical dewatering equipment
- Water treatment equipment
    - Piping to lake or WWTP for treatment of water and collected fluids
    - Water treatment system
        - Oil/water separator
        - Bag filtration
        - Activated carbon adsorption
- Sediment excavation equipment
    - Bulldozers
    - Excavators
    - Crane equipped with drag–line to move sediment into position for handling and stabilization
    - Wheel mounted conveyors
- Sediment stabilization/drainage equipment
    - Backhoes
    - Compressors
    - Tanker trucks containing reagent
    - Asphalt drainage pad and sump
- Disposal equipment
    - Transport to disposal location
        - Truck
- Monitoring equipment – to evaluate effectiveness of remedy
    - Groundwater monitoring wells
    - Piezometers for water level measurements
    - Sediment sampling equipment
    - Surface water sampling equipment

8.3.5.2 Concept and Precedent

The concept behind dry excavation is simple: remove the water that covers the sediment and use traditional excavation equipment to remove it. Advantages to this removal technology include being able to directly "observe" what is being removed, thus making sure all targeted sediment is removed and residuals are minimized. Critical issues to overcome include maintenance of a dewatered condition, especially along the coast of a Great Lake and, and the need to use Low Ground Pressure (LGP) excavation equipment because of the low bearing capacity of the dewatered sediment. The dry excavation method will also increase the potential for volatilization when sediments are exposed to the air. Alternatives for reducing the dynamic forces from lake waves include a wave dampening system and sheet pile containment wall. Alternatives include a stone breakwater or a parallel sheet pile wall system or coffer dams. Worker safety is of paramount concern in selecting the appropriate system.

Dry excavation has been used for removal of contaminated sediment from a variety of sites. This remedial technology is predominantly used for small streams or ponds that are amenable to dewatering by diverting the water around the target area or draining the water body. However, projects as large as the removal of over 500,000 cy of contaminated sediment have been conducted using dry excavation. Examples of sites in Wisconsin that have used dry excavation to remove contaminated sediment include Newton Creek/Hog Island Inlet, where approximately 46,288 cy yards were removed by dry excavation and Hayton Area Remediation Project, near Chilton, Wisconsin where approximately 16,300 cubic yards have been removed since 2001. Superfund sites where dry excavation has been used to remove some or all of the impacted sediment include Velsicol Chemical/Pine River in Michigan and Marathon Battery in New York.

8.3.5.3 Implementation of Remedy

Mobilization/Demobilization

This includes mobilization and demobilization of all the equipment and facilities needed to implement this alternative. This is estimated to be 5% of the remedial costs.

Construction of Temporary Wave Attenuation Device or Stone Breakwater

Wave dampening will be required to minimize dynamic forces on the containment wall. Two forms of wave dampening can be utilized, a temporary floating wave attenuation device or a permanent structure. Both forms of dampening are discussed below with the final selection to be determined at the Remedial Design stage.

Temporary Wave Attenuation Device

The partially assembled wave attenuator (Figure 8-17) will be shipped to the site on flat bed trailers. The device will be unloaded and placed onto a work barge for assembly along the proposed alignment. Installation along the alignment will occur by placing concrete dead-men along the alignment. The exposed rebar extending from the dead-men would be connected to

metal shackles that are connected to a metal cable which connects to the metal rods on the wave attenuator. Adjustment of the cables length would be performed to maximize wave attenuation (Figure 8-18).

During winter the wave attenuator could remain in-place or be pulled below the surface of the water to a depth that would be below the bottom of the ice that customarily forms in the bay. After ice out in the Spring the attenuator could be retuned to its initial position by adjusting the cable attached to the dead-men. At the completion of the project the attenuator could be anchored to the bottom or cleaned and sold.

Stone Breakwater

Alternatively a stone breakwater could be constructed along the proposed alignment show on Figure 8-14. All of the breakwater construction activities will be performed from barges. The stone will be placed by cranes positioned on barges. Additional barges loaded with stone will be mobilized to the breakwater construction area. The bottom of the breakwater will consist of 6 to 12-in-diameter crushed rock base on which large 1 to 2 ton shot rock will be placed. The rock on the perimeter faces of the breakwater will be large stone, several feet in all dimensions and weigh several tons. The side slopes of the breakwater will be 3H:1V, with the breakwaters crest extending above the top of the water a minimum of 5 feet.

Containment Wall Installation

Landside containment wall construction will be performed by driving steel sheet piling that utilizes an interlock sealant to minimize seepage. The lake and landside sheet piling will be driven into the underlying Miller Creek formation approximately 20 feet and 5 feet, respectively. Prior to driving the sheet piling, an exploratory trench will be excavated along the land wall alignment to a depth of approximately 10 feet below ground surface to remove obstacles or debris that would prevent the sheeting from being installed.

The lakeside containment wall will be constructed from a barge by driving steel sheeting or Pipe/AZ sheeting combined wall system. Preliminary structural analysis of the Pipe/AZ wall system without the use of a stone breakwater indicates similar deflections to other systems with the stone breakwater in-place. This pipe pile/sheet pile wall system also minimizes the number of interlocks, which help in minimizing the volume of seepage through the wall as compared to other containment systems that were evaluated. The final design of the lakeside containment wall will be determined at the Remedial Design stage after geotechnical data is collected along the alignment.

Following completion of the containment wall system, the water within the containment will be removed using trailer mounted 500 gpm pumps. The discharged water from initial pumping within the containment wall will be transported to the WWTP and processed with minimal treatment. Variable rate discharge pumps will be deployed to reduce the water content of the sediments within the containment. This water will also be piped to the WWTP and processed using additional treatment.

Excavation/stabilization/disposal of sediments

The excavation of the wood debris will be performed with tracked mounted excavators and a crane equipped with a dragline and bucket. The excavated wood debris and some of the sediments that underlie the debris will be placed on the asphalt drying pad to allowing additional drainage of trapped fluids. The drained wood debris will be loaded into trucks for transport to the disposal facility or to the NSP Bayfield Power Plant for burning. Fluids collected at the drainage pad will be transferred to the WWTP for additional treatment before being discharged.

The silty/clayey sediments underlying the wood deposits will be stabilized with reagents prior to being loaded onto trucks for disposal. The reagent(s) will be of a type that will help to absorb the majority of the remaining fluids within the silty/clayey sediments. Concrete Jersey barriers will be used to separate the stabilization activity from other activities. Stabilization of the sediments will be performed by using a compressor to transfer the reagent provided in tanker trucks to the stabilization area. Mixing of the reagent with the sediments will be performed using an excavator bucket and/or bulldozers. The stabilized sediments will be loaded by excavator into trucks for transport to the disposal facility.

The underlying sandy granular sediments will be removed and placed on an asphalt drainage pad to allow additional drainage of fluids. The sandy material will be moved to the drainage pad using wheel mounted conveyors and/or tracked excavators and bull dozers. Drained sandy sediments will be loaded onto trucks for transport to a disposal facility. Fluids collected at the drainage pad will be transferred to the WWTP for additional treatment before being discharged.

The potential for unacceptable volatilization is substantially greater for this alternative since areas would be exposed to the air. Although a dry excavation scenario was not explicitly modeled in the Air Emissions Treatability Study (Appendix B3), volatiles are expected to disperse beyond the immediate vicinity of excavation and onshore treatment operations, depending upon ambient weather conditions. With the proximity of a relatively large population in Ashland, this presents the possibility of unacceptable exposure unless volatiles can be controlled.

As with other sediment alternatives, controls for minimization of volatile releases are available for onshore operations; however, volatilization control for nearshore dry excavation would have to be investigated further during a pilot scale project, since tenting over working excavators is difficult and would add complexity to maintaining efficient excavation/stabilization/disposal rates. Volatilization controls for dry excavation would be similar to those discussed in the previous section for dredging (Section 8.3.4) with the exception of those controls that take place under water. On the other hand, surrounding excavation areas with “tenting” may be more practical than surrounding dredging areas with “tenting”. Since the project duration is anticipated to be twice that of the other sediment alternatives the potential for volatilization is greater. In addition, it would preclude use of the Kreher Park for approximately two years longer than the other sediment alternatives.

After dredging is completed, six inches of clean sediment would be placed on areas that are dredged. This would help in covering any dredging residuals as well as providing a better habitat for recruitment of benthic macroinvertebrates and for spawning of fish. In addition, because this alternative would result in substantial changes to the bathymetry of the nearshore waters at the Site, approximately 30,000 cy of clean fill will have to be placed in the nearshore areas to partially restore pre-dredge bathymetry.

Sediment Dewatering

Dewatering of the sediment will be performed using variable rate discharge pumps that are placed in sumps pits located within the containment area and adjacent to the outermost containment wall. Additional drainage of wood debris and sandy granular sediments will be provided by placing these materials on the asphalt drainage pad built at the Kreher Park area. Sediment dewatering and seepage through the containment wall are estimated at 7,500 gal/day. No emission controls have been included in costs at this time. However, they may be needed due to VOC emissions. The emissions will last longer due to the large exposed area.

Wastewater Treatment

Water treatment is similar to Alternative SED-3 and SED-4 and includes bag/sand filtration, oil/water separation, adsorption with activated carbon filter and related testing for O&M and discharge. Most of the systems are closed and should have minimal impact on air emissions. Discharge will be to the City of Ashland WWTP or to Lake Superior if it meets WDNR water quality criteria. Estimated total treatment quantity for the dredge in the dry option is 180,000,000 gallons. The total treatment volume is based on a project duration of 3.8 years.

Sediment Treatment

Sediment treatment includes stabilization and/or gravity drainage of excess fluids followed by disposal in a solid waste landfill.

Sediment handling costs include sediment dewatering, water treatment and sediment treatment and are summarized in Table 8-7.

Sediment Disposal

The disposal options under this alternative are the same as for Alternative SED-3 (Section 8.3.3). There is just more sediment to dispose.

Other Disposal Alternatives

As previously discussed, NSPW also may initiate siting of landfill per ch. NR 500 requirements in the Ashland area for solid materials removed from the Lakefront Site. This disposal option is dependent on the material volume. An analysis of siting an landfill per ch. NR 500 requirements in the Ashland area is presented in Appendix I.

Ancillary Solid Wastes

Waste such as PPE, construction debris and other types of solid wastes generated during the conduct of remedial activities can be disposed of at a local municipal landfill. The quantity generated will depend on the remedial alternative. PPE will be evaluated and handled in accordance with USEPA guidance document to handle investigation derived waste (USEPA 2007).

Wood Waste

Under this alternative there is the potential for generating a substantial quantity of wood waste. The wood waste ranges in size from sawdust and chips to timber. Potentially, the larger debris could be burned as fuel at the NSP Bayfield Power Plant located in Ashland. Some additional maintenance at the plant would be required to accommodate the wood debris but this is considered a viable option at this time and will evaluated further during remedial design.

Monitoring

Monitoring options for this alternative would be the same as those listed in Section 8.3.2 with the exception of those elements relating to CDF or cap performance.

8.3.5.4 Cost

The total cost for this alternative is approximately $69,153,000. Cost elements are summarized in Table 8-7.

Table 8-7 - Cost Summary – Alternative SED-5: Dry Excavation.

Estimated Cost*		
Task	**SED-5A**	**SED-5B**
	Dry Excavation - No Treatment	**Dry Excavation - Thermal Treatment**
Mob/Demob & Miscellaneous	$2,100,000	$2,500,000
Sediment Removal and Treatment	27,600,000	38,100,000
Water Removal and Treatment	7,800,000	7,800,000
Transport and Disposal	5,000,000	3,400,000
Long Term Monitoring	700,000	700,000
Total Estimated Cost	**$67,600,000**	**$82,000,000**

* Only Total Cost includes oversight and administration, engineering and contingency.
1: Sediment handling includes screening, dewatering, treatment and/or stabilizing if necessary

8.4 Detailed Analysis of Retained Remedial Action Alternatives – Sediment

In this section the retained alternatives are assessed against criteria specified in the NCP and USEPA guidance, as follows:

- **Threshold Criteria**
  - Overall protection of human health and the environment
  - Compliance with ARARs

- **Balancing Criteria**
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility and volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost

- **Modifying Criteria (assessed after the public comment period)**
  - State and Agency Acceptance
  - Community acceptance

8.4.1 Threshold Criteria

Of the nine CERCLA-defined FS evaluation criteria, two criteria are threshold criteria and must be met by each remedial alternative to be considered applicable and appropriate for the remedy. These include:

- overall protection of human health and the environment; and
- compliance with ARARs.

8.4.1.1 Overall Protection of Human Health and the Environment

Protection of human health and the environment is based on an evaluation of each remedial alternative's ability to be protective of human health and the environment. The evaluation focuses on how a specific alternative achieves adequate protection, and how site risks are eliminated, reduced, or controlled. Unacceptable short-term or cross-media impacts are also evaluated, if present.

This evaluation criterion provides a final check to assess whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Evaluation of the overall protectiveness of an alternative should focus on whether a specific alternative achieves adequate protection and should describe how site risks posed through each pathway being addressed by the FS are eliminated, reduced, or controlled through treatment, engineering, or institutional controls. This evaluation also allows for consideration of whether an alternative poses any unacceptable short-term or cross-media impacts.

Although biota may be removed with sediments, all sediment alternatives otherwise are protective of human health and the environment because contaminated sediments are either isolated from exposure to humans or biota and/or they are removed from the environment. While there may be some potential differences in long term effectiveness regarding protection of human health and the environment amongst the sediment alternatives, these can be addressed through long term monitoring, maintenance of CDF or subaqueous cap and implementation of contingency plans, if necessary. Long term effectiveness is discussed in Section 8.4.2.1 and the potential differences in protection of human health and the environment in Section 8.5.1.

Alternative SED-5 presents a slightly greater risk to human health during project implementation due to the need to work behind the barriers that will be used to enclose and dewater the work area and keep it dewatered for the four year project schedule.

8.4.1.2 Compliance with ARARs and TBCs

Each remedial alternative is evaluated against ARARs to determine compliance. If there are ARARs that are not met by an alternative, either the alternative can not be selected or there may be a basis for justifying a waiver of the ARAR under CERCLA. The justification for a waiver should be discussed under this criterion.

A complete listing and discussion of ARARs and TBCs was presented in the ASTM. This evaluation criterion is used to determine whether each alternative will meet Federal and State ARARs (as defined in CERCLA Section 121) that have been identified in previous stages of the RI/FS process. The detailed analysis should summarize which requirements are applicable or relevant and appropriate to an alternative and describe how the alternative meets these requirements. When an ARAR is not met, the basis for justifying one of the six waivers allowed under CERCLA should be discussed.

ARARs specific to Retained Alternatives

Alternative SED-1 – No Action

There are no ARARs that pertain to the no-action alternative, since no action is taken.

Alternative SED-2 –CDF, Removal and MNR

Under Alternative SED-2, steps would be taken to minimize or eliminate potential exposure to impacted sediment by removing sediment where concentrations of PAH exceed the sediment PRG. ARARs and TBCs that would relate to this alternative include landfill siting requirements (Wisconsin Statutes Chapter 289), design requirements for construction of a CDF in water (NR 322), and permission from the State to build the CDF on state property. In addition, WDNR has indicated that this alternative would need approval from both the Governor and State Legislature

Aquatic CDF

Construction of an aquatic CDF would include the placement of fill material and some type of structure to contain the fill on the bed of Lake Superior. There are several available procedural mechanisms which might be used to authorize such fill and structure placement.

Section 30.12 permit: State of Wisconsin Statute Section 30.12 addresses the deposit of "any material" or placement of "any structure" upon the bed of any navigable waterway. Section 30.12 provides that approval may be given by WDNR via issuance of either a general or individual permit. Section 30.12 also recognizes that special authorization may be granted by the Wisconsin Legislature. In correspondence dated March 30, 2007, WDNR staff have advised their interpretation of Section 30.12 limits the agency's ability to issue permits that authorize deposits to "small amounts of incidental fill when associated with other structures." In a meeting on March 3, 2008 WDNR staff reconfirmed this position with respect to administrative rules enacted under the authority of Section 30.12. The language of Section 30.12 does not contain such a limitation on WDNR's authority and the Company does not agree that the agency's authority is so limited. Nor do the rules enacted under the authority of Section 30.12. To the extent that authorization under Section 30.12 might be deemed necessary but not available to an aquatic CDF, this statutory requirement may be pre-empted on the basis that it improperly "restricts the range of options available to the EPA." See, United States v. Denver, City and County Of, 100 F.3d 1509, 1512 (10th Cir. 1996).

The procedural steps to obtain a permit under Wis. Stat. §30.12 are the same for this project as for any project for which an individual permit under Wis. Stat. Chapter 30 is sought. While exemptions and general permits are available for various projects and impacts, this summary describes the procedures that apply when the permit applicant seeks an individual permit. The procedures are spelled out in detail in Wis. Stat. §§30.208 and 30.209, and ch. NR 310, WAC and are summarized below:

1) While exemptions and general permits are available for various projects and impacts, this summary describes the procedures that apply when the permit applicant seeks an individual permit. The first step would be for the permit applicant to prepare an application to WDNR for issuance of a permit. In this case, the Company would be the permit applicant. The application form is available on the WDNR website and identifies the information required to be submitted.
2) The subsequent steps are spelled out in the statute and administrative rule and summarized as follows:
    a. WDNR staff reviews the permit application and informs the applicant within 30 days whether the application is complete. If the application is deemed incomplete, WDNR must notify the applicant why and what additional information is needed. There is no limit on the number of times the applicant may supplement or resubmit the permit application. Wis. Stat. §30.208(2) and NR 310.14.
    b. Within 15 days of making its determination that the application is complete, WDNR provides public notice and a 30-day public comment period during which an interested party may request a public informational hearing. The project applicant may also request that a public hearing be scheduled, or WDNR may

schedule a public hearing on its own if it determines there is a "significant public interest in holding a hearing"; in either of those cases the public notice will provide the date of the public hearing. If a public informational hearing is to be held, it must be held within 30 days of the date on which DNR gives public notice that there will be a hearing. Wis. Stat. §30.208(3) and NR 310.15 and .16.

c. Within 30 days after the public hearing, or if no hearing is held within 30 days of the 30-day comment period, WDNR is to render a decision on the permit application. That decision may be to issue, deny or modify the requested permit. Wis. Stat. §30.208(3) and NR 310.17.

d. If the permit is issued in its requested or modified form, a third party may challenge it in either or both of two ways: an administrative review via *contested case hearing* or a circuit court review via *petition for judicial review*. Wis. Stat. §30.209 and NR 310.18.

   i. *Contested case hearing*: The party who objects to an issued permit and seeks a contested case hearing must show that the activity may violate specific provisions of Chapter 30. If the hearing request shows that a stay is "necessary to prevent irreversible harm to the environment", the permit is stayed until WDNR denies the hearing request or the administrative law judge (ALJ) to whom the contested case hearing is assigned determines the stay is not necessary. WDNR is required to grant or deny the hearing request within 30 days and to provide written notice of its determination. Wis. Stat. §30.209(1m) and (2) and NR 310.18.

      1. If the hearing request is granted, the hearing must be completed within 90 days after the matter is referred from WDNR to the Division of Hearings and Appeals in the Department of Administration, unless the parties agree to an extension. In extraordinary circumstances, the ALJ may grant a one-time extension of up to 60 days to complete the hearing. Wis. Stat. §30.209(1m) and (2). The decision of the ALJ can be appealed to circuit court via petition for judicial review. Wis. Stat. §30.209(3) and NR 310.18.
      2. If the hearing request is denied, the permit is effective as issued. Wis. Stat. §30.209(1m) and NR 310.17(4).

   ii. *Petition for Judicial Review*: Issuance of the permit in requested or modified form would be considered a final agency action subject to review by the circuit court. The vehicle for this review is a petition for judicial review and must be filed within 30 days of the decision sought to be reviewed. A project opponent could chose this route following the contested case hearing or in lieu of the contested case hearing. Appeal from the circuit court's decision is to the Wisconsin court of appeals. Wis. Stat. §30.209(3) and NR 310.18.

e. If the permit is denied or issued in a modified form which is not satisfactory to the permit applicant, the permit applicant may also challenge that decision in either or both of the same two ways: contested case hearing or petition for judicial review. The key difference would be that the permit applicant's interest in the matter is

recognized by law and, unlike a third party, the permit applicant is not required to identify how the permit fails to comply with specific provisions of Wis. Stat. Chapter 30. Wis. Stat. §30.209.

f. If the outcome of either a contested case hearing or a petition for judicial review is that the permit is denied or issued in a modified form not satisfactory to the permit applicant, the permit applicant may appeal that decision further or reapply. Wis. Admin. Code NR 310.17 and .18. If the outcome of a contested case hearing or a petition for judicial review is that the permit is issued, a project opponent may appeal that decision further. Appeal to the Wisconsin court of appeals is as of right; further appeal to the Wisconsin Supreme Court is a discretionary appeal.

The Company continues to disagree with WDNR's position that Wis. Stat. § 30.12 limits WDNR's ability to issue permits to deposits of "small amounts of incidental fill when associated with other structures." Our review of Wis. Stat. §30.12 and the Wisconsin Administrative Code provisions enacted under its authority lead to the following conclusions:

1) the statute does not specify any maximum volume or amount of fill or deposit that may be authorized by permit;
2) the rules identify certain activities that are exempt from the requirement to obtain a permit; in some cases, this exemption is based on the amount or volume of fill or deposit being less than a specified threshold;
3) the rules identify certain activities that are eligible for a general permit; in some cases, this eligibility is based on the amount or volume of fill or deposit being less than a specified threshold;
4) the rules authorize issuance of individual permits for fills and deposits;
5) the rules do not set a blanket maximum amount or volume or fill or deposit that may be authorized by individual permit;

Chapter NR 310, WAC provides the only other standards by which DNR is to consider an application for an individual permit to construct a CDF. Pursuant to NR 310.17(2), WAC, DNR "shall consider all the following information in deciding whether to approve, modify or deny an individual permit application:

(a) Applicable standards in statutes, rules and common law.
(b) Plans and information provided by an applicant.
(c) Information gathered during site investigations.
(d)Written or oral information provided during a public comment period or public hearing.
(e) Statements or information provided by local, state and national government agencies.
(f) Data or information found in natural resource inventories and plans, or maps collected by the department or others using commonly accepted methods.
(g) Published scientific research.
(h) Section 1.11, Stats., Wisconsin environmental policy act, and ch. NR 150.
(i) Any other pertinent information."

Nothing in these standards sets a specific limitation on the volume or amount of fill that may be authorized under Wis. Stat. § 30.12; nor do these standards authorize DNR to categorically deny an individual permit for a CDF simply because the proposed volume of material exceeds a certain threshold. Thus, we find no support for WDNR's position that individual permits issued under Wis. Stat. §30.12 or the rules enacted thereunder may only authorize "small" amounts of fill or deposit.

Legislative lake bed grant: We are aware of at least two aquatic CDFs that have been authorized in Wisconsin Great Lakes waters via legislative lake bed grant. Pursuant to its authority under Article IX, Section 1 of the Wisconsin Constitution, the Wisconsin Legislature may grant authority to utilize a portion of lake bed for purposes considered to be consistent with the public trust in those navigable waters. Such legislative lake bed grants have been made to authorize the CDF in the waters of Green Bay referred to as Renard (a/k/a Kidney) Island, and the CDF in the waters of Lake Michigan referred to as the Milwaukee Harbor CDF. Wisconsin Statute Section 13.097 provides that WDNR is to report to the Legislature the agency's view of whether the lake bed grant is consistent with protecting and enhancing a public trust purpose. A legislative lake bed grant can be made only to a municipality; thus, if this mechanism is used either the City of Ashland or the County of Bayfield would likely be designated as the lake bed grantee. Because a legislative lake bed grant is a form of legislative action, signature by the Governor would also be required.

Because the legislative lake bed grant is an act of the legislature, the procedural steps to obtain a legislative lake bed grant are the same procedural steps to enact any piece of legislation. They are summarized below:

1) The first step would be to identify a legislator or legislators who will request that a bill be drafted and who will sponsor the bill as legislation. Because the legislative grant would likely designate either the City of Ashland or the County of Bayfield as the lake bed grantee, identification of a legislator or legislators could be done by or in cooperation with either or both of those municipal entities.
2) The second step would be for the legislator or legislators to request the bill be drafted and, once drafted, to sponsor the bill for consideration by the full legislature. This step would include creating the legal description of the area to be included in the lake bed grant.
3) The third step would encompass the standard legislative process, from introduction of the bill, through the committee hearing stage, and to the floors of both the Senate and Assembly for consideration. This step might include responses to proposed amendments and testimony in support of the legislation from the bill's sponsors and other supporters. During this step, the report required of WDNR by Wis. Stat. §13.097 would be provided to and considered by the legislative committees.
4) The fourth step depends on the outcome of the legislature's consideration. If the legislature approves the bill, it would go to the Governor for signature. If the Governor signs it, it would become effective. If the legislature does not approve the bill or if the Governor does not sign it, then the bill sponsors would have the option of reintroducing the legislation in a future legislative session or abandoning the effort.

Board of Commissioners of Public Lands Lease: State of Wisconsin Statute Section 24.39 authorizes the Board of Commissioners of Public Lands (BCPL) to enter into long-term (50-year), renewable leases of submerged lake bed for various purposes, including "improvements to water navigation, construction of harbor facilities, and recreation." State of Wisconsin Statute Section 30.11(5) directs WDNR to advise BCPL of its view as to the consistency of the proposed lease and associated use with the public interest. The BCPL can enter into leases with either municipal or private parties; however, the lessee must be the riparian property owner. If this mechanism is used, the City of Ashland as riparian owner would likely be the lessee and such a lease may well be consistent with the City's harbor development plans. BCPL leases do not require legislative or gubernatorial approval.

Entering into a lease with the BCPL is similar to entering into a lease with any party, although in this case the party is a governmental entity. As a result the purposes for the lease must meet the statutory requirements. The procedural steps to obtain a lease from the BCPL are as follows:

1) The first step would be to identify the parties to the lease. Because the lease must be between the BCPL and the riparian property owner, the likely lessee in this case would be the City of Ashland. Lease negotiations could be conducted by or on behalf of the City, with whatever support from the company the City and BCPL deem appropriate.
2) The second step would be to establish the legal description of the area to be included in the lease. This may require that a survey be conducted; if so, the survey would be conducted by a credentialed survey company working on behalf of the City.
3) The third step would be to prepare a draft of the lease terms. The drafting could be done by staff of the BCPL or by representatives or designees working on behalf of the City, depending on the parties' preferences. The drafting would establish the area to be included in the lease, the purpose of the lease, the term of the lease, and any other conditions the parties agreed to and deemed necessary.
4) The fourth step would be for the BCPL to consider the proposed lease and whether its terms meet the requirements of Wis. Stat. §24.39(4). This step would require a meeting or meetings of the BCPL to consider the proposed lease; the BCPL meets on an as-needed basis so the timing of the meeting would depend on when the proposed lease was ready for consideration and any other internal meeting protocols the BCPL follows. As part of this step, the BCPL would receive and consider the advice required from WDNR by Wis. Stat. §30.11(5) as to WDNR's view of the consistency of the proposed lease and associated use with the public interest. Wis. Stat. §24.39(4)(c) prohibits the execution of a lease without a prior finding of WDNR that any "proposed physical change in the area contemplated as the result of the execution of any term lease is consistent with the public interest in the navigable waters involved."
5) The fifth step would be for the parties to execute the lease, if the BCPL approved the lease. The lease would become effective upon execution. If the BCPL does not approve the lease, the parties would have the option of negotiating other terms that the BCPL would approve, or of abandoning the effort.

In light of the number of mechanisms that might be utilized to authorize an aquatic CDF, it would be premature to eliminate this option or to deem it less viable than other options currently under consideration. Design specifications for the CDF would need to satisfy the substantive statutory, public interest and public trust requirements; however, it is possible that all of these mechanisms may be considered process ARARs and thus subject to the CERCLA § 121(e)(1) permitting exemption as the CDF would constitute an "on-site" remedy as defined in 40 CFR § 300.400(e)(1).

Upland CDF

As an alternative to an aquatic CDF, an upland CDF could be constructed. Wis. Stat. Ch. 289 authorizes DNR to regulate the siting, construction and operation of solid waste facilities. Pursuant to that authority, DNR has promulgated Wis. Admin. Code Ch. NR 504 entitled Landfill Location, Performance, Design and Construction Criteria. NR 504.04(3), WAC specifies the locational criteria applicable to a CDF located on the upland (above the ordinary high water mark). Included in the locational criteria in NR 504.04(3) are the requirements that the limits of fill of the facility be set back 1,000 feet from any navigable lake, 300 feet from any navigable stream, and be outside of the floodplain. NR 504.04(2) authorizes DNR to grant exemptions from the locational criteria, and specifically authorizes DNR to grant an exemption from the 1,000 foot setback from any navigable lake and the 300 foot setback from any navigable stream "upon demonstration by the applicant of circumstances which warrant an exemption." NR 504.04(2) specifies that exemptions may not be granted from the prohibition on locating a facility within the floodplain. This language appears to be based on the Wis. Stat. s. 289.35 which prohibits solid waste facilities within areas under the jurisdiction of shoreland and floodplain zoning regulations.

However, Wis. Stat. s. 289.35 goes on to specifically provide that DNR "may issue permits authorizing facilities in such areas."

The procedural steps to obtain an exemption from the locational criteria for an upland CDF are as follows:

1) The first step would be to prepare an initial site report for siting of a solid waste facility following the procedural steps provided in Wis. Stat. §289.21(1) and Wis. Admin. Code NR 509 and to obtain an initial site report opinion from WDNR.
2) The second step would be to provide notice to each affected municipality of the proposal for the solid waste facility, to request the municipality identify any applicable local approvals, and to apply for those local approvals as provided in Wis. Stat. §289.22 and NR 512.06.
3) The third step would be to prepare a feasibility report for siting a solid waste facility following the procedural steps provided in NR 512.06. The feasibility report would include the request for exemption from the locational criteria as provided in NR 512.05. The request for exemption would include an explanation of the "circumstances that warrant" the exemption as called for by NR 504.04(2)(b).
4) The fourth step would be WDNR's review of the feasibility report.

a) This step would include WDNR's determination as to when the feasibility report is complete and public notice of that determination with the opportunity for public comment and hearing. Included in this step would be the opportunity for either an informational or contested hearing. A request for an informational hearing must be filed within 30 days of the public notice and the hearing must be held within 60 days of the close of the 30-day public comment period. Subject to certain showings, if so requested the hearing may be treated as a contested case hearing. In that case, the hearing must be held within 120 days of the close of the 30-day public comment period and the decision issued within 90 days of the close of the hearing.

b) This step also would include WDNR's evaluation of whether the "circumstances warrant" the requested exemption under the provisions of NR 504.04(2)(b). That decision by WDNR is also subject to review during the public informational or contested case hearing, if either is held.

5) The fifth step would be the decision to grant or deny the exemption. If no hearing is held or if a public informational hearing is held and WDNR determines that the exemption can be granted, then WDNR will grant the exemption as part of its feasibility report approval. Wis. Stat. §289.29(3). If a contested case hearing is held, then the Administrative Law Judge will issue the final determination of feasibility including the decision on any requested exemptions. Wis. Stat. §289.27(4). The decision to grant or deny the exemption is challengeable by the project applicant or a third party under the provisions of Wis. Stat. Ch. 227 via either contested case hearing, if one has not been held, or petition for judicial review to the circuit court. Those decision are further appealable as described above.

While the location of an upland CDF would not be determined until the Remedial Design stage, the statute and the applicable administrative rules provide DNR authority to issue permits authorizing facilities within a floodplain and to grant exemptions from the 1000 foot setback from a navigable lake. The requirements to seek and obtain local approvals are clearly process ARARs, and the procedural steps to submit and obtain feasibility report are equally subject to the CERCLA § 121(e)(1) permitting exemption as the CDF would constitute an "on-site" remedy as defined in 40 CFR § 300.400(e)(1). Thus, these locational requirements are not an impediment to placement of an upland CDF and do not provide a basis for eliminating this option from consideration.

Additional action may be required to meet air and surface water quality during dredging and dewatering operations. Furthermore, wetlands mitigation may be necessary as part of this alternative. In addition to the ARARs and TBCs described above, the design of sediment removal process and CDF needs to have U.S. Army Corps of Engineers concurrence.

Upon proper implementation of this alternative, ARARs would be met.

Table E-3 in Appendix E summarizes the ARARs and TBCs that affect implementation of Alternative SED-2.

Alternative SED-3 – Removal, Treatment, Disposal, Capping, and MNR

Under Alternative SED-3, steps would be taken to minimize or eliminate potential exposure to impacted sediment by removing sediment to a depth of four feet where concentrations of PAH exceed the sediment PRG. Sediment removed would be dewatered and treated on site using thermal treatment, or dewatered and sent off site for disposal in a landfill. Sediment located outside of the capped area with concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC would be monitored. Alternative SED-3 would be similar to Alternative SED-2 with respect to ARARs. As with Alternative SED-2, WDNR has indicated that this alternative would need approval from both the Governor and State Legislature.

A subaqueous cap probably would also be considered a structure and fill on the bed of Lake Superior and would be subject to the same ARARs as Alternative SED-2. As with Alternative SED-2 there are several available procedural mechanisms which might be used to authorize such fill and structure placement. These are discussed in the previous section. In this regard, we are aware that USEPA and WDNR have proposed a ROD change for the Fox River NPL Site that includes capping of sediment in navigable waters. It is possible the mechanism upon which this decision is based can be used for the Ashland Site.

In addition, consideration of requirements for high-temperature thermal desorption units may be required (NR 400 through 499) if it is determined that the sediment needs to be decontaminated. Dewatering would be subject to WPDES requirements (NR 200 and NR 220 through 297). In addition to the ARARs and TBCs described above the design of sediment removal process and the subaqueous cap needs to have U.S. Army Corps of Engineers concurrence. Upon proper implementation of this alternative, ARARs would be met.

Table E-3 in Appendix E summarizes the ARARs and TBCs that affect implementation of Alternative SED-3.

Alternative SED-4 – Removal, Treatment, Disposal and MNR

Under Alternative SED-4, steps would be taken to minimize or eliminate potential exposure to impacted sediment by removing sediment where concentrations of PAH exceed the sediment PRG Sediment removed would be dewatered and treated on site using thermal treatment, or dewatered and sent off site for disposal in a landfill. Treated sediment would be sent off site for beneficial reuse. Alternative SED-4 would be similar to Alternative SED-3 with respect to ARARs. In addition to the ARARs and TBCs described above the design of sediment removal process needs to have U.S. Army Corps of Engineers concurrence.

Table E-3 in Appendix E summarizes the ARARs and TBCs that affect implementation of Alternative SED-4.

Alternative SED-5 – Dry Excavation, Treatment, Disposal and MNR

Alternative SED-5 would be similar to Alternative SED-4 with respect to ARARs.

8.4.2 Balancing Criteria

Five of the remaining criteria are referred to as balancing criteria by which the alternatives are compared and upon which the analysis is based. These include:

- long-term effectiveness and permanence:
- reduction of toxicity, mobility, or volume;
- short-term effectiveness;
- implementability; and
- cost

8.4.2.1 Long Term Effectiveness and Permanence

Each remedial alternative is evaluated as to magnitude of long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring impacted site media. Table 8-8 presents an evaluation of the long-term effectiveness and permanence of each alternative.

Table 8-8. Evaluation of Long-term Effectiveness and Permanence for Potential Remedial Alternatives for Sediment

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative SED-1: No Action	Potential risk to human health or the environment, if any, would not be reduced.	There are no remedial actions or controls associated with this alternative.
Alternative SED- 2: CDF, Removal, and MNR	Risk to human health and the environment would be reduced through covering impacted material above the sediment PRG or placement of impacted sediment above the sediment PRG into the CDF area, and covering the CDF by placing clean material over the impacted sediment to prevent human contact and impact to biota. Monitoring would evaluate the effectiveness of the CDF in containing contaminated sediments and the effect of natural recovery processes that could result in reduction of COPC concentrations outside of the CDF footprint.	Alternative SED-2 would involve technologies that have been used previously, and whose adequacy and reliability have been tested (See Table 1 in Attachment 3 in Appendix A2 (previously provided as Attachment 3 to the Comparative Analysis of Alternatives Technical Memorandum which provides an overview of the state of the practice in use of CDFs for containment of contaminated sediments). Control measures would be required when dredging and placing sediment into the CDF area to prevent or minimize transport of sediment outside of the area of concern. Similarly, impacts to air quality could occur, and may need to be addressed to prevent exposure to workers and downwind receptors. Placing clean material over the CDF would prevent exposure to sediment, and minimize on-going release of volatiles to water and air. Long-term monitoring would be required to evaluate the effectiveness of the CDF in preventing exposure to contaminants and containment of contaminated sediments.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	Risk to human health and the environment would be reduced through removal of impacted sediment to allow sufficient draft to construct a cover, and constructing a cap over the remaining impacted sediment to prevent human contact and impact to biota. Removed sediment would be treated on-site and/or disposed off-site, thereby eliminating any potential risk associated with the sediment. Monitoring would evaluate on-going risk to human health and the environment from failure of the cap as well as the effect of natural recovery processes that could result in reduction of COPC concentrations beyond the cap area.	Alternative SED-3 would involve use of technologies that are proven reliable and accepted, including dredging, sediment capping, and treatment of sediment through incineration or thermal destruction, and off-site disposal. EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA 2005) discusses that subaqueous capping has been selected as a remedy or component of the remedy at over 15 Superfund sites. Capping has also been used at sites where there is NAPL in the sediments such as at the McCormick and Baxter Superfund Site in Oregon where approximately 20 acres of creosote containing sediment were capped. Control measures would be required to ensure that exposure is limited during sediment removal, dewatering, treatment, and transport activities. These control measures could include placement of silt curtains and sorbent booms,

Table 8-8. Evaluation of Long-term Effectiveness and Permanence for Potential Remedial Alternatives for Sediment

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
		and if necessary temporary sheet piling, during dredging operations, vapor recovery during dewatering and treatment operations, and special handling of waste, if necessary, during transport for disposal. Monitoring would be required to evaluate the long-term effectiveness of these measures in preventing unacceptable exposure and risk.
Alternatives SED-4 and SED-5: Removal (by dredging or excavation), Treatment and/or Disposal and MNR	Risk to human health and the environment would be reduced through removal of impacted sediment, thereby preventing human contact and impact to biota. Since sediment removed would be treated on site and disposed off site, any potential risk associated with the sediment would be effectively eliminated. Monitoring would evaluate on-going risk to human health and the environment from impacted sediment that remains in place.	Alternatives SED-4 and SED-5 would involve use of technologies that are proven reliable and accepted, including dredging, treatment of impacted sediment through incineration or thermal destruction, and off-site disposal. Control measures would be required to ensure that exposure is limited during sediment removal, dewatering, treatment, and transport activities. These control measures could include placement of silt curtains and sorbent booms and if necessary temporary sheet piling, during dredging operations, vapor recovery during dewatering and treatment operations, and special handling of waste, if necessary, during transport for disposal. If properly implemented, there would be little risk associated with implementation of this alternative. Monitoring would be required to evaluate the long-term effectiveness of these measures in preventing unacceptable exposure and risk.

8.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment

The remedial alternatives are evaluated for permanence and completeness of the remedial action in significantly reducing the toxicity, mobility, or volume of hazardous materials through treatment. Each alternative is evaluated based on the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. Table 8-9 presents a summary of this evaluation.

Table 8-9. Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Remedial Alternatives for Sediment

Alternative	Treatment Process Used and Materials Treated	Volume of Material Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative SED-1: No Action	No treatment process used.	None.	None.	Not applicable.	No treatment, therefore all residuals remain.
Alternative SED-2: CDF, Removal, and MNR	Auxiliary treatment for water will be necessary prior to discharge.	None treated, although over 74,000 cy of material would be placed and contained within CDF. Approximately another 60,000 cy would be covered by CDF. There would be no reduction in volume.	None, although exposure to contaminants is eliminated by containment within CDF.	Treatment via construction of a CDF would be nearly completely reversible.	No treatment, therefore all residuals remain; however, these residuals do not pose a risk to humans or biota as direct contact is effectively eliminated and the contaminated sediments are contained in a CDF.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	Impacted sediment that is removed would be treated by thermal desorption or incineration, or shipped off-site for disposal.	Approximately 78,000 cubic yards of material would be removed, treated and disposed.	Destruction efficiency of thermal treatment is anticipated to be 99% or more; material that remains in place would be effectively contained thereby eliminating risk to human heath and biota; material shipped off site for disposal would be effectively contained, thereby eliminating exposure.	Thermal destruction is permanent and irreversible; theoretically, untreated sediment that is sent for off-site disposal could present potential risk; however, this scenario is unlikely.	Approximately 50,000 cubic yards of impacted material would remain in place; however, this material would be capped, thereby effectively eliminating risk to human health and biota.
Alternatives SED-4 and SED-5: Removal (by dredging or excavation), Treatment and/or Disposal and MNR	Impacted sediment that is removed would be treated by thermal desorption or incineration, or shipped off-site for disposal.	Approximately 134,000 cubic yards of material would be removed, treated and disposed.	Destruction efficiency of thermal treatment is anticipated to be 99% or more.	Thermal destruction is permanent and irreversible.	Under this alternative, impacted sediment with PAH concentrations greater than the sediment PRG would be removed, thereby effectively eliminating risk to human health and biota.

8.4.2.3 Short Term Effectiveness

The evaluation of short-term effectiveness is based on the degree of protectiveness of human health achieved during construction and implementation of the remedy. Potential implementation risks to the community and site workers and mitigation measures for addressing those risks are included in this evaluation. In addition, environmental impacts during implementation and the time required to achieve the RAOs must also be considered in the evaluation of this criterion. Table 8-10 summarizes the results of this evaluation.

Table 8-10. Evaluation of Short Term Effectiveness for Potential Remedial Alternatives for Sediment

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative SED-1: No Action	Since no remediation is occurring, no protection of community and workers is necessary.	Since no remediation is occurring, there would be no additional impact to the environment over current impacts.	RAOs would not be achieved in the foreseeable future, and are unlikely to be met within 30 years.
Alternative SED-2: CDF, Removal, and MNR	Worker and community protection would be required and controls would need to be implemented during dredging, placement and dewatering of sediment and construction of the CDF.	Dredging and dewatering activities could release volatiles from sediment into surface water and air, thus impacting surface water and air quality. Dredging could agitate sediments, which could lead to resuspension and dispersal. It is unlikely that nearby residents will experience increased exposure to VOCs during dredging and on-shore sediment treatment operations because under this alternative only sediments with low levels of VOCs and PAHs are dredged and treated.	It is anticipated that RAOs would be reached upon completion of the CDF; based on current volume estimates, it is anticipated to be completed within two years from project start.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	Worker and community protection would be required and controls would need to be implemented during dredging, placement and dewatering of sediment and construction of the cap.	Dredging and dewatering activities could release volatiles from sediment into surface water and air, thus impacting surface water and air quality. Dredging could also agitate sediments, which could lead to resuspension and dispersal. . Nearby residents may experience increased exposure to VOCs during dredging and onshore sediment treatment operations. Thermal treatment has the potential to release VOCs into the air during start-up or pilot operations until the unit is operating at optimal efficiency. If sediment is disposed off site without treatment at a NR500 landfill there would be no future exposure to humans or biota because site access is controlled.	It is anticipated that RAOs would be reached upon completion of the cap and completion of thermal treatment; based on current volume estimates, it is anticipated to be completed within three years from project start.
Alternatives SED-4 and SED-5: Removal (by dredging or excavation), Treatment and/or Disposal and MNR	Worker and community protection would be required and controls would need to be implemented during dredging, dewatering, and treatment.	Dredging or excavation and dewatering activities could release volatiles from sediment into surface water and air, thus impacting surface water and air quality. Dredging could also agitate sediments, lead to resuspension and dispersal. Nearby residents may experience increased exposure to VOCs during dredging or excavation and onshore sediment treatment operations. This duration of this potential exposure would be twice as long with SED-5 (approx. 4 years) as with SED-4 or other alternatives. Thermal treatment has the potential to release VOCs into the air during start-up or pilot operations until the unit is operating at optimal efficiency. If sediment is disposed off site without treatment, landfill there would be no future exposure to humans or biota because site access is controlled.	It is anticipated that RAOs would be reached upon completion of the dredging and thermal treatment; based on current volume estimates, it is anticipated to be completed within three years from project start.

8.4.2.4 Implementability

Implementability is based on the evaluation of technical feasibility, administrative feasibility, and the availability of services and materials. Technical feasibility considers the following factors:

- difficulties that may be inherent during construction and operation of the remedy;
- the reliability of the remedial processes involved;
- the flexibility to take additional remedial actions, if needed;
- the ability to monitor the effectiveness of the remedy;
- the availability of offsite treatment, storage, and disposal facilities; and,
- the availability of needed equipment and specialists.

Administrative feasibility considers permitting and regulatory approval and coordination with other agencies. Table 8-11 presents a summary of this evaluation.

Table 8-11. Evaluation of Implementability for Potential Sediment Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative SED-1: No Action	There would be no technical issues associated with this alternative. The ability to complete additional investigation or remedial measures would not be prevented by this alternative.	Not applicable, since no technology is implemented. No monitoring would be conducted.	There would be no administrative issues related to the no-action alternative.	No services or materials would be needed for this alternative.
Alternative SED-2: CDF, Removal, and MNR	The technical aspects of this alternative, including dredging, placement and dewatering of sediment, and construction of a CDF, are all feasible technologies. Implementation of this alternative would not prevent completion of additional investigation or remedial measures. However, significant effort would be required to access impacted sediment in the CDF for additional evaluation or remediation. Installation of a sheet pile through the wood waste layer might be difficult.	The technologies and process options used as part of this alternative have been used elsewhere with success. See Table 1 to Attachment 3 in Appendix A2 which was previously provided as Attachment 3 to the Comparative Analysis of Alternatives Technical Memorandum. Monitoring would allow accurate evaluation of effectiveness of remedial action through collection of samples outside and within the CDF to compare concentrations with pre-remedial action levels.	Administrative issues related to implementation of this alternative would include complying with ARAR requirements for dredging and construction of a CDF in navigable waters. According to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult.	Services necessary for this alternative are readily available and proven technologies. Companies that perform dredging, sheet-pile installation, and cover construction are located in relatively close proximity to the site.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	The technical aspects of this alternative, including dredging, dewatering, treatment, and construction of a subaqueous cap, are all feasible technologies. Implementation of this	The technologies and process options used as part of this alternative have been used elsewhere with success. Monitoring would allow accurate evaluation of	Administrative issues related to implementation of this alternative would include complying with ARAR requirements for dredging and construction of a cap in	Services necessary for this alternative are readily available and proven technologies. Companies that perform dredging, sheet-pile installation, and sub-aqueous cap

Table 8-11. Evaluation of Implementability for Potential Sediment Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
	alternative would not prevent completion of additional investigation or remedial measures. However, significant effort would be required to access impacted sediment under the cap for additional evaluation or remediation.	effectiveness of remedial action through collection of samples to compare concentrations with pre-remedial action levels.	navigable waters, as well as operation of a treatment system at the site. According to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult.	construction are located in relatively close proximity to the site. Thermal treatment units are transportable and can be readily transported to the site.
Alternatives SED-4 and SED-5: Removal (by dredging or excavation), Treatment and/or Disposal and MNR	The technical aspects of this alternative, including dredging or excavation, dewatering, treatment, and off-site disposal, are all feasible technologies. Implementation of this alternative would not prevent completion of additional investigation or remedial measures. Alternative SED-5 is more difficult to implement because it requires installation of safe and watertight enclosures that would have to be maintained for the anticipated four year project schedule.	The technologies and process options used as part of this alternative have been used on many contaminated sediment sites with success.	Administrative issues related to implementation of this alternative would include o complying with ARAR requirements for dredging as well as operation of a treatment system at the site. Furthermore, additional administrative actions could be required to meet the intent of ARARs.	Services necessary for this alternative are readily available and proven technologies. Companies that perform dredging and excavation, and thermal treatment are located in relatively close proximity to the site. Thermal treatment units are transportable and can be readily transported to the site.

8.4.2.5 Cost

For each remedial alternative, estimated capital and O&M were prepared in accordance with the USEPA guidance document *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (USEPA and USACE 2000). The cost estimates are developed primarily for the purpose of comparing remedial alternatives and not for establishing project budgets. The estimating process provides costs that are within a range of 30-percent below to 50-percent above expected actual costs, consistent with USEPA guidance. Present worth analyses were performed for long-term costs using 30-year O&M period and a 7-percent discount rate.

Table 8-12 presents a summary of the cost evaluation for all alternatives evaluated. The details of these costs are presented in Appendix F3 Tables F3-1 through F3-12.

Table 8-12. Cost Summary of for Potential Remedial Alternatives for Sediment.

Alternative	Estimated Cost	Included Transportation & Disposal Costs
Alternative SED-2 - CDF	$ 37,000,000	N/A
Alternative SED-3A – Mechanical Dredge, Cap, No Treatment	$ 30,100,000	$ 2,700,000
Alternative SED-3B - Mechanical Dredge, Cap, Thermal Treatment	$ 34,500,000	$ 1,800,000
Alternative SED-3C – Hydraulic Dredge, Cap, No Treatment	$ 36,400,000	$ 2,700,000
Alternative SED-3D – Hydraulic Dredge, Cap, Thermal Treatment	$ 41,700,000	$ 1,800,000
Alternative SED-4A - Mechanical Dredge, No Treatment	$ 41,300,000	$ 4,600,000
Alternative SED-4B - Mechanical Dredge, Thermal Treatment	$ 48,900,000	$ 3,000,000
Alternative SED-4C – Hydraulic Dredge, No Treatment	$ 51,600,000	$ 4,400,000
Alternative SED-4D – Hydraulic Dredge, Thermal Treatment	$ 61,100,000	$ 3,000,000
Alternative SED-5A – Dry Excavation, No Treatment	$67,600,000	$5,000,000
Alternative SED-5B – Dry Excavation, Thermal Treatment	$82,000,000	$3,400,000

Note: The cost of a NR500 landfill sited in Ashland is approximately $18,100,000 including loading and transportation of sediment and soil. If this were selected as an alternative because of lack of capacity at other existing NR 500 landfills or for other cost benefit reasons, the majority of transport and disposal costs in the above estimates would be avoided. In addition, thermal treatment costs may be avoided for alternatives 3B, 3D, 4B, 4D and 5B.

8.4.3 Modifying Criteria

The third group, the *modifying criteria*, includes:

- State/Support agency acceptance; and
- Community acceptance.

As previously discussed, these last two criteria are typically formally evaluated following the public comment period, although they can be factored into the identification of the preferred alternative to the extent practicable.

With regard to community acceptance criterion, it should be noted that the agencies conducted an outreach session consisting of a "community workshop" in Ashland on October 25, 2007. A summary of that workshop provided by USEPA is included as Appendix C.

8.5 Comparative Analysis of Retained Remedial Alternatives – Sediment

In this section, as required by CERCLA and NCP guidance a comparative evaluation is conducted. The advantages and disadvantages of the alternatives will be concurrently assessed with respect to each criterion. The criteria considered as part of this comparative evaluation were discussed in Section 8.2. Table 8-13 presents a summary of the comparative analysis.

Table 8-13. Summary of Comparative Analysis for Potential Sediment Remedial Alternatives.

Criteria	Alternative SED-1: No Action	Alternative SED-2: Consolidation, CDF, and Monitoring	Alternative SED-3: Removal, Capping, Treatment and/or Disposal, and Monitoring	Alternative SED-4: Dredging, Treatment and/or Disposal, and Monitoring	Alternative SED-5: Dry Excavation, Treatment and/or Disposal, and Monitoring
Overall Protection of Human Health and the Environment	Low	High	High	High	High
Compliance with ARARs and TBCs	Low	High	High	High	High
Long-term Effectiveness and Permanence	Low	Moderate	Moderate to High	High	High
Reduction of Toxicity, Mobility and Volume through Treatment	Low	Moderate	Moderate	High	High
Short-term Effectiveness	High	High	Moderate	Low	Low
Implementability – Technical Difficulty*	Easy	Moderate	High	High	Very High
Implementability – Administrative Difficulty*	High	High	High	Moderate	Moderate
Cost	Low	High	High	High	Very High

* For implementability the least administratively or technically feasible are assigned the highest rating.

8.5.1 Overall Protection of Human Health and the Environment

Alternative SED-1 – No Action – offers the least protection of human health and the environment, as no additional actions would be taken to address site issues.

Alternative SED-2 – CDF – assures protection of human health and the environment by eliminating access to impacted sediment. Under this alternative, there is no destruction of COPCs, but these materials are permanently contained and inaccessible to humans or biota, thereby reducing risk. Attachment 3 to the Comparative Analysis of Alternatives Technical Memorandum (Appendix A2) discusses the state of the practice for use of CDFs for containment of contaminated sediment.

Alternative SED-3 – subaqueous capping of a portion of the sediment and removal of the remainder – is also protective of human health and the environment, because it isolates a portion of the sediment above the sediment PRG from exposure to humans or biota. The remaining sediment above the sediment PRG is removed. If that portion is thermally treated it reduces its volume and permanently eliminates its toxicity by treatment. If the sediment were to be sent for disposal without treatment, then this alternative reduces in situ volume and eliminates exposure to humans and biota by transfer of these materials to an environment where access is controlled. There is no reduction in toxicity if the sediment that is removed is disposed in a landfill although because access would be controlled there would be no exposure to humans or ecological receptors.

Alternative SED-4 – removal – is also protective of human health and the environment if the sediment is treated, because it results in decontamination of sediment above the PRG and removes it from the aquatic environment. If the sediment were to be sent for disposal without treatment, then this alternative would be roughly equivalent to Alternatives SED-2 and SED-3 (if Alternative SED-3 were also completed without sediment treatment); there would be no reduction in toxicity, but exposure to humans and biota is eliminated because access is controlled. There is no reduction in toxicity if the sediment that is removed is disposed in a landfill although because access would be controlled there would be no exposure to humans or ecological receptors.

Alternative SED-5 – dry excavation – is protective of human health and the environment if the sediment is treated, because it results in decontamination of sediment above the PRG and removes it from the aquatic environment. If the sediment were to be sent for disposal without treatment, then this alternative would be roughly equivalent to Alternatives SED-2 and SED-3 (if Alternative SED-3 were also completed without sediment treatment); there would be no reduction in toxicity, but exposure to humans and biota is eliminated because access is controlled. There is no reduction in toxicity if the sediment that is removed is disposed in a landfill although because access would be controlled there would be no exposure to humans or ecological receptors.

Since the project duration is anticipated to be twice that of the other sediment alternatives (approximately four years) the potential for volatilization of VOCs and exposure to residents is greater. In addition, it would preclude use of the Kreher Park for approximately two years longer than the other sediment alternatives.

8.5.2 Compliance with ARARs and TBCs

Alternative SED-1 would not comply with regulations. Alternatives SED-2, SED-3, SED-4 and SED-5 would be similar with respect to meeting ARARs and TBCs, as engineering and construction actions would be developed and completed in compliance with federal and state regulations.

8.5.3 Long-term Effectiveness and Permanence

Alternative SED-1 would not provide any long-term benefit, as any potential risk associated with impacted sediment is not eliminated through remedial action. The risk posed by the COPCs in sediment remains the same under Alternative SED-1.

Although there is no reduction in volume or toxicity of the contaminated sediment, Alternative SED-2 still provides a moderate level of permanence and effectiveness over the long term. Since no sediment is treated, the toxicity of the material remains the same, however accessibility and exposure to humans and biota is eliminated through containment.

Alternative SED-3 provides a high level of long term effectiveness and permanence for that sediment which is removed and treated. For the contaminated sediment that is capped there is no destruction of COPCs, but these materials are permanently contained and inaccessible to humans or biota, thereby reducing risk. A volume of approximately 78,000 cy would be permanently removed from the environment. If the sediment that is removed is not treated but disposed in an NR500 landfill exposure to humans and biota is eliminated through access restrictions.

Alternatives SED-4 and SED-5 would provide the highest effectiveness and permanence over the long term due to the permanent removal of the largest volume of sediment. If treated, thermal treatment of the sediment would eliminate toxicity, reduce volume and is permanent. If the sediment that is removed is not treated but disposed in an NR500 landfill, exposure to humans and biota is eliminated through access restrictions.

8.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative SED-1 offers no reduction in toxicity, mobility, or volume through treatment, as no action is taken.

Alternative SED-2 would permanently reduce the mobility of contaminated sediments, although the toxicity and volume would not change. While there is no destruction of COPCs, these materials are permanently contained and inaccessible to humans or biota, thereby reducing risk.

Alternative SED-3 would reduce toxicity, mobility and volume of approximately 78,000 cy of sediment which would be permanently removed from the environment. That sediment remaining under the cap would have permanently reduced mobility and since it would be inaccessible to humans or biota, it would eliminate exposure and risk. The inherent toxicity of that sediment remaining under the cap would not be reduced.

Alternatives SED-4 and SED-5 would have the greatest degree of reduction of toxicity, mobility, and volume of impacted material. Mobility would be reduced by permanently containing it in an NR500 landfill. Likewise, toxicity would be reduced since exposure to humans and biota would be eliminated because access in an NR500 landfill is controlled.

8.5.5 Short-term Effectiveness

Alternative SED-1 would have the least short-term impact on human health and the environment, as impacted sediment would not be disturbed, thereby potentially releasing COPCs into surface water and air. Of the three active remedial options, Alternative SED-2 would have the least short-term impact, as sediment is not brought to shore for dewatering or treatment, but is disposed in a CDF, a portion of which is subaqueous. Adequate controls would be in place to ensure worker and community safety during remedial activities. All other alternatives would have the potential of some short term risk from release of volatile emissions during debris removal and onshore dewatering and/or treatment. Release of volatile emissions from land-based activities including filling of a CDF could be better controlled than for dredging activities.

8.5.6 Implementability

Implementation of Alternative SED-1 would be easy, as no action would be performed. In addition, because no remedial action would occur, there would be no difficulty in implementing additional remedial actions at a later date.

Alternative SED-2 would be more difficult to implement than Alternative SED-1. The technology and equipment that would be used for this alternative is readily available, and has proven to be reliable at other similar sites. However, because WDNR has indicated that the Governor and Legislature must approve Alternatives SED-2 and SED-3, obtaining authorization to proceed may be problematic. Long term monitoring, included as a part of Alternatives SED-2, SED-3, and SED-4, would allow periodic evaluation of risks associated with materials left in place.

Alternatives SED-3 and SED-4 would be still more difficult to implement, as additional equipment, technology, and permitting would be required to perform the dewatering, thermal treatment, and disposal of sediment as well as for implementation of engineering controls for volatilization. Furthermore, the capping component included as part of Alternative SED-3 would add additional complexity to the implementation of this alternative.

Alternative SED-5 would be much more difficult to implement because of the need to install safe and watertight enclosures that would have to be maintained for the anticipated four year project

duration. A contingency of 25% was used for this alternative compared to 20% for other sediment alternatives.

8.5.7 Cost

Alternatives SED-1 would be the lowest cost alternative.

The cost for Alternative SED-2 would be greater than costs for Alternative SED-1 and SED-3 if construction of the CDF is required to meet ch. NR 504, WAC specifications and armouring to the top of the sheet pile is required on the lakeside. The cost to implement SED-4 is approximately 30 to 50 percent greater than SED-2 and SED-3 depending upon whether the sediment is mechanically or hydraulically dredged and whether it is thermally treated. Cost for implementation of Alternative SED-5 would range between approximately $67,600,000 and $82,000,000 depending upon whether the sediment is thermally treated. This is more than twice the cost of most other alternatives.

Alternative capping designs, for instance a three foot cap (two feet of sand and one foot of rock for erosion control) with a carbon mat (three foot of sand and one foot of rock) would be several million dollars less than the four foot cap upon which the cost estimates for SED-3 is based. Based upon the treatability studies, a thinner cap with a carbon mat would be just as effective in isolating contaminants as the four foot cap upon which the cost estimate for SED-3 is based. An 11 acre carbon mat was placed without any difficulty at the Stryker Bay site.

8.5.8 Summary

For sediment, Alternative SED-1, while costing little to nothing, would not provide any long-term protection, and therefore should not be considered. Alternative SED-2 would provide the most long-term benefit with the fewest short-term technical implementation issues and short term impacts of remedy (due to volatilization) issues. However there would be permanent loss of approximately seven acres of shallow lake bed habitat. WDNR has also indicated that the Governor and Legislature would have to approve this alternative, thus making administrative implementability problematic.

With Alternative SED-3 approximately 78,000 cubic yards would be removed from the environment and either treated or disposed in a NR500 landfill. However, a subaqueous cap at the shoreline may be considered by some to be less permanent than a CDF. In addition the requirement for more debris removal and for sediment treatment as compared to SED-2 increases the short term risk of implementation of this alternative due to the likelihood that these activities would result in release of potentially harmful volatile emissions. As with Alternative SED-2, WDNR has indicated that the Governor and Legislature would have to approve this alternative, thus making administrative implementability more problematic, although no lake bottom would be lost since the top of the cap would be designed to provide a fully functioning benthic habitat with exactly the same bathymetry that presently exists.

Alternative SED-4 would offer greater protection of human health and the environment than Alternatives SED-2 and SED-3, but at a cost that is 30 percent or greater than Alternatives SED-2 and SED_3. If all dredging is conducted mechanically and there is no need for thermal treatment Alternative SED-4 is approximately $11,000,000 greater than Alternative SED-3 ($41,300,000 versus $30,100,000). However if hydraulic dredging is required and there is a need to thermally treat the sediments the cost for Alternative SED-4 could be as much as $20,000,000 greater than Alternative SED-3 ($61,100,000 versus $41,700,000) In addition the requirement for substantially greater debris removal and for treatment of almost twice as much sediment under Alternative SED-3 results in this alternative having the greatest short term risk of implementation due to the likelihood that these activities would result in release of potentially harmful volatile emissions. Unlike Alternatives SED-2 and SED-3, Alternative SED-4 does not have to be approved by the Governor and Legislature.

Alternative SED-5 is similar to SED-4 in achieving greater protection of human health and the environment. However, this alternative is substantially more expensive than Alternative SED-4 (from approximately $25,000,000 to $33,000,000 or about 65% more expensive using similar sediment treatment) and also presents potentially greater risk to human health, because of the need to work behind barriers engineered to keep out the waters of Lake Superior and because the project duration is estimated to be at least twice as long. In addition, if SED-5 were implemented the use of Kreher Park by the public would be precluded for almost four years which is approximately two years longer than with other alternatives..

If both Alternative SED-4 and soil Alternative S-3B are selected, as much as 350,000 cubic yards of sediment and soil or more may require disposal. Given that outcome, it may be cost effective to site a private NR500 in Ashland on property owned or purchased by NSPW.

Based on this evaluation, Alternative SED-4 would provide the most long-term benefit at the least cost and with the fewest short-term technical implementation issues.

9.0 Integrated Remedial Alternatives

9.1 Introduction

Contamination at the Site includes soil and shallow groundwater contamination in the vicinity of the former MGP and at Kreher Park, groundwater contamination in an underlying confined aquifer, and offshore sediment contamination in the inlet area adjacent to Kreher Park. The FS includes remedial alternatives for contaminated media (soil, groundwater, and sediment). Potential remedial alternatives for soil were screened in the ASTM, and those retained for further evaluation were analyzed in the CAATM. Sections 6.0, 7.0, and 8.0 include a summary of the technical memoranda for soil, groundwater and sediment, respectively. In the two previous technical memoranda, the ASTM and the CAATM, a number of potential remedial alternatives for the various Site media were evaluated. Both of these Technical Memoranda were critically reviewed and, in several instances, modified by USEPA and WDNR. The evaluations presented in these two previous memoranda were critically reviewed and modified by the EPA and WDNR and indicated some alternatives were either technically infeasible or not cost effective and these alternatives were eliminated from further consideration. The remedial alternatives presented in previous sections of this FS are those that survived the evaluation conducted as part of the ASTM and the CAATM. The reader is directed to these two technical memoranda which are attached as Appendix A1 and A2 for details on this evaluation process.

For purposes of investigation, the Site was divided into the following areas of concern as described in the RI report:

1. Filled Ravine
2. Copper Falls Aquifer
3. Kreher Park
4. Offshore Sediments

Because of the limited space in the upland area of the Site and the need to coordinate and potentially share other resources and treatment technologies used in the remediation of groundwater, soil and sediment, this section is provided to illustrate how response actions for these media potentially will be integrated. This will provide a comprehensive “whole site” view of site-wide remedial action. Since many of the detailed designs for the various response actions have to await the Remedial Design stage, this “whole site” view is necessarily conceptual. However, this level of detail should be sufficient to evaluate the feasibility of integrating various response actions and determine whether there are any “fatal flaws” that would preclude them being implemented concurrently or sequentially. In addition, by evaluating how these response actions potentially can be integrated, the “integration effect” of response actions on estimated costs due to either competition for resources or sharing of resources can be determined.

9.2 Site-Wide Integrated Remedies

At the FS stage there remain following screening a large number of potential remedial alternatives depending upon the media and the Site area. Potential remedial responses were reviewed for soil, groundwater, and sediment in Sections 6, 7 and 8, respectively. The filled ravine and Kreher Park include remedial alternatives for both soil and groundwater. Remedial alternatives for the Copper Falls aquifer are limited to groundwater, and remedial alternatives for the offshore sediments are limited to sediment. Table 9-1 includes a summary of potential remedial alternatives for each area of concern consisting of the following:

1) At the upper bluff area, 14 alternatives for remediating the "filled ravine";
2) At the upper bluff area, 7 alternatives for remediating "Copper Falls aquifer";
3) At the lakefront, 12 alternatives for remediating soil and groundwater; and
4) In the lake, 12 alternatives for remediating offshore sediments.

Table 9-1 - Summary of Remedial Alternatives by Areas of Concern

Area of Concern	FS Designation	Description
Filled Ravine	S-1/GW-1	No Action (Section 6.3.1 and 7.3.1)
	S-2	Containment Using Surface Barriers (Section 6.3.2)
	S-3A	Limited Removal and Off-site Disposal (Section 6.3.3)
	S-3B	Unlimited Removal and Off-site Disposal (Section 6.3.3)
	S-4A	Limited Removal and On-site Disposal at Kreher Park (Section 6.3.4)
	S-4B	Unlimited Removal and On-site Disposal at Kreher Park (Section 6.3.4)
	S-5A	Ex-situ Thermal Desorption - On-site treatment (limited removal) (Section 6.3.5)
	S-5B	Ex-situ Incineration - Off-site treatment (limited removal) (Section 6.3.5)
	S-6	On-site Soil Washing (limited removal) (Section 6.3.6)
	GW-2A	Containment Using Vertical Barriers (Section 7.3.2)
	GW-3	Ozone Sparge (Section 7.3.3)
	GW-6	In-site Chemical Oxidation (Section 7.3.6)
	GW-7	Electrical Resistance Heating (Section 7.3.7)
	GW-8	Steam Injection – Contained Recovery of Oily Water (CROW) (Section 7.3.8)
	GW-9A	Groundwater Extraction with EW-4 (Section 7.3.9)
Copper Falls Aquifer	GW-1	No Action (Section 7.3.1)
	GW-3	Ozone Sparge (Section 7.3.3)
	GW-4	Dual Phase / Surfactant Injection (Section 7.3.4)
	GW-6	In-situ Chemical Oxidation (Section 7.3.6)
	GW-7	Electrical Resistance Heating (Section 7.3.7)
	GW-8	Steam Injection via Dynamic Underground Stripping (DUS) (Section 7.3.8)
	GW-9A	Groundwater Extraction with existing system (Section 7.3.9)
	GW-9B	Groundwater Extraction with enhanced groundwater extraction system (Section

Table 9-1 - Summary of Remedial Alternatives by Areas of Concern

Area of Concern	FS Designation	Description
Kreher Park	S-1/GW-1	No Action (Section 6.3.1 and 7.3.1)
	S-2	Containment Using Surface Barriers (Section 6.3.2)
	S-3A	Limited Removal and Off-site Disposal (Section 6.3.3)
	S-3B	Unlimited Removal and Off-site Disposal (Section 6.3.3)
	S-5A	Limited Removal and On-site Disposal at Kreher Park (Section 6.3.4)
	S-5B	Unlimited Removal and On-site Disposal at Kreher Park (Section 6.3.4)
	S-6	Ex-situ Thermal Desorption - On-site treatment (limited removal) (Section 6.3.5)
	GW-2A	Containment using vertical barriers (with hydraulic control of contained area)
	GW-2B	Containment using vertical barriers (with hydraulic control of contained area)
	GW-3	Ozone Sparge (Section 7.3.3)
	GW-5	Containment Using Vertical Barriers and Permeable Reactive Barrier Wall
	GW-6	In-site Chemical Oxidation (Section 7.3.6)
	GW-7	Electrical Resistance Heating (Section 7.3.7)
	GW-8	Steam Injection via Dynamic Underground Stripping (DUS) (Section 7.3.8)
	GW-9B	Groundwater Extraction with enhanced groundwater extraction system (Section
Offshore Sediments	SED-1	No Action (Section 8.3.1)
	SED-2	Confined Disposal facility (CDF) (Section 8.3.2)
	SED-3A	Dredge and Subaqueous Cap with Mechanical Dredge (No treatment prior to off-
	SED-3B	Dredge and Subaqueous Cap with Mechanical Dredge (Thermal Treatment prior to
	SED-3C	Dredge and Subaqueous Cap with Hydraulic Dredge (No treatment prior to off-site
	SED-3D	Dredge and Subaqueous Cap with Hydraulic Dredge (Thermal Treatment prior to
	SED-4A	Dredge all with Mechanical Dredge (No treatment prior to off-site disposal)
	SED-4B	Dredge all with Mechanical Dredge (Thermal Treatment prior to off-site disposal)
	SED-4C	Dredge all with Hydraulic Dredge (No treatment prior to off-site disposal) (Section
	SED-4D	Dredge all with Hydraulic Dredge (Thermal Treatment prior to off-site disposal)
	SED-5A	Dry Excavation (Section 8.3.5)
	SED-5B	Dry Excavation (Thermal Treatment prior to off-site disposal) (Section 8.3.5)

Because it would be impractical to attempt to illustrate every permutation of concurrent or sequential implementation of these various remedial alternatives, through discussions with USEPA and WDNR we have selected nine remedial scenarios that illustrate how a range of representative response actions and remedial technologies and processes could be integrated. These are summarized in Table 9-2.

Remedial responses implemented at each area may require forms and combinations of containment, removal and in-situ treatment. This will result in the generation of solid waste (soil and sediment) and wastewater (from sediment de-watering, excavation de-watering, and long-term groundwater extraction). Significant resources will be committed to the management of

these wastes. Cost estimates for the remedial responses evaluated in this report include waste management, but volumes treated or generated will vary among remedial responses. The optimum remedial program for the entire Site may require the utilization of different remedial technologies at each area of concern. The following sections describe suggested remedial scenarios that group these alternatives at each affected area. Elements that will be addressed for each scenario include the following:

1) How different areas of the Site will be used for different activities;
2) Whether there is logic for implementing certain response actions at certain areas of the Site prior to others to prevent cross-contamination;
3) Effectively applying ancillary technologies, i.e. dewatering, wastewater treatment, transportation, and disposal to address more than one medium; and
4) Potential for cost savings from this optimization.

Based on cost estimates presented in this FS, each remedial scenario includes a range of estimated costs for each area of concern. The sum of cost estimates for each area of concern was used to derive a range of costs for remediation at the entire Site. These cost estimates provide useful information to evaluate combinations of potential remedial technologies. However, a more accurate cost estimate of cost savings will not be known until design phase cost estimates are prepared.

Table 9-2 Summary of Integrated Remedial Scenarios

Remedial Scenario	I	II	III	IV	V	VI	VII	VIII	IX
Sediment	Not Applicable	Dredge sediment up to four feet and cap remaining sediment in place (**SED-3).**	Dredge (hydraulic or mechanical) all sediment exceeding 9.5 ppm (**SED-4).**	Dredge (hydraulic or mechanical) all sediment exceeding 9.5 ppm (**SED-4).**	Confined Disposal Facility (CDF) for near shore sediment and material dredged outside of CDF footprint **(SED-2).**	Dry excavation of all sediment exceeding 9.5 ppm (**SED-5).**	Dry excavation of all sediment exceeding 9.5 ppm (**SED-5).**	Dredge (hydraulic or mechanical) all sediment exceeding 9.5 ppm (**SED-4).**	Dry excavation of all sediment exceeding 9.5 ppm (**SED-5).**
Kreher Park	Not Applicable	Surface barriers to prevent direct contact and limit leaching from unsaturated zone (**S-2).**	Limited soil / source removal via off site disposal **(S-3A)**, ex-situ thermal desorption (**S-5A)**, offsite incineration (**S-5B**, or soil washing (**S-6)**, and groundwater remediation via enhanced groundwater extraction for hydraulic control (**GW-9B). -**	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, or soil washing **(S-6)**, and groundwater remediation via engineered surface and vertical barriers with partial caps and hydraulic control **(GW-2A)**, or with PRB wall **(GW-5).**	CDF at Kreher Park combined with engineered surface and vertical barriers for soil and groundwater contamination at Kreher Park (**GW-2B).**	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, or soil washing **(S-6)**, and groundwater remediation via engineered surface and vertical barriers with hydraulic control via groundwater extraction using, partial caps for the park **(GW-2A)**, a cap for entire park **(GW-2B)**, or with a PRB wall **(GW-5)** at Kreher Park.	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, soil washing **(S-6)**, in-situ chemical oxidation (**GW-6),** ERH (**GW-7)**, or steam injection **(GW-8),** and groundwater remediation via ozone sparge **(GW-3)** or enhanced groundwater extraction (**GW-9B)**.	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, soil washing **(S-6)**, in-situ chemical oxidation (**GW-6),** ERH (**GW-7)**, or steam injection **(GW-8),** and groundwater remediation via engineered surface and vertical barriers with hydraulic control via groundwater extraction and using a cap for the entire park **(GW-2B)**, or with a PRB wall **(GW-5)** at Kreher Park.	Unlimited removal of unsaturated and saturated and off-site disposal (**S-3B).**

Table 9-2 Summary of Integrated Remedial Scenarios

Remedial Scenario	I	II	III	IV	V	VI	VII	VIII	IX
Filled Ravine	Not Applicable	Surface barriers to prevent direct contact and limit leaching from unsaturated zone (**S-2).**	Limited soil / source removal via offsite disposal (**S-3A),** ex-situ thermal desorption (**S-5A)**, offsite incineration (**S-5B)**, or soil washing (**S-6)**, and groundwater extraction using the existing system (**GW-9A).**	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, or soil washing **(S-6)**, and groundwater remediation via engineered surface and vertical barriers with partial caps and hydraulic control **(GW-2A)**, or with PRB wall **(GW-5)** at Kreher Park.	Soil remediation via limited soil / source removal and onsite disposal (**S-4A**), and groundwater remediation using existing groundwater extraction system (**GW-9A)**, or soil and groundwater remediation via unlimited removal and onsite disposal (**S-4A).**	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, or soil washing **(S-6)**, and groundwater remediation via engineered surface and vertical barriers with hydraulic control via groundwater extraction, and partial caps and **(GW-2A)**, or with PRB wall **(GW-5)** at Kreher Park.	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, soil washing **(S-6)**, in-situ chemical oxidation **(GW-6),** ERH **(GW-7)**, or steam injection **(GW-8),** and groundwater remediation via ozone sparge **(GW-3)** or groundwater extraction from EW-4 with existing system (**GW-9A)**.	Limited soil / source removal via offsite disposal **(S-3A)**, ex-situ thermal desorption **(S-5A)**, offsite incineration (**S-5B)**, soil washing **(S-6)**, in-situ chemical oxidation (**GW-6),** ERH (**GW-7)**, or steam injection **(GW-8),** and groundwater remediation via engineered surface and vertical barriers with hydraulic control via groundwater extraction (at Kreher Park) and, and partial caps and **(GW-2A)**, or with PRB wall **(GW-5)** at Kreher Park.	Unlimited removal of unsaturated and saturated and off-site disposal (**S-3B).**
Copper Falls	Not Applicable	Groundwater / NAPL extraction using the existing system **(GW-9A)**	Groundwater and NAPL remediation via ozone sparge **(GW-3)** or surfactant injection /dual phase recovery **(GW-4)**, and groundwater / NAPL extraction using the existing system **(GW-9A)**, or in-situ	Groundwater remediation via ozone sparge **(GW-3)**, surfactant injection /dual phase recovery (**GW-4)**, and groundwater extraction with the existing system **(GW-9A),** or in-situ chemical oxidation (**GW-6)**, ERH **(GW-7)**,	Groundwater remediation via ozone sparge **(GW-3)**, surfactant injection /dual phase recovery (**GW-4)**, and groundwater extraction with the existing system **(GW-9A),** or in-situ chemical oxidation (**GW-6)**, ERH **(GW-7)**, steam	Groundwater remediation via ozone sparge **(GW-3)**, surfactant injection /dual phase recovery (**GW-4)**, and groundwater extraction with the existing system **(GW-9A),** or in-situ chemical oxidation (**GW-6)**, ERH **(GW-7)**, or	Groundwater remediation via enhanced groundwater extraction **(GW-9B)**.	Groundwater remediation via ozone sparge **(GW-3)**, surfactant injection /dual phase recovery (**GW-4)**, and groundwater extraction with the existing system **(GW-9A),** or in-situ chemical oxidation (**GW-6)**, ERH **(GW-7)**, steam injection (**GW-8),** or enhanced	Groundwater remediation via enhanced groundwater extraction **(GW-9B)**.

Table 9-2 Summary of Integrated Remedial Scenarios

Remedial Scenario	I	II	III	IV	V	VI	VII	VIII	IX
			chemical oxidation **(GW-6),** ERH **(GW-7)**, steam injection **(GW-7),** or enhanced groundwater extraction (**GW-9B)**.	steam injection **(GW-7),** or enhanced groundwater extraction (**GW-9B).**	injection (**GW-8),** or enhanced groundwater extraction (**GW-9B).**	steam injection (**GW-8).**		groundwater extraction (**GW-9B).**	

9.2.1 Remedial Scenario I: No Action

As previously discussed the National Contingency Plan (NCP) at Title 40 Code of Federal Regulations (40 CFR §300.430(e)(6)) provides that the no-action alternative should be considered at every site. Implementation of no further action consists of leaving contaminated soil, groundwater and sediment in place; no engineering, maintenance, or monitoring will be required. This combined "no action" remedial scenario is included here only as a baseline to which other remedial scenarios can be compared.

9.2.2 Remedial Scenario II:

This integrated remedial scenario is composed of the following:

- **Sediments:** Alternative SED-3 – Mechanically dredge top four feet of offshore sediments and install subaqueous cap. After dredging is completed, place six inches of clean sediment on dredged areas. Transport decontaminated sediment off site for landfill disposal (or beneficial re-use). Dispose of or burn wood debris separately, and discharge treated wastewater from sediment de-watering; to lake.
- **Kreher Park:** Alternatives S-2 - Containment using surface barriers to prevent infiltration and direct contact with subsurface contamination. Will include surface barriers at former coal tar dump and seep area, at the solid waste disposal area, and the well TW-11 area.
- **Filled Ravine**: Alternative S-2 - Containment using surface barriers to prevent infiltration and direct contact with subsurface contamination. Will include asphalt pavement over filled ravine area.
- **Copper Falls Aquifer:** Alternative GW-9A Operate existing NAPL recovery system.
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off site with groundwater. Collect sediment and surface water samples to ensure contaminants are not migrating through cap. Complete annual inspections to ensure integrity of surface barriers and subaqueous cap and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional Controls:** Implement groundwater use and deed restriction as part of remedial response at upper bluff and Kreher Park where contaminants remain in subsurface. Implement deed restriction for subaqueous cap.

9.2.2.1 Site Utilization and Staging

Kreher Park will be used as a staging area for sediment removal activities, which will include temporary storage of dredged sediment, sediment de-watering, waste water treatment, and loading sediment for off-site disposal. Additionally, Kreher Park will be used for the storage of material used to construct the subaqueous cap prior to placement.

Because Kreher Park will be required for staging sediment removal, surface barriers will likely be installed after sediment remediation is complete.[27] New asphalt pavement will be installed over the gravel covered marina parking lot as a surface barrier to prevent infiltration and direct contact with subsurface contamination at the solid waste disposal area. Clay caps will be placed over the former seep and coal tar dump area and the TW-11 area to prevent infiltration and direct contact with subsurface contamination in these areas. In the event that the WWTP is demolished, a clay cap or asphalt pavement will also be placed over this area.

Implementation at the upper bluff would require minimal site disturbance. For the filled ravine, asphalt pavement will be installed on the NSPW property. New asphalt pavement will be placed over the gravel covered storage yard on the north side of St. Claire Street, and existing paved areas south of St. Claire Street will be replaced with new asphalt pavement. The existing groundwater extraction system has been in operation since 2001; continued operation of this system can be implemented immediately. Access will be needed to perform operation, maintenance, and monitoring.

9.2.2.2 Integration of Remedial Processes

Under Remedial Scenario II, contaminants onshore will remain in place beneath surface barriers, and a subaqueous cap will be used to contain offshore contaminated sediments. Deed restrictions and groundwater use restriction will be needed for contained areas as part of the implementation of these remedial responses.

9.2.2.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario II are summarized below.

Table 9-3 Cost Summary for Remedial Scenario II

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-3** - Dredge and Cap	$ 33,785,000	$ 715,000	$34,500,000,
Kreher Park	**S-2** - Engineered Surface Barriers	$1,734,000	$22,000	$1,756, 000
Filled Ravine	**S-2** - Engineered Surface Barriers	$164,000	--	$164,000
Copper Falls Aquifer	**GW-9A** - Existing Groundwater Extraction System	$0	$2,220,000	$2,220,000
	Total Estimated Cost	$35.68 M	$2.96 M	$38.64 M

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $1000.

[27] The final decision-making for sequencing remedial action will be determined during final design.

Capital costs for offshore sediment, Kreher Park, and the filled ravine remediation exceed long-term operation, maintenance, and monitoring because these remedial responses each include on-site containment. However, capital costs for soil and groundwater exceed OM & M costs because the groundwater extraction system for the Copper Falls aquifer will be operated for an extended period of time. The above cost estimate assumes that the existing groundwater extraction system will operate for 30 years.

The total estimated cost for Remedial Scenario II is approximately $38.64 million and includes $35.68 million for capital costs, and $2.96 million for OM & M. Of this total, approximately *9*-percent is for wastewater treatment, and *5*-percent is for solid media treatment, transportation, and disposal. During remedial design, integration of these operations will be more finely evaluated to determine cost-effective management of these waste streams. This same waste stream evaluation will be applied during the design phase for any selected scenario.

9.2.3 Remedial Scenario III

- **Sediments:** Alternative SED-4 - Remove wood debris from offshore sediments and mechanically dredge offshore sediments. After dredging is completed, place six inches of clean sediment on dredged areas. De-water stabilize and thermally treat sediments at Kreher Park area and treat wastewater; discharge treated wastewater to lake. Transport decontaminated sediment off site for landfill disposal or beneficial re-use. Dispose or burn wood debris separately.
- **Kreher Park**: Alternatives S-3A - Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment,(S-5A), offsite incineration (S-5B), or ex-situ soil washing (S-6), and enhanced groundwater extraction (Alternative GW-9B). Shallow groundwater within the contained area would be treated on-site prior to discharge to the lake.
- **Filled Ravine**: Alternatives S-3A - Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment, (S-5A), offsite incineration, (S-5B or soil washing (S-6). Site restoration would include surface barriers to restrict groundwater recharge. Shallow groundwater would be extracted from existing well EW-4 located at the mouth of the filled ravine to limit discharge to the contained area at Kreher Park.
- **Copper Falls Aquifer**: Alternatives GW-3 - In-situ treatment via ozone sparge, surfactant injection and dual phase recovery (GW-4), with continued operation of existing groundwater extraction system (GW-9A), or in-situ chemical oxidation (GW-6), ERH, (GW-7), steam injection (GW-8), or enhanced groundwater extraction.
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off site with groundwater. Complete annual inspections to ensure integrity of surface barriers and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional Controls:** Implement deed restriction where contaminants remain in subsurface following remedial response at upper bluff and Kreher Park. Implement deed restriction for subaqueous cap. Obtain groundwater use restrictions for shallow groundwater and Copper Falls aquifer as condition of closure.

9.2.3.1 Site Utilization and Staging

Kreher Park will be used as a staging area for sediment removal activities, which will include temporary storage of wood waste, dredged sediment, sediment de-watering and thermal treatment, wastewater treatment, and loading sediment for off-site disposal.

Potential remedial alternatives at Kreher Park include limited removal of contaminated soil from source areas (former coal tar dump and seep areas) and enhanced groundwater extraction to remediate contaminated groundwater. To prevent interference with sediment dredging, limited removal could be completed before or after dredging is complete. Regardless, site restoration should be completed last. Site restoration will include clay caps placed over the former seep and coal tar dump areas and the TW-11 area to prevent infiltration and direct contact with subsurface contamination in these areas. New asphalt pavement will also be placed over the existing gravel-covered marina parking lot as a surface barrier to prevent infiltration and direct contact with subsurface contamination in this area. In the event that the WWTP is demolished, a clay cap or asphalt pavement could also be placed over this area.

Limited removal of contaminated soil from the filled ravine at the upper bluff area could be completed before, during, or after sediment dredging. Excavation will include the demolition of the center section of the U-shaped NSPW service center building, and removal of buried gas holder structures. Site restoration will include the installation of asphalt pavement over the filled ravine. However, site restoration will not be completed until after construction of the selected groundwater remedial response for the underlying Copper Falls aquifer is complete. All potential remedial alternatives for this scenario (ozone sparge, surfactant injection/dual phase recovery, in-situ chemical oxidation, ERH, steam injection, and enhanced groundwater extraction) will require the installation of lateral piping and the installation of sparge wells, injection wells, or extraction wells. Following construction, access will be needed to perform operation, maintenance, and monitoring.

9.2.3.2 Integration of Remedial Processes

At the upper bluff, the existing treatment system could be utilized to treat wastewater generated during excavation de-watering activities. Excavation activities can likely be completed within several weeks. Because the excavation will be completed below the water table, excavation de-watering will be required. The rate of water removed from the excavation will exceed the influent treatment rate, but storage tanks can be used for temporary water storage. However, this system will not be adequate to treat wastewater generated from sediment dewatering. Dredged sediment will require de-watering prior to off-site disposal, which will require temporary onsite wastewater treatment. Equipment used for sediment wastewater treatment could also be used to treat groundwater recovered during excavation de-watering activities. Because the WWTP is not currently in use, it may be possible for surface impoundments (i.e., existing clarifiers) and the building to be used for treating wastewater generated from sediment and excavation de-watering. If the WWTP is demolished, demolition should be completed after treatment of all wastewater generated from remedial activities at the lakefront are complete. If containment using hydraulic

control is selected, treatment system equipment could be used for the long-term treatment of contaminated groundwater. This groundwater extraction system will include horizontal wells with on-site treatment. Groundwater extraction will be used to create a sink at Kreher Park that will exceed the rate of recharge from infiltration and groundwater discharge to this fill aquifer. Although the hydraulic gradient at Kreher Park is relatively flat, shallow groundwater at Kreher Park is in hydraulic connection with the lake, and the wood waste is permeable. Because this remedial scenario does not include vertical barriers, pumping rates between 30 to 50 gallons per minute will likely be needed to create the sink that will prevent the off-site migration of contaminants. The design for groundwater extraction at Kreher Park in the absence of vertical barriers may require groundwater modeling or an aquifer performance test during the design phase to evaluate the appropriate pumping rate.

If contaminated sediment is transported off site for landfill disposal then contaminated soil removed from excavations at the upper bluff and at Kreher Park should also be transported off site for landfill disposal. This may require the use of existing NR 500 permitted landfill facilities, or siting and construction of a local landfill per ch. NR 500 requirements for all solid waste generated during remedial activities at the Site. Thermal desorption or incineration of sediment and ex-situ soil washing may be needed to pre-treat contaminated media prior to off-site disposal. Contaminated soil removed during limited excavations could also be treated on site. The on-site treatment of contaminated soil would reduce the volume of material transported off site for disposal if used as backfill for excavated areas.

9.2.3.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario III are summarized below.

Table 9-4 Cost Summary for Remedial Scenario III

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-4** - Dredge all	$ 48,185,000	$ 715,000	$ 48,900,000
Kreher Park	**S-3A** - Limited removal/offsite disposal or	$1,509,000	$0	$1,509,000
	S-5A - Limited removal/onsite ex-situ thermal desorption or	$2,158,000	$0	$2,158,000
	S-5B - Limited removal/offsite incineration or	$3,777,000	$0	$3,777,000
	S-6 - Limited removal/ex-situ soil washing	$2,653,000	$0	$2,653,000
	AND			
	GW-9B – Enhanced groundwater extraction.[1]	$762,000	$17,392,000	$18,154,000
Filled Ravine	**S-3A** - Limited removal/offsite	$3,415, 000	$0	$3,415, 000

Table 9-4 Cost Summary for Remedial Scenario III

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
	disposal or			
	S-5A - Limited removal/onsite ex-situ thermal desorption or	$4,706,000	$0	$4,706,000
	S-5B - Limited removal/offsite incineration or	$8,103,000	$0	$8,103,000
	S-6 - Limited removal/ex-situ soil washing	$5,961,000	$0	$5,961,000
	AND			
	GW-9A – Existing groundwater extraction system	Costs included with GW-9B alternative for Kreher Park		
Copper Falls Aquifer	**GW-3** – Ozone sparge or	$1,182,000	$695,000	$1,877,000
	GW-4 – Surfactant injection and dual phase recovery and	$744,000	$682,000	$1,426,000
	GW-9A – Existing groundwater extraction system	Costs are included with alternatives GW-3 and GW-4 above.		
	OR			
	GW-6 – In-situ Chemical Oxidation or	$3,128,000	$2,596,000	$5,724,000
	GW-7 – Electrical Resistance Heating or	$6,880,000	$123,000	$7,003,000
	GW-8 – Steam Injection or	$7,188,000	$123,000	$7,311,000
	GW-9B – Enhanced Groundwater Extraction System	$411,000	$5,979,000	$6,420,000
Total Estimated Cost	Offshore Sediments	$ 48.2 M	$ 0.7 M	$ 48.9 M
	Kreher Park	$2.3 to $3.4 M	$17.4 M	$19.7 to 20.8
	Filled Ravine	$3.4 to $8.1 M	$0	$3.4 to $8.1 M
	Copper Falls Aquifer	$0.4 to $7.2 M	$0.13 to $5.9 M	$1.4 to $7.3 M
	Total Estimated Cost	$54.3 to $66.9 M	$18.2 to $24 M	$73.4 to 85.1 M

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $1,000.
1 – Does not include installation of engineered surface barriers, which are included with remedial alternatives evaluated for soil.

Total estimated costs for Remedial Scenario III are dominated by sediment removal. Enhanced groundwater extraction at Kreher Park (without vertical barriers) leads to the significant OM & M costs. Limited removal of contaminated soil within the filled ravine and off-site disposal or

ex-situ thermal desorption are lower cost remedial responses than off-site incineration and soil washing. For the Copper Falls aquifer, in-situ treatment using ozone sparge and surfactant injection are lower than in-situ treatment using chemical oxidation, ERH, steam injection, and enhanced groundwater extraction.

9.2.4 Remedial Scenario IV

- **Sediments:** Alternative SED-4 - Remove wood debris from offshore sediments and mechanically dredge offshore sediments. After dredging is completed, place six inches of clean sediment on dredged areas. Dewater and stabilize sediments at Kreher Park area and treat wastewater; discharge treated wastewater to lake. Transport stabilized sediments off site to NR 500 permitted landfill. Dispose of or burn wood debris separately.
- **Kreher Park:** Alternatives S-3A - Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment, (S-5A), offsite incineration (S-5B), or ex-situ soil washing (S-6), and engineered surface and vertical barriers with groundwater extraction as hydraulic control (Alternative 2A) or a PRB wall (Alternative GW-5). Alternative 2A includes partial caps at Kreher Park to limit groundwater recharge. Shallow groundwater extracted from the contained area for hydraulic control would be treated onsite and discharged to the lake would be treated as it passes through the PRB wall.
- **Filled Ravine:** Alternative S-3A - Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment, (S-5A), offsite incineration, (S-5B or soil washing (S-6) and engineered surface and with hydraulic control (Alternative 2A) or a PRB wall (Alternative GW-5) at Kreher Park. Shallow groundwater would discharge to Kreher Park for groundwater extraction or treatment via the PRB wall.
- **Copper Falls Aquifer:** Alternatives GW-3 - In-situ treatment via ozone sparge, surfactant, or injection and dual phase recovery (GW-4), and continued operation of the existing groundwater extraction system (GW-2A), or in-situ chemical oxidation (GW-6), in-situ thermal treatment via ERH (GW-7) or steam injection (GW-8), or enhanced groundwater extraction (GW-9B).
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off site or from the contained area with groundwater. Fluid levels within the contained area will also need to be monitored to ensure that groundwater remains at or below the design elevation. Complete annual inspections to ensure integrity of surface barriers and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional controls:** Implement groundwater use and deed restriction as part of remedial response at upper bluff and Kreher Park where contaminants remain in subsurface. Groundwater use restrictions for shallow groundwater in contained areas will also be required.

9.2.4.1 Site Utilization and Staging

Kreher Park will be used as a staging area for sediment removal activities, which will include temporary storage of wood waste, dredged sediment, de-watering, storage and stabilization of sediment, wastewater treatment, and loading sediment for off-site disposal.

Potential remedial alternatives at Kreher Park include limited removal of contaminated soil and containment using engineered surface and vertical barriers. To maintain hydraulic control within the contained area, groundwater would either be extracted and treated onsite prior to discharge to the lake. Alternatively, contaminated groundwater from Kreher Park could be funneled through a permeable reactive barrier (PRB) wall for treatment prior to discharge to the lake. Limited removal of contaminated soil within the contained area may not be necessary if either containment alternative is selected, but if soil is excavated, it should be excavated prior to sediment dredging. Vertical barrier walls should also be excavated prior to sediment dredging. Site restoration should be completed last, and will include clay caps placed over the former seep and coal tar dump areas and the TW-11 area to prevent infiltration and direct contact with subsurface contamination in these areas. New asphalt pavement will also be placed over the existing gravel-covered marina parking lot as a surface barrier to prevent infiltration and direct contact with subsurface contamination in this area. In the event that the WWTP is demolished, a clay cap or asphalt pavement could also be placed over this area.

Limited removal of contaminated soil from the filled ravine at the upper bluff area could be completed before, during, or after sediment dredging. Excavation will include the demolition of the center section of the U-shaped NSPW service center building, and removal of buried gas holder structures. Site restoration will include the installation of asphalt pavement over the filled ravine. However, site restoration will not be completed until after construction of the selected groundwater remedial response the underlying Copper Falls aquifer is complete. All potential remedial alternatives for this scenario (ozone sparge, surfactant injection/dual phase recovery, in-situ chemical oxidation, ERH, steam injection, and enhanced groundwater extraction) will require the installation lateral piping and the installation of sparge wells, injection wells, or extraction wells. Following construction, access will be needed to perform operation, maintenance, and monitoring.

9.2.4.2 Integration of Remedial Processes

If contaminated sediment is transported off site for landfill disposal then contaminated soil removed from excavations at the upper bluff and at Kreher Park should also be transported off site for landfill disposal. This may require the use of existing NR 500 permitted landfill facilities, or siting and construction of a local landfill per ch. NR 500 WAC requirements for all solid waste generated during remedial activities at the Site. Thermal desorption or incineration of sediment and ex-situ soil washing may be needed to pre-treat contaminated media prior to off-site disposal. Contaminated soil removed during limited excavations could also be treated on site. The on-site treatment of contaminated soil would reduce the volume of material transported off site for disposal if used as backfill for excavated areas.

At the upper bluff, the existing treatment system could be utilized to treat wastewater generated during excavation de-watering activities. Excavation activities can likely be completed within several weeks. Because the excavation will be completed below the water table, excavation de-watering will be required. The rate of water removed from the excavation will exceed the influent treatment rate, but storage tanks can be used for temporary water storage. However, this system will not be adequate to treat wastewater generated from sediment dewatering. Dredged sediment will require de-watering and stabilization prior to off-site disposal. This will require temporary on-site wastewater treatment. Equipment used for treatment of wastewater resulting from sediment de-watering could also be used to treat groundwater recovered during excavation de-watering activities, and later used for the long-term treatment of groundwater extracted for hydraulic control of the contained area at Kreher Park. Installation of a PRB wall would eliminate the need for long term treatment of wastewater. Because the WWTP is not currently in use, it may be possible to utilize existing clarifiers and the building to treat wastewater generated from sediment and excavation de-watering. If used for wastewater treatment, the WWTP should be demolished after all wastewater generated from remedial activities at the lakefront are complete.

9.2.4.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario IV are summarized below.

Table 9-5 Cost Summary for Remedial Scenario IV

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-4** Dredge all	$33,785,000	$715,000	$34,500,000
Kreher Park	**S-3A** - Limited removal/offsite disposal or	$1,509,000	$0	$1,509,000
	S-5A - Limited removal/onsite ex-situ thermal desorption or	$2,158,000	$0	$2,158,000
	S-5B - Limited removal/offsite incineration or	$3,777,000	$0	$3,777,000
	S-6 - Limited removal/ex-situ soil washing	$2,653,000	$0	$2,653,000
	AND			
	GW-2A - Engineered surface and vertical barriers with hydraulic control or [1]	$4,797,000	$2,505,000	$7,302,000
	GW-5 - Engineered surface and vertical barriers with PRB Wall[1]	$5,658,000	$397,000	$6,055,000
Filled	**S-3A** - Limited removal/offsite	$3,415, 000	$0	$3,415, 000

Table 9-5 Cost Summary for Remedial Scenario IV

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Ravine	disposal or			
	S-5A - Limited removal/onsite ex-situ thermal desorption or	$4,706,000	$0	$4,706,000
	S-5B - Limited removal/offsite incineration or	$8,103,000	$0	$8,103,000
	S-6 - Limited removal/ex-situ soil washing	$5,961,000	$0	$5,961,000
	AND			
	GW-2A - Engineered surface and vertical barriers with hydraulic control (at Kreher Park)[1] or	Capital costs for surface barriers are included with alternatives S-3A, S-5A, S-5B, and S-6 above, and OM&M costs are included with OM&M costs for Kreher Park.		
	GW-5 - Engineered surface and vertical barriers with PRB Wall (at Kreher Park)[1]			
Copper Falls Aquifer	**GW-3** - Ozone sparge or	$1,182,000	$695,000	$1,877,000
	GW-4 - Surfactant injection and dual phase recovery and	$744,000	$682,000	$1,426,000
	GW-9A - Existing groundwater extraction system	Costs are included with alternatives GW-3 and GW-4 above.		
	OR			
	GW-6 - In-situ Chemical Oxidation or	$3,128,000	$2,596,000	$5,724,000
	GW-7 - Electrical Resistance Heating or	$6,880,000	$123,000	$7,003,000
	GW-8 - Steam Injection or	$7,188,000	$123,000	$7,311,000
	GW-9B - Enhanced Groundwater Extraction System	$411,000	$5,979,000	$6,420,000
Total Estimated Cost	Offshore Sediments	$33.8M	0.7M	$34.5M
	Kreher Park	$7.2 to $7.9 M	$0.4 to $2.5 M	$7.6 to $10 M
	Filled Ravine	$3.4 to $8.1 M	$0	$3.4 to $8.1 M
	Copper Falls Aquifer	$0.4 to $7.2 M	$0.13 to $5.9 M	$1.4 to $7.3 M
	Total Estimated Cost	$44.8 to $57 M	$1.3 to $9.1 M	$46.9 to $59.9 M

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $1,000.
1 – Does not include installation of engineered surface barriers, which are included with remedial alternatives evaluated for soil.

As shown above, estimated costs for Remedial Scenario IV are also dominated by sediment removal. At Kreher Park, estimated costs for containment using a PRB wall are lower than containment using groundwater extraction for hydraulic control. For both Kreher Park and the filled ravine, estimated costs for limited removal with off-site disposal or thermal desorption are lower than off-site incineration and soil washing. For the Copper Falls aquifer, in-situ treatment using ozone sparge and surfactant injection are lower than in-situ treatment using chemical oxidation, ERH, steam injection, and enhanced groundwater extraction

9.2.5 Remedial Scenario V

- **Sediments:** Alternative SED-2 - Construct NR 504, WAC conforming CDF over approximately seven acres of lake bed and all of Kreher Park. Dredge remaining offshore sediments above sediment PRG and dispose in CDF. After dredging is completed, place six inches of clean sediment on dredged areas outside of CDF. Dewater sediment, treat wastewater and discharge to lake. Dispose of or burn wood debris separately.
- **Kreher Park:** Alternative GW-2B – Engineered surface and vertical barriers would be used in conjunction with the on-site CDF. Implement hydraulic control around periphery of CDF, which will include groundwater extraction from the contained area for on-site treatment prior to discharge to the lake.
- **Filled Ravine:** Alternatives S-4 - Conduct limited (Alternative S-4A) or unlimited excavation (Alternative S-4B) of contaminated soil in saturated and unsaturated zone at upper bluff, dispose of these soils in CDF.
- **Copper Falls Aquifer:** Alternatives GW-3 - In-situ treatment via ozone sparge, or surfactant injection and dual phase recovery (GW-4), and continued operation of the existing groundwater extraction system (G-9A), or in-situ chemical oxidation (GW-6), in-situ thermal treatment via ERH (GW-7) or steam injection (GW-8), or enhanced groundwater extraction (GW-9B).
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off site with groundwater. Collect sediment and surface water samples to ensure contaminants are not migrating through CDF. Complete annual inspections to ensure integrity of surface barriers and CDF and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional controls:** Implement groundwater use and deed restriction as part of remedial response at upper bluff and Kreher Park where contaminants remain in subsurface.

9.2.5.1 Site Utilization and Staging

Kreher Park and approximately seven acres of lake bottom will be used for construction of the CDF. On- and offshore sections of the vertical barrier should be constructed before sediment dredging begins. Following construction of the vertical barrier walls, this area will then be used as a staging area for sediment removal activities, which will include temporary storage of wood waste, dredged sediment, sediment de-watering, and wastewater treatment.

At the upper bluff, excavation will include the demolition of the center section of the U-shaped NSPW service center building, and removal of buried gas holder structures. Limited or unlimited removal of contaminated soil from the filled ravine could be completed before, during, or after sediment dredging, but must be done before the CDF cap is constructed. The filled ravine excavation should be completed before sediment is placed in the CDF if clean fill from the park is salvaged and used for backfill at the upper bluff. Limited removal of contaminated soil at Kreher Park will not be necessary because contaminated soil and groundwater at Kreher Park will be enclosed in the CDF. The construction of the ch. NR 504, WAC cap over the CDF will be completed in the final phase of construction.

Site restoration at the upper bluff will include the installation of asphalt pavement over the filled ravine. However, site restoration will not be completed until after construction of the selected groundwater remedial response the underlying Copper Falls aquifer is complete. All potential remedial alternatives for this scenario (ozone sparge, surfactant injection/dual phase recovery, in-situ chemical oxidation, ERH, steam injection, and enhanced groundwater extraction) will require the installation of lateral piping and sparge wells, injection wells, or extraction wells. Following construction, access will be needed to perform operation, maintenance, and monitoring.

9.2.5.2 Integration of Remedial Processes

The CDF consists of the containment of contamination at Kreher Park and nearby offshore sediment, contaminated soil from the upper bluff area as well as sediment dredged outside the footprint of the CDF. This remedial scenario integrates removal of soil from the filled ravine and removal of offshore sediment with on-site containment at Kreher Park. The CDF will require long-term operation, maintenance, and monitoring. Because infiltration will recharge groundwater within the contained area, groundwater extraction and treatment from the CDF will likely be required.

At the upper bluff, the existing treatment system could be utilized to treat wastewater generated during excavation de-watering activities. Excavation activities can likely be completed within several weeks. Because the excavation will be completed below the water table, excavation de-watering will be required. The rate of water removed from the excavation will exceed the influent treatment rate, but storage tanks can be used the temporary storage of this water. This system will not be adequate for treatment of wastewater generated by sediment dewatering. Dredged sediment will require de-watering after placement in the CDF. This will require temporary on-site wastewater treatment. Because the WWTP is not currently in use, it may be possible to utilize the existing clarifiers and the building to treat wastewater generated from sediment and excavation de-watering. If used for wastewater treatment, the WWTP should be demolished after all wastewater generated from remedial activities at the lakefront are complete.

9.2.5.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario V are summarized below.

Table 9-6. Cost Summary for Remedial Scenario V

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-2** – Confined Disposal Facility (CDF)	$36,285,000	$715,000	$37,000,000
Kreher Park	**SED-2** /**GW-2B** – CDF combined with engineered surface and vertical barriers with hydraulic control.			
Filled Ravine	**S-4A** – Limited removal and on-site disposal or[1]	$2,250,000	$0	$2,250,000
	S-4B – Unlimited removal and on-site disposal[1]	$2,772,000	$0	$2,772,000
Copper Falls Aquifer	**GW-3** - Ozone sparge or	$1,182,000	$695,000	$1,877,000
	GW-4 - Surfactant injection and dual phase recovery and	$744,000	$682,000	$1,426,000
	AND			
	GW-9A - Existing groundwater extraction system	Costs are included with alternatives GW-3 and GW-4 above.		
	OR			
	GW-6 - In-situ Chemical Oxidation or	$3,128,000	$2,596,000	$5,724,000
	GW-7 - Electrical Resistance Heating or	$6,880,000	$123,000	$7,003,000
	GW-8 - Steam Injection or	$7,188,000	$123,000	$7,311,000
	GW-9B - Enhanced Groundwater Extraction System	$411,000	$5,979,000	$6,420,000
Total Estimated Cost	Offshore Sediments	$36.2M	$0.7M	$37 M
	Kreher Park			
	Filled Ravine	$2.3 to $2.8 M	$0	$2.3 to $2.8 M
	Copper Falls Aquifer	$0.4 to $7.2 M	$0.13 to $5.9 M	$1.5 to $7.3 M
	Total Estimated Cost	$38.9 to $46.2 M	$0.83 to $6.6 M	$40.8 to 47.1 M

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $1,000.
1 – Does not include installation of engineered surface barriers, or OM & M costs which are included with the CDF costs.

As shown above, estimated costs for Remedial Scenario V are dominated by construction of the CDF, which included the use of engineered surface and vertical barriers at Kreher Park. If material removed from the filled ravine is also placed in the CDF, transportation and disposal costs can be significantly reduced, and estimated costs for limited removal are only slightly less than unlimited removal costs. For the Copper Falls aquifer, in-situ treatment using ozone sparge and surfactant injection are lower than in-situ treatment using chemical oxidation, ERH, steam injection, and enhanced groundwater extraction

9.2.6 Remedial Scenario VI

- **Sediments:** Alternative SED-5 - Construct offshore sheetpile or rock breakwater enclosure and dewater impacted areas; remove debris and excavate offshore sediments; dewater and stabilize sediments at Kreher Park area and treat wastewater and discharge to lake. Transport stabilized sediments to NR 500 permitted landfill. Dispose or burn wood debris separately.
- **Kreher Park:** Alternatives S-3A Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment (S-5A), offsite incineration (S-5B), or ex-situ soil washing (S-6), and engineered surface and vertical barriers with hydraulic control (Alternative 2A or 2B) or a PRB wall (Alternative GW-5). Alternative 2A includes partial caps at Kreher Park, and Alternative 2B includes capping the entire park. Shallow groundwater extracted for hydraulic control for Alternatives 2A and 2B would be treated onsite and discharged to the lake, or for Alternative GW-5 it would be treated as it passes through the PRB wall.
- **Filled Ravine:** Alternative S-3A - Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment, (S-5A) offsite incineration, (S-5B or soil washing (S-6) and groundwater remediation via engineered surface and vertical barriers with hydraulic control (Alternative 2A) or a PRB wall (Alternative GW-5) at Kreher Park. Shallow groundwater would discharge to Kreher Park for groundwater extraction or pass through the PRB wall at Kreher Park.
- **Copper Falls Aquifer:** Alternatives GW-3 - In-situ treatment via ozone sparge, surfactant injection and dual phase recovery (GW-4), and continued operation of the existing groundwater extraction system (G-9A), or in-situ chemical oxidation (GW-6), in-situ thermal treatment via ERH (GW-7), or steam injection (GW-8).
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off site with groundwater. Complete annual inspections to ensure integrity of surface barriers and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional controls:** Implement groundwater use and deed restriction as part of remedial response at upper bluff and Kreher Park where contaminants remain in subsurface.

9.2.6.1 Site Utilization and Staging

At the lakefront sediment removal will require the use of Kreher Park as a staging area. Sediment removal activities, which will include construction of the offshore sheet pile or rock

breakwater enclosure, wood waste and sediment handling and de-watering, and wastewater treatment. Potential remedial alternatives at Kreher Park include limited removal of contaminated soil and containment using engineered surface and vertical barriers. Vertical barrier walls should be installed prior to sediment dredging. Limited removal of contaminated soil within the contained area may not be necessary if soil and shallow groundwater at Kreher Park is contained by surface and vertical barriers. If required, limited removal at Kreher Park should be completed either before or after dredging is complete to prevent interference with sediment removal activities.

To maintain hydraulic control within the contained area, groundwater will be extracted and treated on site, or funneled through a passive permeable reactive barrier (PRB) wall constructed for groundwater treatment prior to discharge to the lake. The PRB wall would require installation concurrent with vertical barrier wall construction. If a PRB wall is not used, groundwater extraction would be required following installation of the vertical barrier walls. Site restoration should be completed last, and will include a ch. NR 500, WAC clay cap over the entire park, or partial caps placed over the former seep and coal tar dump areas and the TW-11 area to prevent infiltration and direct contact with subsurface contamination in these areas. New asphalt pavement will also be placed over the existing gravel-covered marina parking lot as a surface barrier to prevent infiltration and direct contact with subsurface contamination in this area. In the event that the WWTP is demolished, a clay cap or asphalt pavement could also be placed over this area.

Limited removal of contaminated soil from the filled ravine at the upper bluff area could be completed before, during, or after sediment dredging. Excavation will include the demolition of the center section of the U-shaped NSPW service center building, and removal of buried gas holder structures. Site restoration will include the installation of asphalt pavement over the filled ravine. However, site restoration will not be completed until after construction of the selected groundwater remedial response for the underlying Copper Falls aquifer is complete. All potential remedial alternatives for this scenario (ozone sparge, surfactant injection/dual phase recovery, in-situ chemical oxidation, ERH, steam injection, and enhanced groundwater extraction) will require the installation lateral piping and the installation of sparge wells, injection wells, or extraction wells. Following construction, access will be needed to perform operation, maintenance, and monitoring.

9.2.6.2 Integration of Remedial Processes

If contaminated sediment is transported off site for landfill disposal then contaminated soil removed from limited removal excavations at the upper bluff and at Kreher Park should also be transported off site for landfill disposal. This may require the use of existing NR 500 permitted landfill facilities, or siting and construction of a local landfill for all solid waste generated during remedial activities at the Site. Thermal desorption or off-site incineration of sediment and ex-situ soil washing may be needed to pre-treat contaminated media prior to off-site disposal. Contaminated soil removed during limited excavations could also be treated on site. The on-site treatment of contaminated soil would reduce the volume of material transported off site for disposal if used as backfill for excavated areas.

At the upper bluff, the existing treatment system could be utilized to treat wastewater generated during excavation de-watering activities, which can likely be completed within several weeks. Because the excavation will be completed below the water table, excavation de-watering will be required. The rate of water removed from the excavation will exceed the influent treatment rate, but storage tanks can be used for temporary water storage. However, this system will not be adequate for treatment of wastewater generated from sediment de-watering. Dredged sediment will require de-watering prior to off-site disposal, which will require temporary on-site wastewater treatment. Equipment used for sediment wastewater treatment could also be used to treat groundwater recovered during excavation de-watering activities. Installation of a PRB wall would eliminate the long term treatment of wastewater. Because the WWTP is not currently in use, it may be possible to utilize existing clarifiers and the building to treat wastewater generated from sediment and excavation de-watering. If used for wastewater treatment, the WWTP should be demolished after all wastewater generated from remedial activities at the lakefront are complete.

9.2.6.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario VI are summarized below.

Table 9-7 Cost Summary for Remedial Scenario VI

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-5** Dry Excavation	$66,885,000	$715,000	$67,600,000
Kreher Park	**S-3A** - Limited removal/offsite disposal or	$1,509,000	$0	$1,509,000
	S-5A - Limited removal/offsite disposal or	$2,158,000	$0	$2,158,000
	S-5B - Limited removal/offsite incineration or	$3,777,000	$0	$3,777,000
	S-6 - Limited removal/ex-situ soil washing	$2,653,000	$0	$2,653,000
	AND			
	GW-2A - Engineered surface (partial cap) and vertical barriers with hydraulic control [1]or	$4,797,000	$2,505,000	$7,302,000
	GW-2B - Engineered surface (full cap) and vertical barriers with hydraulic control [1] or	$9,348,000	$1,469,000	$10,817,000
	GW-5 - Engineered surface and vertical barriers with PRB Wall [1]	$5,658,000	$397,000	$6,055,000
Filled Ravine	**S-3A** - Limited removal/offsite disposal or	$3,415, 000	$0	$3,415, 000
	S-5A - Limited removal/offsite disposal or	$4,706,000	$0	$4,706,000
	S-5B - Limited removal/offsite incineration or	$8,103,000	$0	$8,103,000
	S-6 - Limited removal/ex-situ soil washing	$5,961,000	$0	$5,961,000

Table 9-7 Cost Summary for Remedial Scenario VI

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
	AND			
	GW-2A - Engineered surface and vertical barriers with hydraulic control (at Kreher Park) or	Capital costs for surface barriers are included with alternatives S-3A, S-5A, S-5B, and S-6 above, and OM&M costs are included with OM&M costs for Kreher Park.		
	GW-5 - Engineered surface and vertical barriers with PRB Wall (at Kreher Park)			
Copper Falls Aquifer	**GW-3** – Ozone sparge or	$1,182,000	$695,000	$1,877,000
	GW-4 – Surfactant injection and dual phase recovery	$744,000	$682,000	$1,426,000
	AND			
	GW-9A – Existing groundwater extraction system	Costs are included with alternatives GW-3 and GW-4 above.		
	OR			
	GW-6 – In-situ Chemical Oxidation or	$3,128,000	$2,596,000	$5,724,000
	GW-7 – Electrical Resistance Heating or	$6,880,000	$123,000	$7,003,000
	GW-8 – Steam Injection	$7,188,000	$123,000	$6,420,000
Total Estimated Cost	Offshore Sediments	$66.9 M	$0.7 M	$67.6 M
	Kreher Park	$7.2 to $12 M	$0.4 to $2.5 M	$7.6 to $13.5 M
	Filled Ravine	$3.4 to $8.1 M	$0	$3.4 to $8.1 M
	Copper Falls Aquifer	$0.7 to $7.2 M	$0.13 to $2.6 M	$1.4 to $7.0 M
	Total Estimated Cost	$78.2 to $94.5 M	$1.2 to $5.8 M	$80 to $96.2 M

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $1,000.
1 – Does not include installation of engineered surface barriers, which are included with remedial alternatives evaluated for soil.

As shown above, estimated costs for Remedial Scenario VI are also dominated by sediment removal. At Kreher Park, the estimated cost for and containment using a PRB wall is lower than containment requiring groundwater extraction for hydraulic control. Although placing a cap over the entire park will reduce infiltration and groundwater extraction and treatment cost, the capital cost for installation of this cap exceeds the cost savings; total costs for containment with partial caps is lower than containment using a cap over the entire Park. For both Kreher Park and the filled ravine, estimated costs for limited removal with off-site disposal or thermal desorption are lower than off-site incineration and soil washing. For the Copper Falls aquifer, in-situ treatment using ozone sparge and surfactant injection are lower than in-situ treatment using chemical oxidation, ERH, and steam injection.

9.2.7 Remedial Scenario VII

- **Sediments:** Alternative SED-5 - Construct offshore sheetpile or rock breakwater enclosure and dewater impacted areas; remove debris and excavate offshore sediments; dewater and stabilize sediments at Kreher Park area and treat wastewater and discharge to lake. Transport stabilized sediments to NR 500 permitted landfill. Dispose or burn wood debris separately.
- **Kreher Park:** Alternatives S- 3A - Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment (S-5A), offsite incineration (S-5B), or soil washing (S-6), or in-situ treatment of source area via chemical oxidation (GW-6), ERH (GW-7), or steam injection (GW-8), and groundwater remediation via ozone sparge (GW-3), or enhanced groundwater extraction (GW-9B).
- **Filled Ravine:** Alternatives S-3A Limited removal and off-site disposal , or beneficial reuse as backfill following ex-situ thermal treatment,(S-5A), offsite incineration, (S-5B or soil washing (S-6), or in-situ treatment of source area via chemical oxidation (GW-6), ERH (GW-7), or steam injection (GW-8), and groundwater remediation via ozone sparge (GW-3), or continued groundwater extraction from EW-4 located at the mount of the filled ravine (GW-9A)..
- **Copper Falls Aquifer:** Alternative GW-9B - Enhanced groundwater extraction, to remove NAPL and contaminated groundwater, which would include additional extraction wells and an upgraded on-site treatment system.
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off site with groundwater. Complete annual inspections to ensure integrity of surface barriers and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional controls:** Implement groundwater use and deed restriction as part of remedial response at upper bluff and Kreher Park where contaminants remain in subsurface.

9.2.7.1 Site Utilization and Staging

Kreher Park will be used as a staging area for sediment removal activities, which will include construction of the offshore sheet pile or rock breakwater enclosure, wood waste and sediment handling and de-watering, and wastewater treatment. Potential remedial alternatives at Kreher Park include limited removal or in-situ treatment at source areas, and ozone sparge or groundwater extraction for groundwater remediation. To prevent interference with sediment removal activities, limited removal or in-situ treatment activities and groundwater remediation at Kreher Park could be completed either before or after dredging is complete.

Site restoration should be completed last, and will include clay caps placed over the former seep and coal tar dump areas and the TW-11 area to minimize infiltration and direct contact with residual subsurface contamination in these areas. New asphalt pavement will also be placed over the existing gravel-covered marina parking lot as a surface barrier to prevent infiltration and direct contact with subsurface contamination in this area. In the event that the WWTP is demolished, a clay cap or asphalt pavement could also be placed over this area.

At the upper bluff limited removal or in-situ treatment of source areas within the filled ravine could be completed before, during, or after sediment dredging. Implementation of the selected remedial response will include the demolition of the center section of the U-shaped NSPW service center building. Excavation will require the removal of buried gas holder structures, but in-situ treatment remedial responses will be completed in and around these buried structures. Site restoration will include the installation of asphalt pavement over the filled ravine. However, site restoration will not be completed until after construction of the selected groundwater remedial response the filled ravine and underlying Copper Falls aquifer are complete. All potential remedial alternatives for this scenario (ozone sparge, surfactant injection/dual phase recovery, in-situ chemical oxidation, ERH, steam injection, and enhanced groundwater extraction) will require the installation lateral piping and the installation of sparge wells, injection wells, or extraction wells. Following construction, access will be needed to perform operation, maintenance, and monitoring.

9.2.7.2 Integration of Remedial Processes

Sediment dewatering and stabilization will be conducted at Kreher Park. It may be possible for equipment at the dormant WWTP (i.e. existing clarifiers and the facility building) to be used for treatment of wastewater generated from sediment and excavation de-watering. If used for wastewater treatment, the WWTP should be demolished after all wastewater generated from remedial activities at the lakefront are complete.

Sediment wastewater treatment equipment could also be used for treating wastewater generated from excavation de-watering activities, or from in-situ treatment via chemical oxidation, ERH, or steam injection. However, installation of an ozone sparge system for groundwater remediation would eliminate the need for long term treatment of wastewater.

At the upper bluff, the existing treatment system could be utilized to treat wastewater generated during excavation de-watering activities. Excavation activities can likely be completed within several weeks. Because the excavation will be completed below the water table, excavation de-watering will be required. The rate of water removed from the excavation will exceed the influent treatment rate, but storage tanks can be used for temporary water storage. However, in-situ remedial response for shallow soil and groundwater in the filled ravine and the Copper Falls aquifer will require an upgrade to the existing on-site treatment system for the treatment of wastewater generated during remediation.

If contaminated sediment is transported off site for landfill disposal then contaminated soil removed from excavations at the upper bluff and at Kreher Park should also be transported offsite for land fill disposal. This may require the use of existing NR 500 permitted landfill facilities, or siting and construction of a local landfill per ch. NR 500, WAC requirements for all solid waste generated during remedial activities at the Site. Thermal desorption or incineration of sediment and ex-situ soil washing may be needed to pre-treat contaminated media prior to off-site disposal. Contaminated soil removed during limited excavations could also be treated on

site. The on-site treatment of contaminated soil would reduce the volume of material transported off site for disposal if used as backfill for excavated areas.

9.2.7.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario VII are summarized below.

Table 9-8 Cost Summary for Remedial Scenario VII

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-5** – Dry Excavation	$66,885,000	$715,000	$67,600,000
Kreher Park	**S-3A** - Limited removal/offsite disposal or	$1,509,000	$0	$1,509,000
	S-5A - Limited removal/offsite disposal or	$2,158,000	$0	$2,158,000
	GW-6 – In-situ Chemical Oxidation or	$2,097,000	$94,000	$2,191,000
	GW-7 – Electrical Resistance Heating (ERH) or	$4,572,000	$72,000	$4,644,000
	GW-8 – Steam injection	$2,450,000	$72,000	$2,522,000
	AND			
	GW-3 – Ozone sparge[1] or	$1,564,000	$84,000	$1,648,000
	GW-9B – Enhanced Groundwater Extraction System[1]	$762,000	$17,392,000	$18,154,000
Filled Ravine	**S-3A** - Limited removal/offsite disposal or	$3,415, 000	$0	$3,415, 000
	S-5A - Limited removal/offsite disposal or	$4,706,000	$0	$4,706,000
	GW-6 – In-situ Chemical Oxidation or	$2,067,000	$67,000	$2,134,000
	GW-7 – Electrical Resistance Heating or	$4,422,000	$51,000	$4,473,000
	GW-8 – Steam Injection	$2,633,000	$51,000	$2,684,000
	AND			
	GW-3 – Ozone sparge and	$206,00	$64,000	$270,000
	GW-9A - Existing Groundwater Extraction System	Costs are included with alternatives GW-9B above.		
Copper Falls Aquifer	**GW-9B** – Enhanced Groundwater Extraction System	$411,000	$5,979,000	$6,420,000

Table 9-8 Cost Summary for Remedial Scenario VII

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Total Estimated Cost	Offshore Sediments	$66.9 M	$0.7	$67.6 M
	Kreher Park	$2.3 to $6.1 M	$0.1 to $17.5 M	$3.2 to $22.8 M
	Filled Ravine	$2.3 to $4.6 M	$0.06 to $0.13 M	$2.4 to $ 4.9 M
	Copper Falls Aquifer	$0.4 M	$7.2 M	$7.6 M
	Total Estimated Cost	$ 71.9 to $ 78	$8 to $25.3	$80.8 to $102.9

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $1,000.
1 – Does not include installation of engineered surface barriers, which are included with remedial alternatives evaluated for soil.

As shown above, estimated costs for Remedial Scenario VII are also dominated by sediment removal. Estimated costs for ozone sparge at Kreher Park are significantly lower than enhanced groundwater extraction. For both Kreher Park and the filled ravine, estimated costs for limited removal with off-site disposal or thermal desorption are lower than in-situ chemical oxidation, ERH, and steam injection. Capital costs for enhanced groundwater extraction for the Copper Falls aquifer are lower than OM & M costs. Although this remedial response will require additional extraction wells and upgrading an existing groundwater extraction system it will be operated for an extended period of time.

9.2.8 Remedial Scenario VIII

- **Sediments:** Alternative SED-4 - Prior to dredging, construct a breakwater (with third party funds) at the northern boundary of the contaminated sediment area. It is assumed this breakwater will be later utilized by the City in the expansion of the marina as proposed in the City's Lakefront Development Plan. Remove wood debris and dredge contaminated offshore sediments. After dredging is completed, place six inches of clean sediment on dredged areas. Dewater and stabilize sediments at Kreher Park area and treat wastewater and discharge to lake. Transport stabilized sediments to ch. NR 500 permitted landfill. Dispose or burn wood debris separately.
- **Kreher Park:** Alternatives S-3A - Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment,(S-5A), offsite incineration, (S-5B or soil washing (S-6), or in-situ treatment of source area via chemical oxidation (GW-6), ERH (GW-7), or steam injection (GW-8), and groundwater remediation via engineered surface and vertical barriers with hydraulic control (Alternative 2B) or a PRB wall (Alternative GW-5).. Alternative 2B includes capping the entire park. Shallow groundwater extracted for hydraulic control for Alternatives 2B would be treated onsite and discharged to the lake, or for Alternative GW-5 it would be treated as it passes through the PRB wall.
- **Filled Ravine:** Alternatives S-3A Limited removal and off-site disposal, or beneficial reuse as backfill following ex-situ thermal treatment (S-5A), offsite incineration (S-5B),

or soil washing (S-6), or in-situ treatment of source area via chemical oxidation (GW-6), ERH (GW-7), or steam injection (GW-8), and groundwater remediation via engineered surface and vertical barriers with hydraulic control (Alternative 2B) or a PRB wall (Alternative GW-5) at Kreher Park.

- **Copper Falls Aquifer:** Alternatives GW-3 - In-situ treatment via ozone sparge, surfactant injection and dual phase recovery (GW-4), and continued operation of the existing groundwater extraction system (G-9A), or in-situ chemical oxidation (GW-6), in-situ thermal treatment via ERH (GW-7), steam injection (GW-8), or enhanced groundwater extraction (GW-9B).
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off site with groundwater. Complete annual inspections to ensure integrity of surface barriers and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional controls:** Implement groundwater use and deed restriction as part of remedial response at upper bluff and Kreher Park where contaminants remain in subsurface.

9.2.8.1 Site Utilization and Staging

Kreher Park will be used as a staging area for construction of the breakwater and sediment removal activities, which will include temporary storage of wood waste, dredged sediment, sediment de-watering, wastewater treatment, and loading sediment for off-site disposal. Additionally, Kreher Park will be used for storage and on-site treatment of sediment prior to landfill disposal if required.

Potential remedial alternatives at Kreher Park include limited removal or in-situ treatment of contaminated soil or source areas, and containment using engineered surface and vertical barriers. To maintain hydraulic control within the contained area, groundwater would either be extracted and treated onsite, or a pass through a permeable reactive barrier (PRB) wall for treatment. Limited removal or in-situ treatment of source areas within the contained area may not be necessary if either containment alternative is selected, but if performed, source area remediation or removal should be completed prior to sediment dredging. Vertical barrier walls should also be installed prior to sediment dredging. Site restoration should be completed last, and will include a ch. NR 500, WAC clay cap over the entire Park, or clay caps placed over the former seep and coal tar dump areas and the TW-11 area to minimize infiltration and direct contact with residual subsurface contamination in these areas. New asphalt pavement will also be placed over the existing gravel-covered marina parking lot as a surface barrier to prevent infiltration and direct contact with subsurface contamination in this area. In the event that the WWTP is demolished, a clay cap or asphalt pavement could also be placed over this area.

At the upper bluff limited removal or in-situ treatment of source areas within the filled ravine could be completed before, during, or after sediment dredging. Implementation of the selected remedial response will include the demolition of the center section of the U-shaped NSPW service center building. Excavation will require the removal of buried gas holder structures, but in-situ treatment remedial responses will be completed in and around these buried structures.

Site restoration will include the installation of asphalt pavement over the filled ravine. However, site restoration will not be completed until after construction of the selected groundwater remedial response at the filled ravine and underlying Copper Falls aquifer are complete. All potential remedial alternatives for this scenario (ozone sparge, surfactant injection/dual phase recovery, in-situ chemical oxidation, ERH, steam injection, and enhanced groundwater extraction) will require the installation lateral piping and the installation of sparge wells, injection wells, or extraction wells. Following construction, access will be needed to perform operation, maintenance, and monitoring.

9.2.8.2 Integration of Remedial Processes

Kreher Park will be used as a staging area for sediment removal activities, which will include construction of breakwater, wood waste and sediment handling and de-watering, and wastewater treatment. Because the WWTP is not currently in use, it may be possible to utilize existing clarifiers and the building to treat wastewater generated from sediment and excavation de-watering. This equipment could also be used for excavation wastewater. If used for wastewater treatment, the WWTP should be demolished after all wastewater generated from remedial activities at the lakefront are complete. Installation of a PRB wall would eliminate the long term treatment wastewater

At the upper bluff, the existing treatment system could be utilized to treat wastewater generated during excavation de-watering activities. Excavation activities can likely be completed within several weeks. Because the excavation will be completed below the water table, excavation de-watering will be required. The rate of water removed from the excavation will exceed the influent treatment rate, but storage tanks can be used the temporary storage of this water. However, in-situ remedial response for shallow soil and groundwater in the filled ravine will require an upgrade to the existing onsite treatment system for the treatment of wastewater generated during remediation.

If contaminated sediment is transported off site for landfill disposal then contaminated soil removed from excavations at the upper bluff and at Kreher Park should also be transported off site for landfill disposal. This may require the use of existing ch. NR 500 permitted landfill facilities, or siting and construction of a local landfill per ch. NR 500, WAC requirements for all solid waste generated during remedial activities at the Site. Thermal desorption, off-site incineration, ex-situ soil washing may be needed to pre-treat contaminated media prior to off-site disposal. Contaminated soil removed during limited excavations could also be treated on-site. The on-site treatment of contaminated soil would reduce the volume of material transported off-site for disposal if used as backfill for excavated areas.

9.2.8.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario VIII are summarized below.

Table 9-9 Cost Summary for Remedial Scenario VIII

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-4** Dredge all	$40,985,000	$715,000	$41,700,000*
Kreher Park	**S-3A** - Limited removal/offsite disposal or	$1,509,000	$0	$1,509,000
	S-5A - Limited removal/offsite disposal or	$2,518,000	$0	$2,518,000
	GW-6 – In-situ Chemical Oxidation or	$2,097,000	$72,000	$2,191,000
	GW-7 – Electrical Resistance Heating (ERH) or	$4,572,000	$72,000	$4,644,000
	GW-8 – Steam Injection or	$2,450,000	$72,000	$2,522,000
	AND			
	GW-3 – Ozone sparge or	$1,564,000	$84,000	$1,684,000
	GW-2B - Engineered surface (full cap) and vertical barriers with hydraulic control or	$9,512,000	$1,469,000	$10,981,000
	GW-5 - Engineered surface and vertical barriers with PRB Wall	$5,658,000	$397,000	$6,055,000
Filled Ravine	**S-3A** - Limited removal/offsite disposal or	$3,415,000	$0	$3,415,000
	S-5A - Limited removal/offsite disposal or	$4,706,000	$0	$4,706,000
	GW-6 – In-situ Chemical Oxidation or	$2,067,000	$67,000	$2,134,000
	GW-7 – Electrical Resistance Heating or	$4,422,000	$51,000	$4,473,000
	GW-8 – Steam Injection	$2,633,000	$51,000	$2,684,000
	AND			
	GW-3 – Ozone sparge and	$206,00	$64,000	$270,000
	GW-2A - Engineered surface and vertical barriers with hydraulic control at Kreher Park	Capital costs for surface barriers are included with alternatives S-3A, S-5A, GW-6, GW-7, and GW-8 above, and OM&M costs are included with OM&M costs for Kreher Park.		

Table 9-9 Cost Summary for Remedial Scenario VIII

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
	GW-5 - Engineered surface and vertical barriers with PRB Wall			
Copper Falls Aquifer	**GW-3** – Ozone sparge or	$1,182,000	$695,000	$1,877,000
	GW-4 – Surfactant injection and dual phase recovery	$744,00	$682,000	$1,426,000
	AND			
	GW-9A – Existing groundwater extraction system	Costs are included with alternatives GW-3 and GW-4 above.		
	OR			
	GW-6 – In-situ Chemical Oxidation or	$3,128,000	$2,596,000	$5,724,000
	GW-7 – Electrical Resistance Heating or	$6,880,000	$123,000	$7,003,000
	GW-8 – Steam Injection	$7,188,000	$123,000	$7,311,000
	GW-9B – Enhanced Groundwater Extraction System	$411,000	$5,979,000	$6,420,000
Total Estimated Cost	Offshore Sediments	$40,985,000	$715,000	$41,700,000*
	Kreher Park	$3.1 to $14 M	$0.08 to $1.5 M	$3.2 to $15.6 M
	Filled Ravine	$2.3 to $4.9 M	$0.06 to $0.13 M	$2.4 to $5 M
	Copper Falls Aquifer	$0.4 to $7.2 M	$0.13 to $6 M	$1.4 to $7.3 M
	Total Estimated Cost	$46.8 to $67.08 M	$0.87 to $8.3 M	$48.7 to $69.6 M

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $100.
*Does not include costs for third party construction of breakwater.
1 – Does not include installation of engineered surface barriers, which are included with remedial alternatives evaluated for soil.

As shown above, estimated costs for Remedial Scenario VIII are also dominated by sediment removal. Estimated costs for ozone sparge at Kreher Park are significantly lower than containment using a PRB wall or containment using groundwater extraction for hydraulic control. For both Kreher Park and the filled ravine, estimated costs for limited removal with off-site disposal or thermal desorption are lower than in-situ chemical oxidation, ERH, and steam injection. For the Copper Falls aquifer, in-situ treatment using ozone sparge and surfactant injection are lower than in-situ treatment using chemical oxidation, ERH, steam injection, and enhanced groundwater extraction

9.2.9 Remedial Scenario IX

- **Sediments:** Alternative SED-5 - Construct offshore sheetpile or rock breakwater enclosure and dewater impacted areas; remove debris and excavate offshore sediments; dewater and stabilize sediments at Kreher Park area and treat wastewater and discharge to lake. Transport stabilized sediments to ch. NR 500, WAC permitted landfill. Dispose or burn wood debris separately.
- **Kreher Park:** Alternative S-3B - Remove all fill material including wood waste and underlying impacted media at Kreher Park. Treat/stabilize soil and transport decontaminated soils off site for disposal. Dispose off the wood waste at an offsite facility.
- **Filled Ravine:** Alternative S-3B -. Removal entire fill and impacted soil including gas holders from the ravine and upper bluff, dispose of these soils to NR500 landfill:
- **Copper Falls Aquifer:** Alternative GW-9B - Enhanced groundwater extraction and treatment of NAPL and groundwater from Copper Falls Aquifer; discharge treated groundwater to sanitary sewer (alternative may also include in-situ treatment of NAPL prior to extraction).
- **Conduct O&M and Long Term Monitoring:** Collect groundwater samples to ensure contaminants are not migrating off-site with groundwater. Complete annual inspections to ensure integrity of surface barriers and repair damage as needed. Conduct MNR monitoring of sediments.
- **Institutional controls:** Implement groundwater use and deed restriction as part of remedial response at upper bluff and Kreher Park where contaminants remain in subsurface. Conduct MNR monitoring of sediments.

9.2.9.1 Site Utilization and Staging

Kreher Park will be used as a staging area for sediment removal activities, which will include construction of the offshore sheet pile or rock breakwater enclosure, wood waste and sediment handling and de-watering, and wastewater treatment. To prevent interference with sediment removal activities, unlimited removal at Kreher Park could be completed either before or after dredging is complete.

The sheet pile wall along the shoreline required for the Kreher Park excavation can be installed before dredging begins, but excavation will not be completed until after sediment remediation is complete. All fill material at Kreher Park will be removed and replaced with clean fill to existing grade. Although the sheet pile wall along the shoreline will prevent lake water from filling the excavation, excavation de-watering will still be required due to groundwater seepage. Water seeping into the excavation area will be removed and treated on site. Because material will be removed from below lake level, it may need to be temporarily stockpiled and dried before transportation off site for disposal. Wood waste and other debris may also need to be separated from soil and temporarily stockpiled on site. Unlimited removal will also necessitate the demolition of the WWTP prior to excavation in this area. Backfilling at Kreher Park will follow the progression of the excavation area, and site restoration will be completed after the excavated area is backfilled to existing grade.

Unlimited removal of contaminated soil from the filled ravine at the upper bluff area could be completed before, during, or after sediment dredging and unlimited removal at Kreher Park. This excavation will require the demolition of the center section of the U-shaped NSPW service center building and removal of buried gas holder structures. Utilities located beneath or adjacent to St. Claire Street will be removed to access fill soil beneath the street. Site restoration will include replacing these utilities, the street pavement, and installation of asphalt pavement over the remainder of the filled ravine. However, site restoration will not be completed until after construction lateral piping for the enhanced groundwater extraction. Following construction, access will be needed to perform operation, maintenance, and monitoring.

9.2.9.2 Integration of Remedial Processes

Dry excavation will require the removal of a significant volume of surface water. Treatment will be required for surface water that is in contact with contaminated sediment and for wastewater generated from sediment de-watering. It may be possible to use portions (i.e. existing clarifiers) of the dormant WWTP at Kreher Park for this wastewater. However, additional wastewater treatment equipment will also be needed. This equipment could also be used to treat wastewater generated during excavation dewatering activities and for the enhanced groundwater extraction system for the Copper Falls aquifer.

9.2.9.3 Estimated Cost of Integrated Remedy

Estimated costs to implement Remedial Scenario IX are summarized below.

Table 9-10 Cost Summary for Remedial Scenario IX

Area of Concern	Remedial Response	Capital Costs	OM & M	Total
Offshore Sediment	**SED-5** – Dry excavation	$ 66,885,000	$ 715,000	$ 67,600,000
Kreher Park	**S-3B** - Unlimited removal/offsite disposal	$35,017,000	$0	$35,017,000
Filled Ravine	**S-3B** - Unlimited removal/offsite disposal	$7,911,000	$0	$7,911,000
Copper Falls Aquifer	**GW-9B** – Enhanced Groundwater Extraction System	$411,000	$5,979,000	$6,420,000
	Total Estimated Cost	$110.2 M	$6.7 M	$116.9 M

Capital costs include engineering and construction oversight.
Operation, maintenance, and monitoring (OM & M) costs are calculated using a 7-percent discount rate.
All costs include 20-percent contingency rounded to the nearest $1,000.

Total estimated cost for Remedial Scenario IX is $116.9 M, which includes $110.2 M for capital costs, and $ 6.7 M for OM & M. Capital costs for sediment removal and removal of a fill material from Kreher Park dominate the estimated cost for this scenario. Capital costs for enhanced groundwater extraction for the Copper Falls aquifer are lower than OM & M costs.

Although this remedial response will require additional extraction wells and upgrading an existing groundwater extraction system it will be operated for an extended period of time.

10.0 References

DCI. 2007. A Final Report for the Pilot Demonstration of Controlled In-Situ Chemical Oxidation Technology at Ashland/Xcel Energy Lakefront Site d.b.a Xcel Energy, Ashland, Wisconsin.

Miller, J.A. 1998. Confined Disposal Facilities on the Great Lakes. Great Lakes & Ohio River Division, U.S. Army Corps of Engineers.

Newfields. 2005. Quality Assurance Project Plan RI/FS Tasks, Revision: 03, February 2005, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin, Remedial Investigation/Feasibility Study

Palermo, M. R., Montgomery, R. L., and Poindexter, M. 1978. Guidelines for Designing, Operating, and Managing Dredged Material Containment Areas. Technical Report DS- 8-10, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Palermo, M., Maynord, S., Miller, J., and Reible, D. 1998. Guidance for In-Situ Subaqueous Capping of Contaminated Sediments. EPA 905-B96-004, Great Lakes National Program Office, Chicago, IL.

Thermoretec. 1999. Draft Feasibility Study. Lower Fox River, Wisconsin.

URS. 2005. Remedial Investigation Feasibility Study (RI/FS) Work Plan and associated planning documents. Revision 02. Ashland/NSP Lakefront Superfund Site, Ashland Wisconsin.

URS. 2006. Candidate Technologies and Testing Needs Technical Memorandum and appended Phase I Treatability Study Work Plan and Sampling and Analysis Plan - Ashland/Northern States Power Lakefront Superfund Site.

URS. 2007a. Alternatives Screening Technical Memorandum - Ashland/Northern States Power Lakefront Superfund Site.

URS. 2007b. Remedial Investigation Report- Ashland/Northern States Power Lakefront Superfund Site.

URS. 2007c. Comparative Analysis of Alternatives Technical Memorandum - Ashland/Northern States Power Lakefront Superfund Site.

USACE. 1987. Engineer Manual No. 1110-2-5027, Engineering and Design Confined Disposal of Dredged Material. September 30, 1987.

USACE and USEPA. 2003. Great Lakes Confined Disposal Facilities.

USACE and USEPA. 1992. (Revised 2004). Evaluating Environmental Effects of Dredged Material Management Alternatives - A Technical Framework. EPA842-B-92-008, US Environmental Protection Agency and US Army Corps of Engineers, Washington, D.C.

USEPA and USACE 2000. A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA-540-R-00-002.

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA: Interim Final. EPA/540/G-89/004. OSWER Directive 9355.3-01.

USEPA 2007. Management of Investigation Derived Waste. SESDPROC-202-R1.

USEPA. 1994. Assessment and Remediation of Contaminated Sediments (ARCS) Program - Remediation Guidance Document. EPA 905-R94-003, U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, ILL.

U.S. Environmental Protection Agency (USEPA). 2005. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. OSWER 9355.0-85, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

APPENDICES

APPENDIX A

FEASIBILITY STUDT TECHNICAL MEMORANDUMS

APPENDIX A1

ALTERNATIVE SCREENING TECHNICAL MEMORANDUM

REVISED FINAL DRAFT REPORT

ALTERNATIVES SCREENING TECHNICAL MEMORANDUM - ASHLAND/NORTHERN STATES POWER LAKEFRONT SUPERFUND SITE

Prepared for

Northern States Power Company - WI
1414 West Hamilton Avenue
Eau Claire, WI 54701

July 30, 2007

URS

Milwaukee County Research Park
10200 Innovation Drive, Suite 500
Milwaukee, WI 53226
25688375.70000

TABLE OF CONTENTS

1.0 Introduction 1-1

2.0 Summary of Community Relations Support 2-1

3.0 Site Characterization 3-1
3.1 Site Description 3-1
3.2 Nature and Extent 3-2

4.0 Summary of Remedial Investigation 4-1
4.1 Summary of RI Findings 4-1
4.2 Summary of Site Risks 4-3
4.2.1 Risks to Human Health 4-3
4.2.2 Risks to Ecological Receptors 4-4
4.3 Calculation of Areal Extent and Volume of Contaminated Media 4-5

5.0 Identification of Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) Criteria 5-1
5.1 Introduction 5-1
5.2 Chemical-Specific ARARs 5-2
5.2.1 Clean Air Act 5-2
5.2.2 Clean Water Act 5-2
5.2.3 State of Wisconsin Water Quality Standards – Chs. 281, 283 and 160, Wis. Stats. and WAC NR 100 Series 5-2
5.2.4 State of Wisconsin Air Pollution Control Standards – WAC NR 400 - 499 5-3
5.2.5 State of Wisconsin Hazardous Substance Spill Law and Soil Cleanup Standards – Ch. 292.11, Wis. Stats. and WAC NR 720 5-3
5.2.6 State of Wisconsin Sediment Quality Guidance 5-3
5.3 Location-Specific ARARs 5-3
5.3.1 Clean Water Act 5-3
5.3.2 State of Wisconsin Statutes Chapter 289 5-3
5.3.3 State of Wisconsin Statutes Chapter 30 5-4
5.3.4 State of Wisconsin Solid Waste Management – Beneficial Reuse Exemption WAC NR 500.08 5-4
5.4 Action-Specific ARARs 5-4
5.4.1 State of Wisconsin Environmental Policy Act - Sec. 1.11, Wis. Stats. and WAC NR 150 5-4
5.4.2 State of Wisconsin Requirements for Plans and Specification Submittal – WAC Chapter NR 108 5-4
5.4.3 State of Wisconsin Laboratory Certification and Registration Program – WAC Chapter NR 149 5-4
5.4.4 State of Wisconsin Pollutant Discharge Regulations (WPDES) – WAC NR 200 5-5
5.4.5 State of Wisconsin Water Quality Regulations – WAC NR 300 5-5
5.4.6 State of Wisconsin Air Pollution Control Regulations – WAC NR 400 5-5
5.4.7 State of Wisconsin Solid Waste Management Regulations - WAC NR 500 through 520 5-5
5.4.8 State of Wisconsin Solid Waste Management Regulations – WAC NR 500 and Wisconsin Statute 289.43 5-5

5.4.9 State of Wisconsin Hazardous Waste Management Rules – WAC NR 600 5-5
5.4.10 State of Wisconsin Investigation and Remediation of Environmental Contamination – WAC NR 700 5-6
5.4.11 State of Wisconsin Statutes Chapter 30 5-6
5.4.12 Section 10 – Rivers and Harbors Act 5-6
5.4.13 Clean Water Act 5-6
5.4.14 Occupational Safety and Health Administration (OSHA) 5-6
5.4.15 Department of Transportation Rules for Hazardous Materials Transport 5-6
5.4.16 State Stormwater Pollution Control Program - WAC NR 216 5-7
5.5 To Be Considered Information 5-7
5.5.1 State of Wisconsin Water Quality Regulations - WAC NR 300 5-7
5.5.2 Federal Safe Drinking Water Act 5-7
5.5.3 Great Lakes Water Quality Agreement 5-7
5.5.4 Section 303(d) – Clean Water Act 5-7
5.5.5 Resource Conservation and Recovery Act (RCRA) 5-7
5.5.6 Sediment Quality Assessment at MGP Sites 5-7
5.5.7 WDNR Sediment Quality Guidelines 5-8
5.5.8 Sediment Remediation Implementation Guidance 5-8
5.5.9 USEPA's Contaminated Sediment Management Strategy 5-8
5.5.10 USEPA's Contaminated Sediment Management Guidance 5-8
5.5.11 Great Lakes Water Quality Initiative 5-8
5.5.12 Dredge and Fill Requirements 5-8
5.5.13 Local Permits 5-9
5.5.14 State of Wisconsin Investigation and Remediation of Environmental Contamination – WAC NR 700 Supplementary Guidance 5-9

6.0 Development of Remedial Action Objectives (RAO) and General Response Actions (GRA) 6-1

7.0 Identification and Screening of Remedial Technologies 7-1
7.1 Screening Process 7-1
7.2 Development of Alternatives 7-3
7.3 Soil – Ravine Fill in Upper Bluff Area and Fill Soils in Kreher Park 7-3
7.3.1 Chemicals of Potential Concern 7-3
7.3.2 Screening of Remedial Alternatives for Soil 7-4
7.3.3 Description of Retained Alternatives 7-12
7.4 Groundwater – Shallow Ravine Fill at Upper Bluff Area and Fill Soils at Kreher Park, and Underlying Copper Falls Aquifer 7-20
7.4.1 Chemicals of Potential Concern 7-20
7.4.2 Screening of Groundwater Remediation Alternatives 7-20
7.4.3 Screening of Groundwater Remediation Alternatives 7-28
7.5 Sediment 7-39
7.5.1 Chemicals of Potential Concern 7-39
7.5.2 Screening of Sediment Remediation Alternatives 7-39
7.5.3 Description of Retained Alternatives 7-44
7.6 Ancillary Technologies including Disposal 7-56
7.6.1 **Dewatering** 7-57
7.6.2 Waste Water Treatment 7-58
7.6.3 **Disposal** 7-60

7.6.4 Transportation 7-62
7.6.5 Monitoring 7-62

8.0 References 8-1

FIGURES

Figure 3-1 Site Location
Figure 3-2 Site Features
Figure 3-3 Area of Impacted Sediment
Figure 4-1 Lateral Extent of Soil Contamination in Upland Area and Kreher Park
Figure 4-2 Lateral Extent of Shallow and Deep Groundwater Contamination
Figure 7-1 RI/FS Alternatives Screening Process
Figure 7-2 Disposal Facilities within 125 Miles

TABLES

Table 4-1 Volumes and Areal Extent of Contaminated Media
Table 5-1 Chemical-Specific ARARS and TBCs for the Ashland/Northern States Power Lakefront Superfund Site
Table 5-2 Location-Specific ARARS and TBCs for the Ashland/Northern States Power Lakefront Superfund Site
Table 5-3 Action -Specific ARARS and TBCs for the Ashland/Northern States Power Lakefront Superfund Site
Table 6-1 Summary of Remedial Action Objectives
Table 6-2 Preliminary Remediation Goals for Site COPCs
Table 6-3 Preliminary Remediation Goals for Site COPCs in Soil
Table 6-4 Preliminary Remediation Goals for Site COPCs in Surface Water
Table 7-1 Sources for Screening of Potential Remedial Technologies
Table 7-2 Summary of Soil Technologies Reviewed
Table 7-3 Description of Retained Remedial Alternatives for Soils
Table 7-4 Screening of Potential Remedial Alternatives for Soils
Table 7-5 Summary of Groundwater Technologies Reviewed
Table 7-6 Description of Retained Remedial Alternatives for Groundwater
Table 7-7 Screening of Potential Remedial Alternatives for Groundwater
Table 7-8 Summary of Sediment Technologies Reviewed
Table 7-9 Description of Retained Remedial Alternatives for Sediment
Table 7-10 Screening of Potential Remedial Alternatives for Sediment

APPENDICES

Appendix A Volumes and Areal Extent of Contaminated Media – Computations

List of Acronyms and Abbreviations

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Regulations
bgs	Below ground surface
^{o}C	Degrees Celsius
CERCLA	Comprehensive Environmental Response and Compensation Liability Act
COPC	Chemical of Potential Concern
DNAPL	Dense Non-Aqueous Phase Liquid
ES	Enforcement Standard
^{o}F	Degrees Fahrenheit
FS	Feasibility Study
GRA	General Response Action
LNAPL	Light Non-Aqueous Phase Liquid
MGP	Manufactured Gas Plant
MNA	Monitored natural attenuation
MNR	Monitored natural recovery
MSL	Mean Sea Level
NAPL	Non-Aqueous Phase Liquid
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NOAA	National Oceanographic and Atmospheric Administration
NSPW	Northern States Power Wisconsin
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic Aromatic Hydrocarbon
PRG	Preliminary Remediation Goal
RAO	Remedial Action Objective
RCL	Residual Contaminant Level
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
TBC	To Be Considered regulations
UCL	Upper Confidence Limit
URS	URS Corporation
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

As required by the Statement of Work (SOW) appending Administrative Order on Consent CERCLA Docket No. V-W-04-C-764 for the Ashland/NSP Lakefront Superfund Site (Site) this technical memorandum evaluates a range of general response actions (GRAs) that can be applied to contaminated groundwater, soil and sediment on the Site to reduce the toxicity, mobility or volume of contaminants.[1] These options vary by types of treatment, the amount of waste treated and the manner in which long-term residuals are managed. The options include the statutorily required "no-action" alternative as well as removal, containment and treatment options.

The screening process was conducted in accordance with USEPA RI/FS guidance (USEPA 1988). First, a list of potential technologies for each medium was developed and then the list was refined by considering implementability, effectiveness and relative cost as described later in Section 7. The following summarizes the approach:

- A comprehensive list of technologies and process options was developed for each GRA;
- The potential technologies were screened based upon their implementability, effectiveness and relative cost;
- The rationale for each screening decision is presented;
- Each retained technology and process option is described in greater detail;
- Ancillary technologies that are required to implement specific GRAs such as dewatering, wastewater treatment and transportation are described; and
- Any other information related to the implementation of a specific technology is presented.

Prior to presenting details of the alternatives screening a summary of the findings of the Remedial Investigation (RI) is presented. Findings from the RI that are important to selection of appropriate GRAs include:

- The nature and extent of contaminants in Site media;
- The potential risk to humans and ecological receptors presented by contaminants in Site media;
- An estimate of the volume of and areal extent of Site media to be addressed by the GRAs;
- Identification of Potential Applicable, or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) Criteria; and
- Remedial Action Objectives (RAOs).

This technical memorandum is organized as follows:

Section 1: Introduction
Section 2: Summary of community relations support
Section 3: Site characterization
Section 4: Summary of RI findings

[1] GRAs for the treatment and disposal of non-aqueous phase liquid (NAPL) are also discussed in this memorandum. However, the remedial technologies for NAPL removal and disposal are applied in combination with the other media.

Section 5: Identification of ARARs and TBC Criteria
Section 6: Development of RAOs (from the RAO Technical Memorandum)
Section 7: Identification and screening of remedial technologies
Section 8: References

2.0 SUMMARY OF COMMUNITY RELATIONS SUPPORT

Task 2 of the SOW concerns Community Relations Support. USEPA has delegated lead for the Community Relations aspects of the RI/FS to Wisconsin Department of Natural Resources (WDNR). NSPW has pledged its support in staffing and assisting in community outreach activities for the RI/FS process, as contemplated in the SOW.

3.0 SITE CHARACTERIZATION

3.1 Site Description

The Site consists of property owned by Northern States Power Company, a Wisconsin corporation (d.b.a. Xcel Energy, a subsidiary of Xcel Energy Inc. ("NSPW") a portion of Kreher Park[2], and sediments in Chequamegon Bay of Lake Superior which is an offshore area adjacent to Kreher Park. The Site is located in S 33, T 48 N, R 4W in Ashland County, Wisconsin, shown on Figure 3-1. Existing site features showing the boundary of the Site are shown on Figure 3-2.

The NSPW facility is located at 301 Lake Shore Drive East in Ashland, Wisconsin. The facility lies approximately 1,000 feet southeast of the shore of Chequamegon Bay of Lake Superior. The NSPW property is occupied by a small office building and parking lot fronting on Lake Shore Drive, and a larger vehicle maintenance building and parking lot area located south of St. Claire Street between Prentice Avenue and 3rd Avenue East. There is also a gravel-covered parking and storage yard area north of St. Claire Street between 3rd Avenue East and Prentice Avenue, and a second gravel-covered storage yard at the northeast corner of St. Claire Street and Prentice Avenue. A large microwave tower is located on the north end of the storage yard. The office building and vehicle maintenance building are separated by an alley. The area occupied by the buildings and parking lots is relatively flat, at an elevation of approximately 640 feet above mean sea level (MSL). Surface water drainage from the NSPW property is to the north. Residences bound the Site east of the office building and the gravel-covered parking area. Our Lady of the Lake Church and School is located immediately west of Third Avenue East. Private homes are located immediately east of Prentice Avenue. To the northwest, the site slopes abruptly to the Canadian National (f.k.a. Wisconsin Central Limited) Railroad property at a bluff that marks the former Lake Superior shoreline and then to the City of Ashland's Kreher Park, beyond which is Chequamegon Bay.

Based on current data, the impacted area of Kreher Park consists of a flat terrace adjacent to the Chequamegon Bay shoreline. The surface elevation of the park varies approximately 10 feet, from 601 feet above MSL, to about 610 feet above MSL at the base of the bluff overlooking the park. The bluff rises to an elevation of about 640 feet above MSL, which corresponds to the approximate elevation of the NSPW property. The lake elevation fluctuates about two feet, from 601 to 603 feet above MSL. At the present time, the park area is predominantly grass covered. A gravel overflow parking area for the marina occupies the west end of the property, while a miniature golf facility formerly occupied the east end of the site. The former City of Ashland waste water treatment plant (WWTP) and associated structures front the bay inlet on the north side of the property. Kreher Park occupies approximately 13 acres and is bounded by Prentice Avenue and a jetty extension of Prentice Avenue to the east, the Canadian National Railroad to the south, Ellis Avenue and the marina extension of Ellis Avenue to the west, and Chequamegon Bay to the north.

[2] Reference to this portion of the Site as Kreher Park developed colloquially over the course of this project. Kreher Park consists of a swimming beach, a boat landing, an RV park and adjoining open space east of Prentice Avenue, lying to the east of the subject study area of the Site. For purposes of this document and to be consistent with previous reports, the portion of the Site to the west of Prentice Avenue, east of Ellis Avenue and north of the NSPW property is referred to as the "Kreher Park Area" or simply Kreher Park.

The offshore area with impacted sediments is located in a small bay created by the Prentice Avenue jetty and marina extensions previously described. For the most part, contaminated sediments are confined within this small bay by the northern edge of the line between the Prentice Avenue jetty and the marina extension (Figure 3-3). The affected sediments consist of lake bottom sand and silts, and are mixed with wood debris likely originating from former log rafting and lumbering operations. The wood debris layer varies in thickness from 0 to seven feet, with an average thickness of nine inches. Wood debris overlays approximately 95-percent of the sediment that is impacted. Based on current data, the entire area of impacted sediments encompasses approximately sixteen acres.

3.2 Nature and Extent

Site characterization began in 1989 when apparent contamination was discovered at Kreher Park. The primary contaminants at the Site are derived from tar compounds[3], including volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). Soils, groundwater, and offshore sediments have been impacted. The predominant sources of contamination at the Site consist of discrete free-phase hydrocarbons (free-product) derived from the tars that is present as a non-aqueous phase liquid (NAPL) at the following locations:

1. In the upper reaches of a filled ravine on the NSPW property;
2. At isolated areas at Kreher Park including the former “seep” area and former coal tar dump area;
3. In the offshore sediments; and
4. In the upper elevations of the deep Copper Falls aquifer.

The upper bluff/filled ravine has a free-product mass at the base of the ravine located south of St. Claire St. below the NSPW service center building. Part of the building includes an older section incorporating the former manufactured gas plant. The free-product is found at the base of the ravine varying in depth from 15 to 20 feet. A perched water table has formed within the filled ravine within four to six feet of the ground surface. This is part of the regional water table that extends across the area within the Miller Creek Formation, a low permeability silty-clay/clayey silt that forms the surficial geologic unit underlying the fills in the Ashland area. Soil and groundwater in the filled ravine are contaminated largely by contact/proximity with the free-product mass. The fill is variable consisting of cinders, debris, and other locally derived detritus.

Within the filled ravine, migration in the down gradient direction toward Kreher Park occurred through both the fill as well as a 12-inch clay tile that extended along the base of the ravine to its mouth. This discharge was eliminated in 2002 with the installation of an interception well (EW-4) at the mouth of the former ravine. Groundwater extracted from the filled ravine is conveyed to the existing tar removal system for treatment prior to discharge to the sanitary sewer

[3] The term “tar” is used generically in this document to refer to a suite of VOC and PAH compounds the sources of which are the former MGP and other lakefront industrial operations including wood treatment activities.

Although the lateral extent of the free-product zone is limited, contaminated soil and groundwater conditions are widespread across the entire Park area. Free-product is present at the seep area and in the former coal tar dump area north of the mouth of the filled ravine at Kreher Park. This material is found at the base of the fill/wood waste layer which underlies the entire Park. In the seep area, contaminated soil above the wood waste layer was removed in 2002 and replaced with clean fill. In the former coal tar dump area, contaminated soil was encountered beneath several feet of clean fill overlying the wood waste layer. Elsewhere in Kreher Park, contaminants were encountered in the wood waste layer beneath several feet of clean surficial soil; oily sheen was observed in several test pits during the test pit investigation in Kreher Park when the underlying wood waste was encountered.

A free-product mass is present underlying the Miller Creek Formation in the same area of the NSPW service center. This material is found within the upper reaches of the Copper Falls aquifer, a sandy, coarse grained unit. Free-product extends from depths of approximately 30 to 70 feet. The greatest thickness of free product is present directly south of St. Claire Street within the main access drive of the NSPW service center. It thins in all directions from this area. Since 2000, NSPW has maintained a free-product recovery system consisting of three extraction wells which have removed over 8,000 gallons of free-product from the aquifer.

North of the alley behind the service center, the Miller Creek Formation increases in plasticity creating an aquitard to the Copper Falls aquifer. Vertical gradients in the Copper Falls aquifer south of the alley are downward, indicating this is a zone of recharge. North of the alley, vertical gradients at nested wells screened in the Copper Falls aquifer indicate strong upward flow. These gradients increase in magnitude with both depth and distance toward Chequamegon Bay. Wells screened in the aquifer north of the bluff face forming the boundary between Kreher Park and the NSPW property are flowing (artesian) wells. Additionally, the aquitard thickens toward the shoreline. This creates an apparent convergent flow condition beneath the center of Kreher Park near MW-2B(NET). Flow in the upper Copper Falls aquifer in this area is restricted because of the configuration of the Miller Creek Formation, which thickens to the north toward the shoreline. Upward vertical discharge through the Miller Creek occurs as shown by the artesian wells at the Park. However, the same condition indicates that the volume of discharge is extremely low due the low permeability of the aquitard.

. Free-product is also present in sediments in the offshore zone along the Kreher Park shoreline, mainly at the sand/wood waste interface (historic lakebed). The greatest mass of material extends between the marina and an area north of the former WWTP from 100 to 300 feet from the shore. Free-product is found at depths up to four feet below the sediment/water interface in this zone. A separate free product area is found at depths up to 10 feet between the former WWTP and the boat launch.

Section 4.0 in the RI provides specific detail on the distribution of specific contaminants.

4.0 SUMMARY OF REMEDIAL INVESTIGATION

4.1 Summary of RI Findings

The sources of contamination at the Site consist of discrete free-product zones within each of the four affected areas, which include the upper bluff filled ravine including the former MGP facility, Kreher Park fill, the affected sediments and the Copper Falls aquifer. These free-product zones are similar in character and contain a light-weight fraction containing VOCs and a heavy-weight fraction containing primarily PAHs. The principal compounds within each of these parameter groups are the benzene (VOC) and the naphthalene (PAH).

Free-product referenced in this document includes both light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) found across the entire Site. The DNAPL areas are limited in extent and are found at the base of the various filled areas at the ravine including the former MGP facility, Kreher Park and the affected sediments (because of the dynamic conditions in the sediments, DNAPLs are less defined than those at the upland areas). These DNAPLs correspond to high levels of VOCs in groundwater (> 50,000 µg/L). However, LNAPLs consisting of sheens were observed in the underlying wood waste layer across much of Kreher Park[4].

The upper bluff/filled ravine has a free-product mass at the base of the ravine located south of St. Claire St. below the NSPW service center building.[5] Part of the NSPW building includes an older section incorporating the former manufactured gas plant. The free-product is found at the base of the ravine varying in depth from 15 to 20 feet. It has been measured historically from a few inches to nearly 10 feet in thickness.[6] A perched water table has formed within the filled ravine within four to six feet of the ground surface. This is part of the regional water table that extends across the area within the Miller Creek Formation, a low permeability silty-clay/clayey silt that forms the surficial geologic unit underlying the fills in the Ashland area. Soil and groundwater in the filled ravine are contaminated largely by contact/proximity with the free-product mass. The fill is variable consisting of cinders, debris, and other locally derived detritus. A free-product mass is present underlying the Miller Creek Formation in the same area of the NSPW service center. This material is found within the upper reaches of the Copper Falls aquifer, a sandy, coarse grained unit. Free-product extends from depths of approximately 30 to

[4] Fill used to construct Kreher Park consists of several feet of clean fill soil overlying several feet of wood waste. This wood waste layer consists of slab wood, logs, and other wood debris submerged near the shoreline to form a platform for lumbering operations in the late 19th century. Native soil units beneath the wood waste layer consist of a thin sand unit (beach sand unit) and the Miller Creek formation. The Miller Creek behaves as a confining unit for the underlying Copper Falls aquifer.

[5] Free-product north of St. Claire Street was confined within a former clay tile that extended along the base of the ravine from the area of the former MGP to its mouth. The limited extent of this material north of St. Claire Street within this pipe was confirmed when excavation trenches were made exposing the tile in 2001. Additionally, groundwater quality on samples collected north of St. Claire have not yielded evidence of free-product, nor has this material been observed as part of the fraction of free-product removed following the installation of extraction well EW-4 in 2004 as part of the interim treatment system.

[6] Free product has also been found within the confines of former gas holders constructed on the flanks of the ravine south of St. Claire Street. The extent of this material within one former holder was further defined during the Superfind Innovative Technology Evaluation (SITE) demonstration project performed in 2006-2007.

70 feet. The greatest thickness of free-product is present directly south of St. Claire Street within the main access drive of the NSPW service center. It thins in all directions from this area. Since 2000, NSPW has maintained a free-product recovery system consisting of three extraction wells which have removed approximately 8,300 gallons of free-product from the aquifer.

Contaminated groundwater containing the principal VOC and PAH compounds are found in proximity to these free-product zones. However, contaminant migration via groundwater is limited. Within the filled ravine, migration in the down gradient direction toward Kreher Park occurred through both the fill as well as a 12-inch clay tile that extended along the base of the ravine to its mouth. This discharge was eliminated in 2002 with the installation of an interception well at the mouth of the former ravine. The effluent is conveyed to the existing tar removal system for treatment prior to discharge to the sanitary sewer. Within the Copper Falls aquifer, the contaminant mass and dissolved phase plumes are restricted from movement by the natural hydrogeologic conditions. North of the alley behind the service center, the Miller Creek Formation increases in plasticity creating an aquitard to the Copper Falls aquifer. Vertical gradients at nested wells screened in the Copper Falls aquifer indicate strong upward flow. These gradients increase in magnitude with both depth and distance toward Chequamegon Bay. Wells screened in the aquifer north of the bluff face forming the boundary between Kreher Park and the NSPW property are flowing (artesian) wells. Additionally, the aquitard thickens toward the shoreline. This creates a stagnation zone restricting further horizontal flow toward the north.

In Kreher Park, free-product (DNAPL) is present at the seep area north of the mouth of the filled ravine, and in the area near TW-11 north of the former WWTP. This material is limited in extent, but is found at the base of the fill/wood waste layer that comprises the majority of the filled material at the Park. Although the lateral extent of DNAPL zones in the Kreher Park fill are limited, LNAPL sheens were observed in the wood waste layer across the entire Kreher Park area. This wood waste layer is underlain by several feet of a relatively clean surficial soil unit two to four feet thick.

LNAPL is also present in sediments in the offshore zone along the Kreher Park shoreline, mainly at the sand/wood waste interface (historic lakebed) where it is manifested as a “sheen” when disturbed. The greatest mass of material extends between the marina and an area north of the former WWTP from 100 to 300 feet from the shore. LNAPL is found at depths up to four feet below the sediment/water interface in this zone. LNAPL is also found at depths up to 10 feet between the former WWTP and the boat launch.

A wood waste layer varying from sawdust sized particles to timber overlies the entire affected bay at depths from a few inches to more than six feet. Approximately 95 percent of the impacted sediments are covered by wood debris. The greatest wood waste thickness is found at the area east of the WWTP, where the former Schroeder Lumber sawmill operated. Approximately 25,000 cubic yards of wood debris is intermixed with the affected sediments. Contaminated sediments are found across the entire bay area, but contaminant concentrations decline significantly beyond a line between the north ends of the marina and the boat launch.

4.2 Summary of Site Risks

4.2.1 Risks to Human Health

The results of the HHRA indicate that five exposure pathways result in estimated risks that exceed USEPA's target risk levels and seven exposure pathways result in estimated risks that are either equivalent to or exceed the Wisconsin Department of Health threshold of 1×10^{-5}. These exceedances are indicated below.

Exceeds USEPA Risk Range ($\geq 1\times10^{-4}$)	**Exceeds Wisconsin Threshold** ($\geq1\times10^{-5}$)
Residents (Soil[0-3 feet and all soil depths] - Cancer)	Residents (Soil[0-3 feet and all soil depths] - Cancer)
–	Residential Child (Soil – Noncancer)
Construction Worker (Soil [0-10 feet bgs]/Groundwater)	Construction Worker (Soil [0-10 feet bgs]/Groundwater)
Construction Worker (Trench Air)	Construction Worker (Trench Air)
Adult Swimmer (Surface Water)	Adult Swimmer (Surface Water)
Adult Wader (Surface Water)	Adult Wader (Surface Water/Sediment)
–	Industrial Worker (Indoor Air)
Subsistence Fisher (Biota)	Subsistence Fisher (Biota)

These include estimates for the RME scenarios for potential cancer risks and non-cancer risks. These conclusions are based on assumed exposures to soil in the filled ravine area (for residential receptors) and the filled ravine, upper bluff and Kreher Park area (for construction worker receptors), and to indoor air samples collected at NSPW Service Center. Carcinogenic risks based on CTE scenarios indicate that only the residential receptor exposure to soil (all soil depths to 10 feet bgs) are estimated to be at 1×10^{-4}, the upper-end of the USEPA target risk range or greater than the WDPH threshold. Noncarcinogenic risks for the residential receptor (for soil depths 0-1 foot and 0-3 foot bgs) and risks associated with the construction scenario are within acceptable levels. However, residential receptor exposure to subsurface soil is not expected, given the current and potential future land use of the Site. For this Site, residential risks associated with exposures to surface soil (0 to 1 foot bgs) are within the target risk ranges.

Although the results of the HHRA indicate risks for the construction workers under the RME conditions exceed USEPA's target risk levels, the assumptions used to estimate risks to this receptor were conservative and assumed the worst case. Given both the current and future land use of the Site, it is unlikely that construction workers would be exposed to soil in the filled ravine and Upper Bluff. The most likely scenario for the future construction worker is exposure to soil within 0 to 4 feet bgs in Kreher Park (a typical depth for the installation of underground utility corridors), as most activities associated with the implementation of the future land use would be associated with regrading, landscaping, and road or parking lot construction. Therefore, risks to this receptor population are most likely overstated in this HHRA.

An HI of 3 was calculated for the general industrial worker exposure to indoor air pathway under the RME conditions. This risk level is likely to be an overestimate because:

- It was estimated using the maximum detected concentrations as the concentrations at points of exposure.

- It was calculated based on USEPA default exposure parameters for the industrial /commercial workers (i.e., an individual works at the Site for 8 hours per day, 5 days per week, 50 weeks per year for a total of 25 years). The NSPW Service Center is used as a warehouse; there is an office space inside the building, but used only on a part-time basis.

Cancer risks to subsistence fisher (finfish) are equivalent to the upper-end of the USEPA target risk range, but greater than the WDPH threshold of 1×10^{-5}. Noncarcinogenic risk is within acceptable limits for both USEPA and WDPH.

Risks to recreational children (surface soil) are equivalent to the WDPH cancer risk threshold. However, risks to adolescent and adult receptors exposed to surface soil are below the USEPA acceptable risk range and below the WDPH risk threshold.

Risks to waders and swimmers (sediments), industrial workers (surface soil), and maintenance workers (surface soil) are all within USEPA's target risk range of 10^{-4} to 10^{-6} for lifetime cancer risk and a target HI of less than or equal to 1 for non-cancer risk and are less than the WDPH threshold of 1×10^{-5} for lifetime cancer risk and a target HI of less than or equal to 1 for non-cancer risk.

At the request of the Wisconsin Department of Public Health, risks were also estimated for construction workers exposed to "oily materials" in groundwater via dermal contact and swimmers and waders who may be exposed to oil slicks in surface water via ingestion and dermal contact. Because no media-specific concentrations are available for either scenario, risks were estimated using analytical data collected from the product stream from the active free product recovery system for the Copper Falls aquifer or chemical-specific solubility values detected in the DNAPL sample. Risks to construction workers exposed to "oily material" in groundwater and adult swimmers and waders exposed to "oil slicks" in surface water is greater than both the USEPA upper risk range (CR 1×10^{-4} and HI of 1) and than WDPH threshold (CR 1×10^{-5} and HI of 1). However, it is important to note that there is much uncertainty associated with estimating risks to oily material in groundwater or oil slicks in surface water. The primary uncertainties are associated with the lack of:

- Established methodology for estimating this exposure pathway
- Relevant oily material data resulting in the use of DNAPL data that are expected to result in an overestimate of risk.

4.2.2 Risks to Ecological Receptors

The BERA concluded that the potential for adverse effects to ecological receptors other than benthic macroinvertebrates was not sufficient to result in significant adverse alterations to populations and communities of these ecological receptors. Unacceptable impacts to the benthic macroinvertebrate community in aquatic portions of the Site are possible. Two lines of evidence, bulk sediment chemistry and sediment toxicity testing, indicated that the probability of impairment at the community level was likely.

However, the fact that hydrocarbons are sporadically released as sheens from Site sediment during some high energy meteorological events or when disturbed indicates the potential for impact to the benthic community that may not have necessarily been fully measured by the studies conducted to support the RI. While there is no evidence that effects from these releases will lead to impairment of populations and communities of these receptors inhabiting the waters of Chequamegon Bay, the presence of this continuing source degrades the functioning of a healthy aquatic community in the Site area.

In addition, if normal lakefront activities, i.e., wading, boating etc., were not presently prohibited, the disturbance of sediments and concomitant release of subsurface COPCS would increase. This potentially could lead to greater impacts than were measured during these RI/FS studies.

4.3 Calculation of Areal Extent and Volume of Contaminated Media

The areal extent of soil, groundwater and sediment contamination has been identified based in historic and RI Site Investigation results presented in the RI Report. For the purpose of preparing this document, these results were used to estimate the areal extent of contamination be media. The areal extent of contamination identified for soil, groundwater, and sediment is shown on Figures 4-1, 4-2, and 3-3, respectively. The volume of contaminated media is summarized in Table 4-1, and calculations are included in Appendix A.

Soil contamination was identified in the upper bluff area, primarily in the backfilled ravine, and throughout the Kreher Park fill soil (see Figure 4-1). Based on the benzene residual contaminant level (RCL) per NR 720 WAC exceedances, the areal extent of contamination in the upper bluff area encompasses approximately 2 acres, and over 10 acres in Kreher Park. Assuming an average thickness of 10 feet, this yields 32,600 cubic yards of contaminated soil in the upper bluff area. Assuming an average thickness of 5 feet, this yields 83,700 cubic yards of contaminated soil in Kreher Park. However, as shown in Figure 4-1, soil contamination underlies the NSPW facility buildings, parking lots, and St. Clair Street. Contaminated soil in Kreher Park underlies a layer of clean fill that ranges in thickness from 2 to 4 feet.

Potential remedial alternatives for soil evaluated in Section 7.3 focused on the removal of areas with the highest levels of contamination. This includes an area approximately 95 feet by 130 feet located beneath the central portion of the NSPW service center and adjacent courtyard area; former gas holders for the former MGP were located in this area. The depth to contamination in this area ranges from 5 to 20 feet. Assuming and average depth of 15 feet, there is an estimated 7,600 cubic yards of contaminated soil in this area. In Kreher Park, the highest levels of soil contamination encountered above the saturated wood waste layer in the former “coal tar dump area.” This area is approximately 250 by 85 feet. Assuming an average depth of 5 feet there is an estimated 4,000 cubic yards of contaminated soil in this area.

Groundwater contamination was identified in the perched aquifer overlying the Miller Creek formation and in the underlying Copper Falls aquifer. As shown on Figure 4-2, the areal extent of shallow groundwater contamination in the upper bluff area and in Kreher Park is similar to the areal extent of soil contamination (see Figure 4-1.) Compared to shallow groundwater

contamination, the areal extent of contamination in the Copper Falls is more extensive in the upper bluff area, but less extensive in Kreher Park. Based on benzene Enforcement Standard (ES per NR 140 WAC exceedances, the areal extent of shallow groundwater contamination encompasses almost 3 acres in the upper bluff area and over 10 acres in Kreher Park. The plume in the underlying Copper Falls aquifer is almost 7 acres in size.

Assuming an average thickness of 15 feet, this yields a volume of 65,600 cubic yards of contaminated saturated media (groundwater) in the upper bluff area. Assuming an average thickness of 8 feet, this yields 133,900 cubic yards of contaminated saturated media in Kreher Park. There is an estimated 500,200 cubic yards of contaminated saturated media for the Copper Falls aquifer. This estimate assumes an average plume thickness of 50 feet in the upper bluff area and 35 feet beneath Kreher Park.

The areal extent of sediment contamination is shown on Figure 3-3. Laboratory results and sample coordinate data for sediment samples were incorporated into geographic information system (GIS). Using ArcGIS, the areal extent of contaminated sediment was first calculated for total PAH concentrations exceeding 10 ppm dry weight (dwt)[7]. Approximately 16 acres of the Site contains total PAH concentrations in excess of 10 ppm. The volume of sediment in the 16 acres was then calculated for contamination up to maximum depths of 4 and 10 feet. Total PAHs exceeding 10 ppm include an estimated 77,800 cubic yards of sediment between 0 and 4 feet, and an estimated 133,900 cubic yards of sediment up to a maximum depth of 10 feet. All volume estimates include wood waste overlying and mixed with the contaminated sediment.

[7] For purposes of estimating sediment volumes the 9.5 ug PAH/g dwt was rounded to 10 ppm and it was assumed that the concentration was on a dry weight basis.

5.0 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO-BE-CONSIDERED (TBC) CRITERIA

5.1 Introduction

Section 121(d) of CERCLA requires that remedial actions undertaken pursuant to CERCLA comply with or otherwise attain legally applicable or relevant and appropriate standards or requirements (ARARs) where such compliance is technically practicable. While not legally binding, consideration is also to be given to TBCs. ARARs and TBCs are the statutes, regulations, ordinances, and guidance, relating to all aspects of the GRAs contemplated in this FS. Remedial alternatives considered in this Technical Memorandum must meet, insofar as practical, the requirements of the ARARs and must consider the interests advanced by the TBCs, including:

- Air, groundwater, surface water quality and residual soil concentration standards,
- Waste handling, storage, transfer and disposal, permitting and siting, requirements and limitations,
- Operating parameters,
- Health and safety requirements, and
- Monitoring requirements.

The identification of ARARs and TBCs depends on the media, COPCs, site-specific characteristics, and the technologies employed during remediation. ARARs are those cleanup standards or controls that are promulgated under state or federal law that specifically address a hazardous substance, pollutant or contaminant, action, location or other situation at a site. A requirement may be “relevant” but may not be “appropriate” to apply for various reasons, and therefore, not well suited for the site. ARARs and TBCs can be chemical-, action- or location-specific requirements. The three types of ARARs are described below.

Chemical-specific ARARs are usually health or risk-based numerical values or methodologies which, when applied to site-specific conditions, define acceptable concentration limits of a chemical that may be found in, remain in, or discharged to, the ambient environment. These standards establish site remediation targets for the COPCs in the designated medium (e.g. water, soil, sediment or air) because those standards are considered protective of human health and the environment. Examples of chemical-specific ARARs include state and federal drinking water quality standards.

Location-specific ARARs are “restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in a specific locations.” (EPA 1988) Location-specific ARARs place restrictions on remedial activities due primarily to the presence of environmentally sensitive areas. Examples of location-specific ARARs include the standards and requirements imposed for work conducted affecting wetlands.

Action-specific ARARs govern the design, performance, or operational aspects of contaminated materials management. Action-specific requirements "do not themselves determine the cleanup alternative, but define how chosen cleanup alternatives should be achieved" (EPA 1988). Examples of action-specific ARARs include establishment of safe concentrations of discharge of materials during implementation of a remedial action.

ARARs and TBCs that may contribute to defining remedial alternatives for the Ashland/NSP Lakefront Site are presented in Tables 5-1 through 5-3. These tables contain detailed information about the ARARs and the TBCs. The narrative text below is a summary of the key ARARs and the TBCs, but does not contain the same level of detail as is presented in the Tables.

5.2 Chemical-Specific ARARs

The principal chemical-specific ARARs that apply to the Ashland/NSP Lakefront Site are as follows (Table 5-1).

5.2.1 Clean Air Act

The federal Clean Air Act establishes national ambient air quality standards as well as emission limitations for volatile organic compounds, hazardous air pollutants and particulate matter for both mobile and stationary sources of air pollution.

5.2.2 Clean Water Act

The federal CWA establishes ambient water quality criteria, water quality standards, effluent discharge standards, and dredge and fill permit restrictions and requirements. National recommended water quality criteria developed under the CWA are non-enforceable guidelines that identify protective concentrations of various chemical constituents for surface waters. As non-enforceable guidelines the national recommended water quality criteria are TBCs for the Site.

5.2.3 State of Wisconsin Water Quality Standards – Chs. 281, 283 and 160, Wis. Stats. and WAC NR 100 Series

Chapters 281 and 283 of the Wisconsin Statutes govern the surface water quality protection programs for the state and Wisconsin Administrative Code (WAC) chapters NR 102 through 105 establish surface water quality standards for the state. The standards are used in making water quality management decisions and in the control of municipal, business, land development and agricultural discharges. Chapter 160 of the Wisconsin Statutes is the State's groundwater protection law and WAC chapter NR 140 establishes groundwater quality standards for the state. These standards are used for managing upland areas of the Site and disposal facilities. These standards constitute ARARs.

5.2.4 State of Wisconsin Air Pollution Control Standards – WAC NR 400 - 499

WAC chapters NR 400 through 499 establish air emission discharge limits for specific contaminants. Air discharge loading rates are specified by contaminant levels. Discharge permits are issued in accordance with the procedures outlined in these chapters.

5.2.5 State of Wisconsin Hazardous Substance Spill Law and Soil Cleanup Standards – Ch. 292.11, Wis. Stats. and WAC NR 720

The Wisconsin Hazardous Substance Spill Law (§292.11, et. seq.) requires the reporting response and restoration of the environment following detection of a release of hazardous substances. WAC Chapter NR 700 implements Wisconsin's cleanup program responding to such hazardous substance release sites. WAC chapter NR 720 establishes soil cleanup standards for the remediation of soil contamination for the state. The standards apply to soil remediation activities in upland areas of the Site and may be potentially applicable if dewatered sediment is considered soil after treatment.

5.2.6 State of Wisconsin Sediment Quality Guidance

With respect to establishing sediment cleanup levels, WDNR's interim guidance for sediment (WDNR 2003) recommends that the consensus-based sediment quality guidelines (CBSQG) of MacDonald et al. (2000a) be used for sediment quality assessments for protection of benthic organisms. This guidance is not legally enforceable and therefore is a TBC. Comparable effects-based freshwater sediment guidelines from published scientific literature or in Water Quality Standards Section development memos should be used for contaminants for which CBSQG are not available. Protective sediment COPC concentrations for the Site were developed in the BERA as discussed in Section 6.0.

5.3 Location-Specific ARARs

The principal location-specific ARARs that apply to the Ashland/NSP Lakefront Site are as follows (Table 5-2).

5.3.1 Clean Water Act

The CWA authorizes the US Army Corps of Engineers to issue permits for the dredging and filling of wetlands considering site-specific conditions or limitations.

5.3.2 State of Wisconsin Statutes Chapter 289

This statute governs waste management in the State and prohibits the construction of landfill facilities in floodplains or in open-water except by special state permits or legislative authority. The statute also governs the landfill siting and approval process for upland disposal facilities.

5.3.3 State of Wisconsin Statutes Chapter 30

This statute regulates activities in or affecting navigable waters and harbors. Provisions address minimizing adverse effects on waterways resulting from work performed. This statue also requires the WDNR to take into consideration potential effects of projects on valuable natural resources and to condition permits so as to minimize such adverse affects.

WAC NR 113 governs site-specific practicable alternatives analyses applicable to projects affecting wetlands.

5.3.4 State of Wisconsin Solid Waste Management – Beneficial Reuse Exemption WAC NR 500.08

This section establishes criteria for beneficial reuse of solid waste on-site after treatment and is potentially applicable for disposal of treated sediment and/or soil meeting disposal criteria.

5.4 Action-Specific ARARs

The principal action-specific ARARs that apply to the Ashland/NSP Lakefront Site are as follows (Table 5-3).

5.4.1 State of Wisconsin Environmental Policy Act - Sec. 1.11, Wis. Stats. and WAC NR 150

The Wisconsin Environmental Policy Act requires the government to analyze the impacts of any action or inaction that significantly affects the quality of the human environment. Depending on the type of action involved, an environmental analysis (EA), environmental impact report (EIR) and environmental impact statement (EIS) may be required.

5.4.2 State of Wisconsin Requirements for Plans and Specification Submittal – WAC Chapter NR 108

This regulation requires the submittal of plans and specifications for WDNR approval of any reviewable project, general operation and control of water and/or wastewater systems.

5.4.3 State of Wisconsin Laboratory Certification and Registration Program – WAC Chapter NR 149

This regulation requires certification or registration of laboratories submitting data to the WDNR.

5.4.4 State of Wisconsin Pollutant Discharge Regulations (WPDES) – WAC NR 200

These regulations establish water quality effluent limitations for point source discharges during remediation activities. Discharge limitations will likely apply to dredging and pump and treat type remedies with subsequent discharge of dredge water or treated groundwater to surface water. Likewise, dewatering ponds or lagoons will also be managed under these regulations.

5.4.5 State of Wisconsin Water Quality Regulations – WAC NR 300

Establishes minimum design standards and specifications for projects permitted under a general permit. Requires permits for structures placed on, and dredging of, the beds of navigable waters. These regulations also establish procedures and protocols for sediment sampling and analysis, disposal criteria and monitoring requirements for dredging projects, and establish information needed and standards of approval for shoreline protection.

5.4.6 State of Wisconsin Air Pollution Control Regulations – WAC NR 400

These regulations are ARARs that establish air quality standards for removal, treatment and disposal of contaminated media. Construction and operational permits are managed under these regulations.

5.4.7 State of Wisconsin Solid Waste Management Regulations - WAC NR 500 through 520

These regulations are ARARs that establish standards for collection, handling, transport, storage, and disposal of solid wastes. These disposal standards apply for both new and existing landfills. Under Wisconsin law, dredged material is considered solid waste. These regulations also establish criteria for possible beneficial reuse of solid waste after treatment.

5.4.8 State of Wisconsin Solid Waste Management Regulations – WAC NR 500 and Wisconsin Statute 289.43

These regulations and statute contain exemptions for the management of solid and low-hazard wastes. This section of the Wisconsin statutes addresses the permitting and siting requirements for construction of new upland landfills and disposal of solid waste along a water body. Under this statute, WDNR has the authority to waive setback requirements for siting disposal facilities.

5.4.9 State of Wisconsin Hazardous Waste Management Rules – WAC NR 600

These regulations establish procedures for identification, handling, storage and disposal of hazardous waste.

5.4.10 State of Wisconsin Investigation and Remediation of Environmental Contamination – WAC NR 700

These regulations govern the investigation and remediation of sites and facilities subject to regulation under Wisconsin Statute Chapter 292. The activities covered by these regulations include notification requirements, management of contaminated media, public participation, screening and selection of remedial actions and design, implementation, operation, maintenance and monitoring of remedial actions.

5.4.11 State of Wisconsin Statutes Chapter 30

This section of the Wisconsin Statutes contains provisions to minimize adverse effects on navigable waterways. The statute specifically bans open water disposal of dredged material on the beds of navigable waters unless a permit is granted by WDNR or the state legislature specifically authorizes an open-water disposal project. The statute does not prohibit construction of a nearshore confined disposal facility (CDF) and disposal of dredged sediments into a newly constructed CDF. This statue also requires the WDNR to take into consideration potential effects of projects on valuable natural resources. According to WDNR, this alternative will need approval of both the State Legislature and the Governor, thus potentially making implementability difficult.

5.4.12 Section 10 – Rivers and Harbors Act

This federal statute contains provisions for minimizing adverse effects from dredge and fill work conducted within a navigable waterway of the United States.

5.4.13 Clean Water Act

Section 404 of the Clean Water Act in an ARAR that requires approval from the USACE for discharges of dredge or fill materials into waters of the United States.

5.4.14 Occupational Safety and Health Administration (OSHA)

This ARAR contained in 29CFR Part 1910 is applicable to workers in and near areas of contamination during remedial actions. It establishes daily exposure limits to chemicals, medical monitoring requirements and personal protective equipment requirements (PPE).

5.4.15 Department of Transportation Rules for Hazardous Materials Transport

These rules establish the requirements for transport of hazardous materials and will be applicable for transport of excavated materials for disposal.

5.4.16 State Stormwater Pollution Control Program - WAC NR 216

Any project disturbing more than 1 (one) acre of land is subject to storm water pollution prevention planning and construction site erosion controls.

5.5 To Be Considered Information

TBCs can be grouped into chemical-, location-, and action-specific categories. Important laws, regulations and guidance that are TBCs for the Ashland/NSP Lakefront Site are presented below.

5.5.1 State of Wisconsin Water Quality Regulations - WAC NR 300

The state water quality standards are TBCs for evaluating the effectiveness of sediment remedial alternatives. However, these standards are not used to develop sediment cleanup levels.

5.5.2 Federal Safe Drinking Water Act

Drinking water standards are TBCs for sediment cleanup at the Site. These standards are not used to develop sediment cleanup levels. However, federal maximum contaminated levels ("MCLs") are ARARs insofar as they are adopted as groundwater quality standards in Ch. NR 140 WAC.

5.5.3 Great Lakes Water Quality Agreement

This agreement calls for the identification of "Areas of Concern" and the establishment of remedial goals for impacted harbors, ports, and river mouths of the Great Lakes area.

5.5.4 Section 303(d) – Clean Water Act

Ambient water quality criteria developed under the CWA are non-enforceable guidelines that identify protective concentrations of various chemical constituents for surface waters.

5.5.5 Resource Conservation and Recovery Act (RCRA)

Provides criteria for classification of solid waste disposal facilities and practices. Also provides requirements for management of excavations to prevent fugitive dust emissions.

5.5.6 Sediment Quality Assessment at MGP Sites

WDNR provides a framework for investigating potential surface water problems at MGP sites in the document entitled: "Assessing Sediment Quality in Water Bodies Associated with manufactured Gas Plant Sites".

5.5.7 WDNR Sediment Quality Guidelines

In 2003, WDNR prepared a document entitled "Consensus-Based Sediment Quality Guidelines; Recommendations for Use and Application Interim Guidance". This guidance document provides a framework for use of consensus based sediment quality guidelines in determining cleanup standards.

5.5.8 Sediment Remediation Implementation Guidance

Part of the 1995 Strategic Directions Report prepared by WDNR addresses how sediment remediation work should be addressed in Wisconsin. The guidance calls for using a risk management process to appraise environmental impacts and assess the technical feasibility and costs of sediment remediation, and states that water quality standards are goals for evaluating sediment impacts to the aquatic environment and for evaluating the performance of various remedial options.

5.5.9 USEPA's Contaminated Sediment Management Strategy

This 1998 document was prepared by the USEPA's Sediment Steering Committee and establishes four goals to manage the problem of contaminated sediment, and describes the action the Agency intends to take to accomplish these goals.

5.5.10 USEPA's Contaminated Sediment Management Guidance

This Guidance issued in final form in 2005, "provides technical and policy guidance for project managers and management teams making remedy decisions for contaminated sediment sites. It is primarily intended for federal and state project managers considering actions under CERCLA, although technical aspects of the guidance are also intended to assist project managers addressing sediment contamination under RCRA. Many aspects of this guidance also will be useful to other governmental organizations and potentially responsible parties (PRPs) that may be conducting a sediment cleanup. Although aspects related to site characterization and risk assessments are addressed, the guidance focuses on considerations regarding feasibility studies and remedy selection for contaminated sediment."

5.5.11 Great Lakes Water Quality Initiative

This initiative provides guidance to states bordering the Great Lakes regarding wastewater discharge programs. For remedial actions involving discharges, any lowering of water quality should be minimized to the extent practicable.

5.5.12 Dredge and Fill Requirements

This report by the Technical Subcommittee on Determination of Dredge Material Suitability of In-Water Disposal (WDNR, 2000) is a TBC for alternatives involving in-water disposal.

5.5.13 Local Permits

Building, zoning or other permit requirements are TBCs for construction activities related to a given remedial alternative.

5.5.14 State of Wisconsin Investigation and Remediation of Environmental Contamination – WAC NR 700 Supplementary Guidance

The State of Wisconsin established human risk based generic soil cleanup levels for a series of polycyclic aromatic hydrocarbon (PAH) compounds. These levels correspond to either residential or industrial site settings for specific routes of exposure (direct contact, ingestion, air pathway, soil to groundwater). The limits are found in WDNR publication RR519, Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons (PAHs) Interim Guidance.

The State of Wisconsin established guidance for design, construction and maintenance of cover systems to meet soil performance standards promulgated in ch. NR 720, as well as PAH soil guidelines referenced in the aforementioned interim guidance. These cover systems are described in WDNR publication RR709 Guidance for Cover Systems as Soil Performance Standard Remedies.

These guidance documents are not legally enforceable and therefore are TBCs.

6.0 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES (RAO) AND GENERAL RESPONSE ACTIONS (GRA)

Remedial Action Objectives were developed in Appendix A to the RI report and are summarized in Table 6-1.

Based upon these RAOs acceptable contaminant levels, protective of human health and the environment were identified for each environmental media. These are summarized in Table 6-2 through 6-4.

7.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

The initial step of the alternatives screening process involves the identification of GRAs, remedial action technologies and remedial action processes that potentially can be applied to Site media to meet RAOs.

As the term implies, a GRA is defined as an action that can be applied to Site media that will result in a RAO being achieved. As an example, removal, containment and in-situ treatment are GRAs for sediment. Potential GRAs for the Site can be divided into the following categories:

- No Action;
- Institutional Controls;
- Monitored Natural Recovery
- Containment;
- Removal;
- In-situ Treatment; and
- Ex-situ Treatment.

Several different remedial action technologies could conceivably be employed to achieve a GRA. For instance, sediment removal could be achieved by either excavation or dredging. Within a technology there may be several process options. Dredging could be implemented using hydraulic or mechanical dredges.

7.1 Screening Process

This section evaluates alternatives that potentially could be used for management of the contaminated groundwater, soil and sediments at the Site.

USEPA RI/FS guidance (USEPA 1988) indicates that after information is available from the RI, including the volumes and areas of media to which GRAs may be applied, and the RAOs are established, alternative screening should be a two-step process. After compiling a list of all available alternatives, the first step selects alternatives based upon whether they can be implemented at the Site. Those determined to be technically implementable are retained. Those alternatives that have no applicability to the Site contaminants, haven't been demonstrated in full-scale operations or for some other reason are unworkable are eliminated at this step. In the second step the alternatives remaining are further evaluated based upon administrative implementability, (e.g., conformance to ARARs, and TBCs, ability to permit certain actions, etc.) effectiveness and relative cost. Table 7-1 [Figure 4-1 from USEPA's (1988) RI/FS guidance] depicts this process.

Effectiveness considers whether an alternative can reduce the toxicity, mobility and/or volume of contaminants and achieve the RAOs. Several factors are considered when evaluating an alternative's effectiveness including:

- Precedent for use with a specific media and contaminant at the scale contemplated at this Site;
- Whether RAOs are met by this alternative;
- Whether ARARs and TBCs can be met with this alternative;
- Whether the alternative can be implemented in a timely manner; and
- Whether implementation of an alternative is protective of human health and the environment.

The relative capital and operations and maintenance (O&M) costs for an alternative are also evaluated although at this stage is typically not used as justification for elimination unless an alternative is substantially different from other alternatives. At this stage in the process, the cost analysis is made on the basis of engineering judgment. Relative costs of alternatives are categorized as very high, high, moderate, and low.

USEPA recently finalized Contaminated Sediment Management Guidance (USEPA 2005) provides the following guidance for developing remedial alternatives for sediment:

> *"Project managers should consider the following steps, which build on EPA's RI/FS Guidance by adding details specific to sediment, when developing alternatives at sediment sites:*
>
> - *Develop remedial action objectives specifying the contaminants and media of interest, exposure pathways, and remediation goals that permit a range of alternatives to be developed including each of the three major approaches (MNR, capping, and removal), and that consider state and local objectives for the site;*
> - *Identify estimated volumes or areas of sediment to which the approaches may be applied, taking into account the need for protectiveness as identified in the RAOs and the biological, chemical and physical characteristics of the site;*
> - *Develop additional detail concerning the equipment, methods, and locations to be evaluated for each alternative, including the three major approaches (e.g., potential natural recovery processes, potential cap materials and placement methods, number and types of dredges or excavators, transport methods, treatment methods, type of disposal units, general disposal location, need for monitoring and/or institutional controls);*
> - *Develop additional detail concerning known major constraints on each alternative, including the three major approaches at the site (e.g., need to maintain flow capacity for flood control, need to accommodate navigational dredging);*
> - *To the extent possible with information available at this stage of the FS, identify the time frame(s) in which the alternatives are expected to achieve cleanup levels and RAOs; and*
> - *Assemble the more detailed methods into a set of alternatives representing a range of options, including MNR, in-situ capping, and removal options or combination of options, as appropriate."*

7.2 Development of Alternatives

Alternatives for each media and GRA were identified from experience, familiarity with similar sites and from various references. Table 7-1 lists some of the sources reviewed for this effort.

After evaluating each alternative for technical implementability those retained are described in more detail. The description of these alternatives discusses implementability, effectiveness and cost and includes such information as:

- Time required for the alternative to achieve RAOs;
- Relative cost of the alternative;
- How much risk reduction will be achieved from implementing the alternative;
- Land use required for implementation;
- Compliance with ARARs and TBCs;
- Need for any institutional controls after alternative is implemented; and
- Other relevant information.

In addition, any ancillary technologies required to implement these technologies are described. Ancillary technologies and processes are not screened, *per se*, as they are essential for a process to achieve its RAO. For instance, dewatering and wastewater treatment are required for any dredging technology prior to treatment of the sediment and disposal. Ancillary technologies include:

- Dewatering;
- Wastewater treatment;
- Water quality management;
- Residuals management, including resource recovery; and
- Transportation.

If a specific alternative uniquely requires any of these ancillary technologies, it will be discussed in conjunction with that alternative option and the relative cost for implementation that ancillary technology considered in the estimate of relative costs. Ancillary technologies that are generic to several alternatives will be discussed in a separate section. In addition, if long-term monitoring is required for the effective implementation of any alternative then this will also be discussed and considered in the estimate of relative costs.

7.3 Soil – Ravine Fill in Upper Bluff Area and Fill Soils in Kreher Park

7.3.1 Chemicals of Potential Concern

This evaluation focuses on VOCs and PAHs contained in MGP tar waste as the primary COPCs. NAPL and inorganics associated with the fill soil are also considered in the screening of certain process options for treatment.

7.3.2 Screening of Remedial Alternatives for Soil

Potential remedial alternatives that are capable of preventing direct contact with subsurface soil contamination or reducing the toxicity and mobility of soil contaminants at the upper bluff area and at Kreher Park are summarized in Table 7-2. Those retained for further consideration are highlighted in that table. Potential remedial alternatives are described below.

7.3.2.1 No Action

The NCP at Title 40 Code of Federal Regulations (40 CFR) §300.430(e)(6) provides that the no-action alternative should be considered at every site. Implementation of no further action consists of leaving contaminated soil in place; no engineering, maintenance, or monitoring will be required. A "no action" alternative, however, does not meet the RAOs for the Site, and will not be acceptable to the community or Agency. The "no action" alternative for soil was retained for screening as required by the NCP as a basis for comparing the other alternatives.

7.3.2.2 Institutional Controls

Institutional controls for soil could include fencing, deed restrictions, or legislative action to prevent exposure to existing subsurface soil contamination in the upper bluff area and in Kreher Park. Implementation will restrict future site use. Although, these actions could be implemented to protect public health over the long-term it will not result in a reduction in contaminant mass, toxicity, or mobility. Institutional controls do not meet the RAOs for the Site as a stand alone alternative, but were retained for screening because they may be acceptable to the community and Agency in combination with other active remedial technologies.

7.3.2.3 Monitored Natural Recovery

Monitored natural recovery (MNR) relies upon naturally occurring processes to contain, reduce or eliminate the toxicity or bioavailability of soil contaminants. This alternative also includes the collection of addition data to verify that natural processes are reducing contaminant concentrations over time. Soil samples could be collected periodically, or soil vapors could be monitored for off-gases, primarily carbon dioxide, to evaluate the microbial degradation of contaminants in the unsaturated zone. The shallow depth to groundwater my limit the effectiveness of soil monitoring, but groundwater samples could be collected to evaluate natural processes. For groundwater, this is referred to as Monitored Natural Attenuation (MNA). MNA consists of the baseline collection of geochemical and biochemical indicator parameters to demonstrate that site conditions are suitable. Periodic groundwater samples will then be collected to demonstrate that contaminant concentrations are declining. Although MNA does not meet the RAOs for the Site as a stand alone alternative, it was retained for further evaluation because it may be acceptable to the community and Agency in combination with other active remedial technologies. Because MNA could be completed for unsaturated zone and saturated zone contamination at the Site, it was evaluated as a potential remedial response for contaminated groundwater in Section 7.4.

7.3.2.4 Containment

Containment for contaminated soil encountered at the Site consists of the use of existing barriers that meet the ARAR's, or the construction of engineered barriers to eliminate the direct contact exposure pathway. Surface barriers could also be designed and constructed to restrict infiltration of precipitation to reduce contamination leaching into groundwater from the unsaturated zone. Surface barriers include the following:

- Asphalt cap
- Clay cap
- Multi-layer cap with a minimum two-foot thick clay barrier, drainage layer, soil and vegetated top soil cover
- Multi-layer cap with geomembrane or equivalent (geocomposite fabric layer or GCL)

Engineered surface barriers that are limited to preventing exposure to subsurface contamination are evaluated as potential remedial alternatives for soil. These barriers are considered passive containment alternatives because the contaminated zone is not disturbed, and little maintenance is required following implementation. Engineered surface barriers designed and constructed to restrict infiltration are also evaluated as potential remedial alternatives for groundwater. Vertical barriers could also be used to contain contaminated soil and shallow groundwater contamination. Engineered surface barriers for groundwater and vertical barriers are considered active containment alternatives because contaminated material may be disturbed, and/or long-term maintenance such as groundwater extraction may be required. The use of each type of barrier is described below.

Engineered Surface Barrier for Soil

Existing buildings and asphalt pavement, or new buildings and asphalt pavement could be used as a surface barrier to prevent exposure to subsurface contamination eliminating the direct contact exposure pathway. In the upper bluff area, the NSPW service center building and adjacent asphalt pavement could act as an existing surface barrier as well as a potential cap for the filled ravine on the south side of St. Claire Street. In Kreher Park, a fine grained low permeability soil cap was installed in the former seep area (following the removal of contaminated soil) as an interim response in 2002; it provides a surface barrier preventing exposure to contaminated material remaining in the underlying wood waste layer.

In the upland area, the existing building and asphalt pavement may need to be repaired to improve the integrity of these barriers on the south side of St. Claire Street. New asphalt pavement on the north side of St. Claire Street (NSPW storage yard) and in Kreher Park (marina parking lot) could be installed as surface barriers for these areas to replace existing gravel surfaces. Because these barriers would not reduce contaminant mass, toxicity, or mobility of contaminants, they would likely be used in conjunction with a groundwater remedial alternative to address the potential migration of contaminants from the unsaturated zone to the saturated zone. New asphalt pavement or buildings could be used as surface barriers for residual subsurface contamination following the remediation of soil and/or shallow groundwater contamination by another

response (i.e. in-situ remediation). Surface barriers were retained for further evaluation as a potential remedial response for soil contamination.

Engineered Surface Barrier for Groundwater

In addition to preventing direct contact with subsurface contamination, engineered surface barriers could also be used to severely restrict infiltration of precipitation. Although this will not reduce contaminant mass or toxicity, it will limit the mobility of contaminants leaching from the unsaturated zone. Consequently, engineered surface barriers designed to restrict infiltration were retained for further evaluation as a potential remedial response for groundwater in Section 7.4.

Engineered Vertical Barrier

Vertical barriers could also be used for containment of contaminated soil and groundwater, encountered at shallow depths. Although surface barriers could be used in conjunction with vertical barriers to limit infiltration into a contained area, a remedial response for groundwater (i.e. groundwater extraction) may be required. Vertical barriers were also evaluated as a potential remedial alternative for groundwater in Section 7.4. Additionally, vertical barriers were evaluated as a potential remedial alternative as part of a confined disposal facility for sediment in Section 7.5.

7.3.2.5 In-situ Treatment

In-situ treatment consists of the in place treatment of contaminated soil. Because in-situ treatment is most effective for high levels of contamination in source areas, remedial alternatives evaluated in-situ treatment of contaminated soil in the back filled ravine south of St. Claire Street, and contaminated soil above the wood waste layer in the former "Coal Tar Dump Area." In-situ treatment alternatives may be limited by site conditions. The existing NSPW facility building and buried structures (gas holders) may prevent the installation of injection and extraction wells. Additionally, contaminants may not be accessible for treatment if located beneath buried structures (or in cavities within the buried structures). In the event the building and buried structures are removed, in-situ treatment would not be limited and could be implemented for the remaining contaminants in the filled ravine. Building demolition and removal of buried structures are considered with removal and ex-situ treatment alternatives described in Sections 7.2.3.6 and 7.2.3.7 below. At Kreher Park, fine-grained low permeability soils and the shallow depth to groundwater may limit the use of soil vapor extraction; groundwater extraction rather than soil vapor extraction may be required to implement this remedial alternative in the former Coal Tar Dump Area.

Phytoremediation, which uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment was not retained for screening; this remedial alternative is effective for sites with low to moderate levels of contamination, and may not be suitable for NAPL contamination. Soil flushing, which uses co-solvent or surfactant injection to mobilize contaminants, was also not retained for screening; variable permeability of soils may limit implementability, but it may not be suitable for NAPL contamination. The remaining in-situ treatment alternatives that could be implemented to achieve RAOs were retained for screening and are described below.

Enhanced Bioremediation

Enhanced bioremediation increases the rate of bioremediation of organic contaminants by adding electron acceptors and/or nutrients that may not otherwise be available or abundant. This increases the metabolic rate of the indigenous microbial population and accelerates the conversion of contamination to innocuous end products. Oxygen is the main electron acceptor for aerobic bioremediation, and nitrate serves as an alternative electron acceptor under anoxic conditions. The addition of reagents to create reducing conditions in the subsurface (e.g. hydrogen release compound (HRC)) were not retained for screening. Reducing conditions are created to enhance reductive de-chlorination at sites with chlorinated constituents. Chlorinated compounds are not COPCs at the Site.

Enhanced bioremediation can be performed both ex-situ and in-situ as a hybrid soil washing technique. In-situ technologies include soil vapor extraction, air sparging (injecting air below the water table), and oxygen enhancement by adding hydrogen peroxide (H_2O_2) or solid-phase peroxide products (e.g. oxygen releasing compound (ORC)) to increase the rate of biodegradation in the subsurface. Because enhanced bioremediation has not been proven for NAPL containing soil, it was retained for screening only as a potential remedial alternative for dissolved phase groundwater in Section 7.4. Slurry phase biological treatment was evaluated as a potential ex-situ enhanced bioremediation alternative (a hybrid soil washing technique) in Section 7.3.3.9.

Soil Vapor Extraction

Soil vapor extraction (SVE) uses air as a carrier to remove volatile organic compounds from the unsaturated zone with vapor extraction wells and an induced vacuum. Variable permeability of soils and a shallow water table may limit the effectiveness of SVE, and SVE may not be effective for PAHs contamination. However, SVE was retained for screening because it could be used with thermal or chemical treatment alternatives described below. Bioventing is similar to SVE, but is used to enhance the degradation of contaminants in the unsaturated zone. It is typically used for low to moderate levels of contamination. It was not retained for screening because high levels of soil contamination in source areas, variable permeabilities and a shallow water table will limit its effectiveness at the Site.

Chemical Oxidation

Chemical oxidation introduces strong oxidizing chemicals into the subsurface to degrade VOCs and PAH compounds to CO_2 and H_2O end products. Chemical oxidation could be performed on saturated and unsaturated zone soils by injecting chemicals into the subsurface via borings or wells, or by mixing in chemicals in a shallow excavation. Implementation for soil and shallow groundwater remediation could be completed simultaneously, which may require a passive or an active SVE system to collect off-gases from treated soils. Implementation for the underlying Copper Falls would be more extensive; it may require groundwater extraction rather than soil vapor extraction. Consequently, chemical oxidation was retained for screening as potential remedial alternative for both soil and groundwater.

Chemical oxidation also includes the use of ozone, which can be injected into the saturated zone as a gas. Although chemical oxidation as a technology is currently being evaluated for the Cool-ox® compound as part of USEPA's SITE demonstration at this Site, ozone, has not been proven for NAPL. Consequently these compounds are retained for screening only as potential remedial alternatives for dissolved phase groundwater in Section 7.4.

Thermal Treatment

Thermal treatment uses a heat source such as electrical resistance, electromagnetic/radio frequency heating, hot-air, or steam injection to increase the volatilization rate of volatiles and semi-volatiles and facilitates their extraction. Thermal treatment could be performed on unsaturated, and shallow saturated zone soils simultaneously. A passive or active SVE system would be required to collect off gases from treated unsaturated zone soils. For saturated zone soils, groundwater extraction wells may also be required to de-water the formation, or to remove contaminants (using water as a carrier rather than air). Several thermal treatment alternatives described below were retained for further evaluation (for both soil and groundwater) because these may be acceptable to the community and Agency.

In-situ vitrification is also a thermal treatment technology. It will convert contaminated soil into a chemically inert high-strength glass or glass-like substance by using large electrodes inserted into the soil to "melt" the contaminant mass. This technology could be used for unsaturated zone and shallow saturated zone contamination. As with other thermal treatment technologies, passive or active SVE system may be needed to vent off-gases. However, this remedial alternative will result in significant site disturbance. Vitrification results in the creation of large blocks of an amorphous solid. In doing so, a significant reduction in mass will occur, which is equivalent to the soil porosity of the soil mass being treated. This will likely require the addition of clean fill in the treated area to maintain existing grade elevations. Buried structures (i.e. gas holders) and the wood waste layer may limit the effectives of the alternative. Because other remedial alternatives are capable of achieving RAOs more efficiently, in-situ vitrification was not retained for further evaluation.

Electromagnetic//radio frequency heating and hot air injection are hybrid SVE system that are efficient in permeable soil. These alternatives were not retained for evaluation because site conditions (low permeability soils and shallow groundwater) are not suitable.

Electrical resistance heating (ERH) technology uses electricity applied into the ground through electrodes to heat the formation. This mobilizes contaminants, which are then recovered with a SVE system. Implementation of this technology for soil, shallow groundwater and deep DNAPL contamination could be completed simultaneously, but SVE and groundwater extraction wells may be required. Buried structures may interfere with implementation of ERH at the upper bluff, and the wood waste layer may interfere with implementation at Kreher Park. Buried structures and wood waste may prevent installation of electrodes at specified locations, which would disrupt the electrode array pattern needed for ERH to properly function; proper spacing is needed to induce current necessary for heating. Although ERH has been installed beneath buildings at other locations, a drill rig could not be utilized for installation of vertical borings inside the existing single story building, and the buried structures (gas holders) will prevent

installation of electrodes beneath the building via angled borings. It may be possible to treat contamination outside the buried structures, but treatment inside the former gas holders can only be completed if an adequate number of electrodes can be installed inside these structures. Additionally, heating fill soil via ERH in the filled ravine and wood waste layer may be difficult to predict, monitor, and control, which may present a safety hazard if implemented. A site evaluation test will need to be completed to obtain additional information to design a full scale ERH system for shallow soil and groundwater remediation. However, building demolition and removal of the buried structures could enhance the implementability of ERH for the underlying Copper Falls aquifer (including DNAPL) and groundwater and soil surrounding the demolished structure. Consequently, ERH was retained for evaluation for soil and shallow groundwater remediation, as well as a potential remedial alternative for deep groundwater in the Copper Falls aquifer in Section 7.4.

Steam extraction physically separates volatile and semi-volatile organic constituents by thermal or mechanical energies. Implementation for soil, deep DNAPL and shallow groundwater remediation could be completed simultaneously. A passive or active SVE ~~and groundwater extraction system~~ may be needed. Implementation for the underlying Copper Falls will require groundwater extraction instead of SVE Consequently steam injection was retained for screening as potential remedial alternative for both soil and groundwater.

7.3.2.6 Removal

For shallow contamination, removal consists of excavation of contaminated soil with conventional earth moving equipment. Deep excavations may require shoring to support sidewalls as the excavation depth is advanced. Removal could be implemented for areas with widespread low to moderate levels of soil contamination, but other potential remedial alternatives may be more effective for these areas. Removal is most effective if limited to unsaturated zone and shallow saturated zone soils with elevated levels of contamination that may include NAPL. Removal of all fill material in the backfilled ravine and Kreher Park is feasible, but would likely require the construction of an on-site or an off-site landfill. Unlimited removal will result in significant site disturbance, which may result in temporary or permanent loss of the current use of Kreher Park.[8] Kreher Park could be restored to pre-filling conditions (i.e. wetland area), backfilled with clean fill to restore it to present elevations, or backfilled with contaminated sediment. Backfilling with contaminated sediment would require the construction of an on-shore confined disposal facility (CDF) for the placement of material removed from the adjacent inlet area. As described in Section 5.4.11, Chapter 30 does not prohibit construction of a near shore confined disposal facility (CDF) and disposal of dredged sediments into a newly constructed CDF. If contaminated soil is excavated below the water table, removal and treatment of contaminated groundwater seeping into the excavation will likely be required. .If removal is limited to source areas, all excavated areas will be backfilled with clean fill, or ex-situ treated material will be returned to the excavation as described in the following section. Both limited and unlimited removal alternatives were retained for screening.

[8] Kreher Park is currently utilized as a recreation area, but it also contains the marina boat storage area, a City street adjacent to the shoreline, and the former waste water treatment building.

7.3.2.7 Ex-situ Treatment

Ex-situ treatment consists of the thermal, biological, or physical/chemical treatment of contaminated soil after it has been removed. These alternatives are most effective for soil with elevated levels of contamination. Treated material is typically returned to the excavation. However, ex-situ treatment may also include transportation to an off-site facility for treatment and/or disposal, or on-site disposal elsewhere on-site.

Thermal treatment includes incineration and thermal desorption. Thermal desorption treats soil by using heat to separate organic contaminants from soil by volatilization; volatilized vapor phase contaminants are then combusted prior to discharge to the atmosphere. Thermal desorption is typically used to treat soils contaminated with VOCs and fuels. It was retained for screening because it can also be used to treat soil contaminated with coal tar waste.

Incineration is used to volatilize and combust solid or liquid phase contaminated waste. Incineration requires higher treatment temperatures than thermal desorption, and is typically used to remediate soils contaminated with explosives and hazardous wastes, particularly chlorinated hydrocarbons, PCBs, and dioxins. Incineration was retained for screening.

Biological treatment using biopiles and land spreading were also not retained for screening. Both are suited for low to moderate levels of contamination, but neither was retained for screening because of the presence of NAPL and elevated concentrations of heavy molecular weight (HMW) PAH compounds at the Site. NAPL and HMW are not readily biodegradable. Additionally, suitable areas to implement each process are not available at the Site.

Solidification/stabilization (S/S) was not retained for screening. S/S requires the addition of a chemical reagent to the subsurface to fixate (immobilize) organic constituents in the soil matrix. This technology can be used for both organic and inorganic constituents, but is best suited for inorganic contaminants. Bench scale testing or pilot testing will be needed to evaluate S/S processes that could remediate MGP waste. S/S was not retained for screening because other remedial alternatives are capable of achieving RAOs more efficiently.

The ex-situ treatment alternatives that may be acceptable to the community and Agency, and could be implemented to achieve RAOs were retained for screening as described below.

Soil Excavation and Disposal

For limited removal, contaminated soil will most likely be transported off-site for disposal at an approved land fill disposal facility. This will require selection of a suitable facility that can accept a large volume of contaminated soil. Unlimited removal will likely require siting and construction of an on-site or off-site disposal facility. Contaminated groundwater seeping into the excavation will require removal and treatment if the excavation is completed below the water table. Because contaminated soil may contain NAPL and may be wet, treatment (i.e. stabilization/solidification) may be required before disposal. Excavations will be backfilled with clean fill materials following the removal of soil to the extent practical. On-site disposal may be possible if implemented with containment alternatives evaluated for sediment described in Section 7.6.

Soil Excavation and Thermal Desorption

Thermal treatment physically separates volatile and some semi-volatile contaminants from excavated soil or sediment by using ambient air, heat, and/or mechanical agitation to volatilize contaminants from soil into a gas stream for further treatment. Excavated soil could be transported off-site, or treated on site by a mobile unit. The most common off-site thermal treatment alternative is asphalt batch plant mixing, but this may not be feasible; fine grained soil and man-made fill material (i.e. ashes, cinders, bricks, concrete, wood debris, and glass) will not be suitable as asphalt aggregate. Additionally, the supply of contaminated soil available for aggregate may exceed the demand for this material, which could require stockpiling of contaminated soil for an extended period of time. Based on the estimated volume of contaminated soil, an on-site unit may be the most cost effective thermal treatment alternative. An advantage for on-site treatment is that treated soil can be used to back fill the excavation.

Thermal treatment is achieved by either low temperature thermal desorption (LTTD) or high temperature thermal desorption (HTTD). LTTD (200 to 600 ^{o}F) is highly effective for VOCs; PAH compounds can also be treated, but at a reduced effectiveness. HTTD (600 to 1,000 ^{o}F) is effective for PAH compounds, but is not as cost effective as LTTD for VOCs. The type of thermal treatment selected will be based on target cleanup standards for VOCs and PAHs in treated soil. Another consideration is the suitability of treated soil as backfill material; soil treated by LTTD will retain pre-treatment physical properties (i.e. organic content) whereas soil treated by HTTD will not.

Soil Excavation and Incineration

Incineration is accomplished by treating contaminated soil to high temperatures (1,400 to 2,200 ^{o}F) to volatilize and combust organic compounds. Rotary kilns are the most common type of incinerator. Circulating bed combustor (CBC), circulating fluidized bed (CFB), and infrared combustion are other incineration technologies that exist. A drawback of incineration is the off gases and residual combustion products generally require treatment. Most incineration is achieved at off-site facilities due to the substantial amount of equipment involved. Additional soil tests such as sieve analysis, soil fusion temperature, and soil heating value are generally needed to achieve proper incineration. Transportation costs, energy costs to sustain high temperatures, and regulatory compliance are higher than LTTD and HTTD described above.

Soil Excavation and Biological, Physical, or Chemical Treatment

Soil washing is a water-based process for mechanically scrubbing excavated soil to remove contaminants by dissolving or suspending them in the wash solution. Wastewater used for soil washing is treated on-site prior to discharge. A bio-slurry reactor is a hybrid soil washing technique that is used to treat a slurry of wastewater and contaminated soil. A mobile unit will be used to treat (washed) soil on-site, and returned to the excavation as backfill material. Semi-volatile organics and hydrophobic contaminants may require the addition of a surfactant or organic solvent. A bench or pilot-scale treatability tests may be needed to determine the best operating conditions and wash fluid compositions for soil washing and or bio-slurry treatment.

7.3.3 Description of Retained Alternatives

Table 7-3 provides summaries of the descriptions of retained soil remedial alternatives that follow. Table 7-4 includes a summary of all alternatives, those retained and not retained for evaluation.

7.3.3.1 No Action

A "no action" alternative for soil was retained for screening as required by the NCP as a basis for comparing other alternatives. Implementation of no further action consists of leaving contaminated soil in place; no engineering, maintenance, or monitoring would be required. The no action alternative does not meet the RAOs for the Site.

7.3.3.2 Institutional Controls

Institutional controls for soil include fencing, deed restrictions, or legislative action to prevent exposure to existing subsurface soil contamination in the upper bluff area and in Kreher Park. Institutional controls could easily be implemented, and the relative cost is very low. As previously described, surface barriers in the upper bluff area and in Kreher Park currently prevent direct contact and ingestion pathways for contaminated soil.

As with the no action alternative, the long-term effectiveness of this option is considered low because it will not reduce the toxicity, mobility, and volume of subsurface soil contaminants (beyond any passive biodegradation which may be occurring). Additionally, soil contamination will remain as a source for groundwater contamination in the upper bluff area and Kreher Park fill units. However, fencing, deed restrictions, or legislative actions could be implemented to protect public health, safety and welfare and the environment over the long term, but future site use will be restricted. Institutional controls may be acceptable to the community and Agency only in combination with other active remedial technologies described below.

7.3.3.3 Containment

The use of existing asphalt pavement and low permeability soil units as surface barriers were retained for screening as a passive containment alternative for soil, and is described below. Engineered surface barriers and vertical barriers were evaluated as active containment alternative for groundwater in Section 7.4 and for sediment in Section 7.5.

Existing surface barriers consist of asphalt pavement or fine grained soil caps overlying areas with contaminated soil. These barriers prevent direct contact with contaminated unsaturated zone soils eliminating the direct contact exposure pathway.

Implementability

Surface barriers can be implemented as a remedial alternative for soil contamination at the Site. As described in Section 7.3.2.4, asphalt pavement and the NSPW facility building at the upper bluff along with the fine-grained low permeability fill soil unit installed at the former seep area at

Kreher Park perform as surface barriers. Existing surface barriers will need to be improved (i.e. repair cracks) to provide an effective barrier to subsurface contamination, and additional barriers will need to be installed at other areas. Additional asphalt pavement will need to be installed at the NSPW storage yard on the south side of St. Clair Street to prevent exposure to contamination in the underlying filled ravine in this area. Soil barrier caps or asphalt pavement could also be installed at other locations at Kreher Park. Surface barriers will likely be acceptable to the community and Agency if implemented in combination with other active remedial technologies for groundwater.

Existing or additional surface barriers will need to be maintained, or replaced if current site use changes. Contaminants in the smear and saturated zones will remain as a source for groundwater in both shallow fill units. Existing down gradient extraction well EW-4 was installed in the backfilled ravine to prevent contaminants from discharging from this shallow groundwater unit to the seep area at Kreher Park, and has been in operation since 2002. This well may need to be operated for an extended period of time to prevent contaminants from migrating off-site with groundwater from the ravine fill unit. A vertical barrier wall could also be installed at the mouth of the backfilled ravine as described in Section 7.4.5. This barrier wall will require operation of EW-4 or a similar extraction system to reduce the hydraulic pressures on the up gradient side of the wall i.e. to create an inward gradient. An evaluation of the volume of groundwater discharged from the backfilled ravine along with a capture zone analysis for EW-4 will need to be completed as part of the evaluation of the continued use of the extraction well, or use of an extraction system with a vertical barrier.

Effectiveness

Engineered surface barriers will effectively prevent direct contact with contaminated unsaturated zone soils eliminating the direct contact exposure pathway. Asphalt pavement and low permeability soil caps also promote runoff. This would reduce infiltration which in turn reduces contaminant leaching from the unsaturated zone. However, this alternative would not reduce contaminant mass or toxicity, or reduce the potential migration of contaminants from source areas. Long-term maintenance of barriers would be required, and the surface barriers may need to be replaced if current Site usage changes. Existing down gradient extraction well EW-4 would need to be operated for an extended period of time to prevent the migration of contaminants from the ravine fill unit with groundwater, or to reduce the hydraulic gradient behind a vertical barrier installed at the mouth of the ravine.

Cost

The relative cost to implement surface barriers in the upper bluff area and Kreher Park would be very low. Existing asphalt pavement south of St. Claire Street and low permeability soil in Kreher Park are currently functioning as surface barriers, but would need to be improved to meet ARARs. Surface barriers could also be installed in other areas; additional asphalt pavement may be needed in the NSPW storage yard on the north side of St. Claire Street. Future costs would include replacing, improving, or installing new surface barriers, long-term maintenance of these surface barriers, and long-term operation of EW-4 and groundwater monitoring.

7.3.3.4 In-situ Treatment – Chemical Oxidation with Soil Vapor Extraction

Chemical oxidation was retained for screening as a potential in-situ treatment alternative for contaminated soil encountered in the ravine fill and for the former Coal Tar Dump Area as previously described. This alternative could also be used to treat shallow saturated zone soils, which may require groundwater extraction rather than vapor extraction to recover contaminants. Chemical oxidation was also evaluated as a groundwater remedial alternative for the underlying Copper Falls aquifer in Section 7.4.

Chemical oxidation consists of the addition of oxidation chemicals such as permanganate, peroxide, or ozone, to the subsurface to chemically destroy constituents of concern. Permanganate or peroxide could be injected as liquid reagents through boreholes, wells, or mixed with a backhoe in shallow trenches. Chemical oxidation has an added benefit of enhancing biodegradation by increasing oxygen concentrations in the subsurface.

Implementability

The implementability of in-situ chemical oxidation is high, but existing conditions may limit implementability at the upper bluff area (the NSPW facility building and buried gas holders) and at Kreher Park (shallow water table) as previously described. Because in-situ chemical oxidation reactions can result in the generation of off-gases, primarily CO_2, passive venting or an active SVE system may be required to capture off-gases, which would also enhance the biodegradation of residual contaminants in the backfilled ravine.

Effectiveness

In-situ chemical oxidation is most effective when treating source areas soils with high contaminant concentrations. The presence of free-phase hydrocarbons (tar) may require multiple applications to lower contaminant concentrations to acceptable levels. Mixing reagent in shallow trenches would be the most effective treatment method at Kreher Park because contamination is present at shallow depths at the former Coal Tar Dump Area, and would be easily accessible. At the upper bluff area, reagent would be injected into the surface via numerous small diameter borings advanced into contaminated zones. Although mixing in an open trench is more effective, both methods would result in a significant reduction of the contaminant mass, and reduce future potential off-site migration of contaminants with groundwater from source areas; this will in turn permit unlimited future site use. If it can be implemented effectively, in-situ chemical oxidation would likely be acceptable to the community and Agency.

Cost

The relative cost to implement chemical oxidation at the upper bluff area would be high to very high; costs would increase if multiple applications are needed to reach the desired clean-up levels. The cost of chemical oxidation in the Kreher Park is expected to be significantly lower when compared to upper bluff area because shallow soil contamination in the coal tar dump area is suitable for mixing in an excavation. Contamination in the filled ravine would be treated in-situ via small diameter borings, which may require multiple applications. Costs would include

injection/mixing (raw materials and contractor costs), installation of a passive venting or SVE system, and post remediation monitoring.

7.3.3.5 In-situ Treatment – Steam Injection with Soil Vapor Extraction

Steam injection in conjunction with soil vapor extraction were retained for screening as a potential in-situ treatment alternative for contaminated soil encountered in the ravine fill at the upper bluff area and for the former Coal Tar Dump area at Kreher Park fill soils as previously described. This alternative could also be used to treat shallow saturated zone soils, which would require /groundwater extraction rather than vapour extraction to recover contaminants. Steam injection would consist of the installation of steam injection wells and soil vapor recovery (extraction) wells. Contaminants would be removed by injecting stream into the subsurface to mobilize volatile and semi-volatile contaminants that would be recovered by vapor extraction wells.

Implementability

The implementability of steam injection and soil vapor extraction is moderate because existing conditions may limit its implementability. At the upper bluff area, the existing NSPW facility building and buried structures (gas holders) may prevent the installation of injection and extraction wells. Additionally, contaminants may not be accessible for treatment if located beneath buried structures (or in cavities within the buried structures). At Kreher Park, fine-grained low permeability soils and the shallow depth to groundwater may limit the use of soil vapor extraction; groundwater extraction also may be required to implement this remedial alternative at the former Coal Tar Dump Area.

Effectiveness

Steam injection and soil vapor extraction would be highly effective at removing MGP tar waste. It would reduce the mass and toxicity of contaminated soil, and prevent future off-site migration of contaminants with groundwater from source areas, which would permit unlimited future site use. If it can be implemented effectively, steam injection and soil vapor extraction would likely be acceptable to the community and Agency.

Cost

The relative cost to implement steam injection and soil vapor extraction at the upper bluff area would be high to very high. Costs would include the installation of injection and extraction wells, steam injection and SVE, energy costs, and post remediation monitoring. The relative costs to implement steam injection and soil vapor extraction at Kreher Park would be higher if extensive groundwater extraction is required.

7.3.3.6 Removal

Unlimited removal would consist of the removal of all fill soil from the backfilled ravine and Kreher Park, and the construction of an on-site or nearby off-site disposal facility. Following

removal of all fill soil in the upland area, the ravine could be backfilled with salvaged soil from Kreher Park. As described in Section 7.3.2.6, following removal of all fill from Kreher Park, Kreher Park could be restored to pre-filling conditions (i.e. wetland area), backfilled with clean fill to restore it to present elevations, or backfilled with contaminated sediment. Backfilling with contaminated sediment would require the construction of an on-shore confined disposal facility (CDF) for the placement of material removed from the adjacent inlet area. As described in Section 5.4.11, Chapter 30 does not prohibit construction of a near shore confined disposal facility (CDF) and disposal of dredged sediments into a newly constructed CDF. If contaminated soil is excavated below the water table, removal and treatment of contaminated groundwater seeping into the excavation will likely be required. At Kreher Park, unlimited removal will also require construction of a dike or vertical barrier along the shoreline to isolate the excavation area from the adjacent inlet area.

Limited removal will consist of the excavation of contaminated soil from source areas. Excavated material could then be treated ex-situ (i.e. thermal desorption, incineration, or soil washing) and returned to the excavation, or transported off-site for disposal. At the upper bluff area, limited removal will include the excavation of contaminated soil in the backfilled ravine south of St. Claire Street where NAPL is encountered. Assuming an average depth of 15 feet, this will require the removal of 7,600 cubic yards of material. At Kreher Park limited removal will include excavation of contaminated soil above the wood waste layer in the former "Coal Tar Dump Area." This will consist of the removal of approximately 4,000 cubic yards of material from the former Coal Tar Dump area. This includes the removal of a contaminated soil zone approximately five feet thick, but does not include the removal of the underlying saturated wood waste layer[9]. If contaminated soil is excavated below the water table, removal and treatment of contaminated groundwater seeping into the excavation will likely be required.

Implementability

Because contaminated soil is encountered at shallow depths, limited removal by excavation could be easily implemented with conventional earth moving equipment. Removal near the former MGP will result in significant site disturbance. This will require the demolition and removal of the center portion of the NSPW service center building. It will also require the removal of buried structures (i.e. former gas holders). Removal of the entire filled ravine (unlimited removal) will require removal and replacement of a section of St. Claire Street and buried utilities along the street. If the excavation is completed below the water table, the removal and treatment of groundwater seeping into the excavation will likely be required in both areas. These excavations would be backfilled with clean soil following the removal of contaminated soil to the extent practical.

Excavated areas in Kreher Park will also be backfilled with clean fill if removal is limited to small areas. If unlimited removal of Kreher Park is required, site restoration alternatives include restoring this area to pre-filling conditions (i.e. wetland area), construction of a CDF for the

[9] Obvious signs of contamination (i.e. strong odors and stained soil) were encountered in the underlying wood waste layer throughout Kreher Park, but the former coal tar dump area was the only location where obvious signs of contamination were encountered above the wood waste layer. Because the wood waste layer is within the saturated zone, remedial alternatives for the wood waste layer were addressed as potential groundwater remedial alternatives.

disposal of sediment from the adjacent inlet area, or backfilling Kreher Park with clean fill to pre-removal conditions. In addition, the release of VOCs into the atmosphere may pose a short term health risk to the Ashland community during construction if not properly controlled.

Effectiveness

Excavation would be highly effective at removing soil contamination from source areas described above and areas with low to moderate levels of soil contamination. Contaminated soil from both the unsaturated and shallow saturated zones could be removed. . Restoration of Kreher Park must be balanced against the election of an acceptable remediation alternative for sediment, intended future site use of Kreher Park and the off-shore inlet area, and cost to be acceptable to the Community.

Cost

The cost for limited removal would be low to moderate, but the cost for unlimited removal would be very high. However, construction on an on-shore CDF may lower sediment remediation costs if treatment of sediment and/or off-site disposal of sediment can be prevented. Costs will include site preparation, excavation, transportation and disposal, and site restoration. The removal and treatment of groundwater seeping into the excavation will increase cost. If an on-site or nearby off-site facility is required, costs will include siting, construction, and long-term operation, maintenance, and monitoring. Removal costs do not include ex-situ treatment costs, which are described in the following section.

7.3.3.7 Ex-situ Treatment – Limited Excavation and Off-site Disposal

Excavation and off-site disposal was retained for screening as a potential ex-situ treatment alternative for contaminated soil encountered in the ravine fill at the upper bluff area, and for the former Coal Tar Dump area. As previously described, this will included the removal of contaminated soil from source areas by excavation. Removal and treatment of groundwater seeping into the excavation will be required in both areas if the excavation is completed below the water table.

Implementability

Although this alternative will result in significant site disturbance, limited excavation and off-site disposal could be implemented at the upper bluff area and at Kreher Park because contaminated soil has been identified at shallow depths (less than 20 feet in the backfilled ravine, and less than 10 feet at the former coal tar dump area). This alternative will consist of removal by excavation of contaminated soil from both source areas and the removal and treatment of water seeping into the excavations.

Effectiveness

Limited excavation and off-site disposal would be highly effective at removing contamination from the backfilled ravine and from the former Coal Tar Dump Area from the saturated and

unsaturated zones. This alternative would result in a significant reduction in the contaminant mass, and reduce future potential off-site migration of contaminants with groundwater from source areas, permitting unlimited future site use. However, the toxicity of the contaminated mass will not be reduced, and selection of a suitable off-site disposal facility will be required. If it can be implemented effectively, limited excavation and off-site disposal will likely be acceptable to the community and Agency.

Cost

The relative cost for limited excavation and off-site disposal would be moderate to high. The removal and treatment of groundwater seeping into the excavation would increase costs, but the removal of contaminated soil from the unsaturated zone would result in lowered costs for groundwater remediation at these areas. Costs will include excavation, transportation, landfill disposal, and costs for laboratory services for confirmation soil and groundwater monitoring.

7.3.3.8 Ex-situ Treatment – Limited Soil Excavation and On-site Thermal Desorption

Excavation and on-site thermal desorption was retained for screening as a potential ex-situ treatment alternative for contaminated soil removed from the ravine fill in the upper bluff area and from the former Coal Tar Dump area in Kreher Park fill soils. As previously described, this will include removal by excavation of contaminated soil from both source areas and the removal and treatment of groundwater seeping into the excavations.

Implementability

On-site thermal treatment utilizing a mobile treatment unit could be implemented, but will result in significant site disturbance at the upper bluff area. As described in Section 7.3.3.6 above, this will require the demolition and removal of the center portion of the NSPW service center building. It will also require the removal of buried structures (i.e. former gas holders). Ex-situ treatment will require the excavation of contaminated soil. Oversize debris that cannot be thermally treated will likely need to be transported off-site for disposal. Treated soil would be returned to the excavation as backfill. Dewatering may be necessary to achieve acceptable soil moisture content levels for treatment, and debris (i.e. bricks, concrete, and wood) must be separated from soil for off-site disposal.

Effectiveness

On-site thermal treatment will be effective at removing contamination from the backfilled ravine and from the former Coal Tar Dump Area from the saturated and unsaturated zones. Thermal treatment of contaminated soil will also reduce the toxicity of the contaminated soil. Limited excavation and on-site thermal treatment will likely be acceptable to the community and Agency.

Cost

The relative cost for limited excavation and on-site thermal treatment will be moderate to high. Removal and treatment of contaminated groundwater seeping into the excavation will increase

costs, but the removal of contaminated soil from the unsaturated zone will result in lowered costs for groundwater remediation at these areas. Retuning treated soil to the excavation (rather than backfilling with clean fill from an off-site source) will lower the relative cost of the remedial alternative. Costs will include excavation, thermal treatment, and laboratory services for confirmation soil and groundwater monitoring.

7.3.3.9 Ex-situ Treatment – Limited Soil Excavation and On-site Soil Washing

Excavation and on-site soil washing was retained for screening as a potential ex-situ treatment alternative for contaminated soil removed from source areas at the upper bluff area and the former Coal Tar Dump area. Contaminated soil from the saturated and unsaturated zones will be treated following removal by excavation. Contaminants are either removed by dissolving or suspending them in a wash solution, or reducing concentrations in smaller volumes of soil by gravity separation. Slurry phase biological treatment (bio-slurry) is a hybrid soil washing technique. An aqueous slurry is created by combining soil, sediment, or sludge with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. Upon completion of the process, the slurry is dewatered and the treated soil is disposed or returned to the excavation. Material processing equipment (mixing unit and batch tanks) and water treatment equipment will require room for setup near one of the excavation areas.

Implementability

Because buried structures will prevent in-situ mechanical mixing, excavation of contaminated soil from the saturated and unsaturated zones will be required. As with the off-site disposal and thermal treatment alternatives, on-site soil washing could be implemented at the upper bluff area and at Kreher Park because contaminated soil has been identified at shallow depths. Treated soil will then be used to backfill excavations. A pilot test or bench scale test will be required to evaluate suitable wash solutions or biological treatment options.

Effectiveness

The effectiveness of soil washing for soil contaminated with MGP tar waste is considered low to moderate. A surfactant may be needed to separate tar from the soil matrix before soil is treated by washing. Liquid waste streams will be generated, which will require additional treatment or off-site disposal. Soil washing will significantly reduce contaminant concentrations, but residual low concentrations may remain in treated soil. A pilot test may be required to evaluate the effectiveness of soil washing. Residual contamination may limit future site use. Regardless, this alternative will result in a reduction in contaminant mass and toxicity and enhance the protection of human health and the environment. Limited excavation and on-site soil washing will likely be acceptable to the community and Agency.

Cost

The relative cost for limited excavation and on-site soil washing will be very high. As with the off-site disposal and thermal treatment alternatives, excavation de-watering will increase costs,

but the removal of contaminated soil from the unsaturated zone will result in lowered costs for groundwater remediation in these areas. Retuning treated soil to the excavation (rather than backfilling with clean fill from an off-site source) will lower the relative cost of the remedial alternative. Costs will include excavation, soil washing, and costs for laboratory services for confirmation soil and groundwater monitoring.

7.4 Groundwater – Shallow Ravine Fill at Upper Bluff Area and Fill Soils at Kreher Park, and Underlying Copper Falls Aquifer

7.4.1 Chemicals of Potential Concern

As with soil, screening focuses on VOCs and PAHs contained in MGP tar waste as the primary COPCs.

7.4.2 Screening of Groundwater Remediation Alternatives

Potential remedial alternative alternatives capable of preventing direct contact and ingestion of contaminated groundwater or reducing the toxicity and mobility of groundwater contamination at the Site are summarized in Table 7-5. Alternatives retained for further consideration are shown in bold in that table. Potential remedial alternatives are described below.

7.4.2.1 No Action

Implementation of no further action for groundwater will consist of no further planning, maintenance, or monitoring. A “no action” alternative, however, does not meet the RAOs for the Site, and will not be acceptable to the community or the Agency. However, a “no action” alternative for groundwater was retained for screening as required by the NCP as a basis for comparing the other alternatives.

7.4.2.2 Institutional Controls

Institutional controls for groundwater will require groundwater use/deed restrictions, or legislative action to prevent the use of groundwater within the Site boundaries. These institutional controls should not restrict future site use because the Site is in an area serviced by a municipal water supply (this eliminates the need for an on-site source for potable water). However, groundwater use/deed restrictions will be required. If implemented, it will protect public health over the long term, but will not result in a reduction in contaminant mass, toxicity, or mobility. Institutional controls do not meet the RAOs for the Site as a stand alone alternative, but were retained for screening because they may be acceptable to the community and Agency in combination with other active remedial technologies.

7.4.2.3 Monitored Natural Attenuation

Monitored Natural Attenuation (MNA) will consist of the baseline collection of geochemical and biochemical indicator parameters to demonstrate that site conditions are suitable for remedial action by natural processes. Periodic groundwater samples will be collected after the baseline

event to demonstrate that contaminant concentrations are declining. Although MNA does not meet the RAOs for the Site as a stand alone alternative, it was retained for screening because it may be acceptable to the community and government agencies in combination with other active remedial technologies.

7.4.2.4 Containment

Containment for groundwater contamination consists of the utilization of natural or man-made barriers to prevent potential exposure or migration of contaminants with groundwater. Containment alternatives include engineered surface barriers, engineered vertical barrier walls installed in the aquifer, installation of down gradient extraction wells (barrier wells) to prevent the off-site migration of contaminants, and/or use of injection wells to dispose of contaminants in formations which will isolate the materials and prevent future exposure.

Deep well injection is a liquid waste disposal technology aquifers. Extensive site characterization will be required to identify these formations for disposal. These geologic units have not been investigated at the Ashland site. However, regional information indicates that the Copper Falls aquifer is underlain by the Oronto Sandstone (encountered in MW-2C and a water supply aquifer in the region), which in turn is underlain by crystalline pre-Cambrian basalt. It is unlikely that deep well injection in these units will result in isolation of contaminants. Consequently, deep well injection was not retained for screening because other remedial alternatives would be more cost effective and acceptable to the community and agencies.

Engineered surface barriers and vertical barrier walls were retained for further evaluation as potential containment alternatives for shallow contaminated groundwater encountered in the ravine fill at the upper bluff and at Kreher Park. Vertical barrier walls would not be feasible for the underlying Copper Falls aquifer because this deep aquifer is confined by the Miller Creek formation creating strong upward gradients. Installation of a barrier wall for contaminants in the Copper Falls aquifer will require penetration of the Miller Creek, which will likely compromise the long-term integrity of the confining unit.

Down gradient barrier wells were also retained for shallow groundwater at the upper bluff and at Kreher Park. Properly engineered, these wells will prevent contaminants from migrating off-site with groundwater. Hydraulic containment for the Copper Falls aquifer was not retained for screening because NAPL encountered at the Miller Creek/Copper Falls interface will remain as a continual source for dissolved groundwater contamination; this may not be acceptable to the community and agencies. However, down gradient barrier wells were not considered for the Copper Falls aquifer because site investigation results have identified a stagnation zone at Kreher Park near the leading edge of the plume; site investigation results indicate that groundwater contamination has not migrated beyond the shoreline.

Engineered surface barriers, vertical barrier walls and barrier wells are technologies considered active containment alternatives because contaminated material may be disturbed, and/or long-term maintenance such as groundwater extraction may be required. Each type of barrier could be used to achieve RAOs and were retained for screening. These alternatives are described below.

Engineered Surface Barrier for Groundwater

In addition to preventing direct contact with subsurface contamination, engineered surface barriers could also be used to severely restrict infiltration of precipitation. Although this will not reduce contaminant mass or toxicity, it will limit the mobility of contaminants leaching from the unsaturated zone. Engineered surface barriers for groundwater include the following:

- Asphalt cap
- Clay cap
- Multi-layer cap with a minimum two-foot thick clay barrier, drainage layer, soil and vegetated top soil cover
- Multi-layer cap with geomembrane or equivalent (geocomposite fabric layer or GCL)

Asphalt caps can be used as single-layer caps to form a surface barrier between contaminated soil and the environment. An asphalt concrete cap could also be designed to reduce infiltration into the subsurface. Clay caps and multilayer caps could be designed in accordance with RCRA Subtitle C and D requirements, respectively. The RCRA C multilayered landfill cap is a baseline design that is suggested for use in RCRA hazardous waste applications. These caps generally consist of an upper vegetative (topsoil) layer, a drainage layer, and a low permeability layer which consists of a synthetic liner over two feet of compacted clay. The compacted clay liners are effective if they retain a certain moisture content but are susceptible to cracking if the clay material is desiccated. As a result alternate cap designs are usually considered for arid environments. RCRA Subtitle D requirements are for non-hazardous waste landfills. The design of a landfill cover for a RCRA Subtitle D facility is generally a function of the bottom liner system or natural subsoils present. The cover must meet the following specifications:

- The material must have a permeability no greater than 1 x 10-5 cm/s, or equivalent permeability of any bottom liner or natural subsoils present, whichever is less.
- The infiltration layer must contain at least 45 cm of earthen material.
- The erosion control layer must be at least 15 cm of earthen material capable of sustaining native plant growth.

Engineered Vertical Barrier Walls

Vertical barriers walls consist of a slurry wall or sheet piling installed around the perimeter of the contaminated soil zone. A slurry wall is a low permeability barrier constructed by placing a low permeability material (slurry) in a trench around the perimeter of the contaminated soil mass. Sheet piling consisting of inter-locking sheets of steel pilings form a continuous wall installed around the perimeter of the contaminated soil mass. Both types of vertical barriers can be anchored into the underlying Miller Creek Formation to prevent contaminants in the shallow fill units from migrating off-site with groundwater. An engineered surface barrier would be installed to prevent infiltration, and/or contaminated groundwater from the contained area would be extracted and treated. For Kreher Park, this alternative may be used in combination with containment alternatives evaluated for near shore sediment described in Section 7.5.

Down Gradient Barrier Wells

As described in Section 7.3.3.3, existing down gradient extraction well EW-4 was installed at the mouth of the backfilled ravine to prevent contaminants from discharging from this shallow groundwater unit to the seep area at Kreher Park. It has been in operation since 2002. A final remedy for ravine groundwater could include continued operation of EW-4, or continued operation along with a vertical barrier wall installed down gradient from the extraction well (use of EW-4 will reduce the hydraulic head behind the vertical barrier). However a thorough hydraulic containment evaluation and demonstration will be needed to show that the EW-4 is capable of capturing and preventing discharge of contamination from the ravine to seep area in Kreher Park. An evaluation of the volume of groundwater discharging from the backfilled ravine and a capture zone analysis for EW-4 will be necessary to evaluate which alternative will be more effective.

Barrier wells could be installed at Kreher Park to create a capture zone for contaminants in the shallow Kreher Park fill groundwater. Because the Park is laterally extensive and groundwater is encountered at a shallow depth, shallow trenches rather than wells could be used more efficiently to create a capture zone in this area. Installing a vertical barrier wall along the shoreline would prevent seepage of surface water into fill soils and significantly reduce the volume of groundwater extraction required to create a sink. The remedial response implemented for shallow soil and groundwater in Kreher Park will need to be coordinated with the remedial response implemented for sediment.

7.4.2.5 In-situ Treatment

In-situ treatment for groundwater consists of the in place treatment by biological, chemical, physical, or thermal processes. These remedial technologies are described below.

Biological Treatment

Biological treatment stimulates an indigenous microbial population to degrade contaminants by adding electron acceptors and/or nutrients that may not otherwise be available or abundant. Oxygen is the main electron acceptor for aerobic bioremediation, and nitrate serves as an alternative electron acceptor under anoxic conditions. Oxygen enhancement can be achieved by air/ozone sparging below the water table, or by introducing oxygen rich fluids into the aquifer using injection or circulation wells. These technologies are best suited for low to moderate levels of contamination, and will not be effective at areas containing free-phase hydrocarbons. No biological treatment alternatives were retained for screening. However, ozone sparging and chemical oxidation were retained for screening as chemical treatment alternatives; oxygen enrichment that could stimulate aerobic bioremediation of dissolved phase contaminants is an added benefit for these technologies.

Chemical Treatment

In-situ chemical treatment of groundwater consists of the addition of chemicals into saturated zones to react with and degrade contaminants. Chemicals resulting in an oxidation reaction can

be used to treat MGP contamination. Hydrogen peroxide (H_20_2) and ozone (O_2) are the most commonly used oxidizing agents. In-situ treatment chemical oxidation consists of the introduction of strong oxidizing agents into the subsurface to degrade contaminants. Chemical oxidation can be used to treat unsaturated and saturated contaminated soils by injecting chemicals into the subsurface via borings or wells, or by mixing chemicals in a shallow excavation. Injection of strong concentrations of hydrogen peroxide produces a rapid reaction (Fenton's reaction). This reaction results in the generation of organic vapors that may need to be captured by a soil vapor extraction system. A passive or active SVE system can be used to collect off gases generated during treatment of shallow soil and groundwater, which is performed simultaneously. In-situ chemical oxidation in the saturated zone may also require groundwater extraction to remove NAPL displaced or mobilized by injection of oxidizing agents.

Implementation for the underlying Copper Falls aquifer would be significantly more extensive. Early indications from the recent SITE program demonstration performed during late 2006 and early 2007 show an increase in the rate of NAPL removed at the existing recovery system as a result of the injected reagent. However, these data are preliminary and are currently being developed as part of the final SITE demonstration report.

Because ozone is a gas, it can be injected into the saturated zone as a gas via sparging. Sparging consists of injecting air or oxygen rich ozone into an aquifer as a gas through small diameter sparge wells. Commercially, ozone is generated by a high voltage discharge through air or oxygen in an ozone generator. Generally, yields are on the order of 1 to 3 percent ozone by volume in air and 2 to 6 percent ozone by volume in oxygen. In water, ozone decomposes to form the free radicals. These free radicals are strong oxidizers and react with contaminants in water to form carbon dioxide and water. As an additional benefit, ozone treatment increases the dissolved oxygen level in the water when any unreacted free radicals combine to form water and oxygen, which increases the dissolved oxygen content in groundwater promoting biodegradation of contaminants. Ozone sparging could be used in areas with low to moderate levels of contamination. It was also retained for screening because it may be acceptable to the community and agencies in combination with other active remedial technologies.

Chemical oxidation will need to be used with other remedial technologies (i.e. soil vapor and groundwater extraction). It was retained for screening because the USEPA sponsored SITE demonstration pilot test performance evaluation will be completed in the near future. Ozone sparging could be used in areas with low to moderate levels of contamination. It was also retained for screening because it may be acceptable to the community and Agency in combination with other active remedial technologies.

Physical/Chemical Treatment

Physical/chemical treatment includes the use of surfactants to enhance the removal of free-phase hydrocarbons, and the use of permeable reactive barrier (PRB) walls to treat contaminated groundwater migrating from source areas. Because surfactant use requires recovery and ex-situ treatment, it was retained for screening as a recovery/ex-situ remedial alternative for groundwater. It is described in the following section. PRB walls are limited to subsurface conditions where contaminants are bound within a continuous aquitard at a depth within the vertical limits of trenching equipment. PRB walls were not retained for the underlying Copper

Falls aquifer. The top of the aquifer at the down gradient limit at Kreher Park is beyond 35 feet in depth. The contaminant mass within the DNAPL plume at this down gradient limit is below 75 feet. Although vertical walls have been installed up to 100 feet in depth, the confining conditions and the strong upward gradients in the Copper Falls aquifer will require penetration of the overlying Miller Creek confining unit. This will compromise the integrity of the confining unit. However, a PRB could be used as a remedial alternative for shallow groundwater encountered at the Site.

PRB walls are installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall. There are two types of barriers, 1) permeable reactive barriers and 2) in-place bioreactors. These barriers allow the passage of water while prohibiting the movement of contaminants. Contaminants are either degraded or retained in a concentrated form by the barrier material. The wall could provide permanent containment for relatively benign residues or provide a decreased volume of the more toxic contaminants for subsequent treatment. Passive treatment walls are generally intended for long-term operation to control migration of contaminants in ground water.

Thermal Treatment

As previously described, thermal treatment uses a heat source such as electrical resistance, electromagnetic/radio frequency heating, hot-air, hot water, or steam injection to increase the volatilization rate of SVOCs and facilitate extraction. A passive or active SVE system and/or groundwater extraction wells will be required to remove contaminants. Treatment of the extracted groundwater will also be required.

Electrical resistance heating technology uses electricity applied to the subsurface soils through electrodes, creating an electric field that heats the formation. This mobilizes contaminants, which are then recovered with a SVE system. Implementation of this technology for shallow soil and groundwater contamination could be completed simultaneously, but SVE and groundwater extraction will be required. Groundwater extraction wells will be required in place of SVE wells if implemented for the underlying Copper Falls aquifer. Consequently, this technology was retained as a potential in-situ treatment alternative for groundwater.

Steam extraction physically separates volatile and semi-volatile organic constituents from soil by thermal or mechanical energies. Implementation for soil and shallow groundwater remediation can be completed simultaneously, and was evaluated as a remedial alternative for soil in Section 7.3 above. Implementation for the underlying Copper Falls aquifer will require groundwater extraction and treatment of contaminated fluids mobilized by heating via a hybrid steam injection process called Dynamic Underground Stripping (DUS). DUS was retained for screening as a potential remedial alternative for groundwater in Section 7.4.3.

Hydrous Pyrolysis/Oxidation (HPO) is a process sometimes completed after contaminants are removed during the DUS phase. HPO consists of steam and air injection, which creates a heated, oxygenated zone in the subsurface. After the injection is terminated the steam condenses causing contaminated groundwater to migrate to the heated zone where it mixes with the condensed steam and oxygen. Although this may destroy some microorganisms impeding natural biodegradation, HPO enhances biodegradation of residual contaminants by stimulating

other microorganisms (called thermophiles) that thrive at high temperatures. A pilot test will be needed to evaluate the effectiveness of HPO after DUS. It was retained for screening as a potential remedial alternative for groundwater with DUS in Section 7.4.3.

Contained Recovery of Oily Waste (CROW) is a patented process that involves the injection of heated water into groundwater to mobilize nearby oily wastes that then can be removed via extraction wells. The pumped groundwater/oily waste mixture is subsequently separated for disposal or recycling; some of the extracted water can be treated and heated for utilization in continuing the subsurface injection process. The remaining extracted water is typically treated on-site prior to discharge. The groundwater extraction rate needs to exceed the hot water injection rate to provide hydraulic containment so that wastes are not spread beyond the treatment area. High concentrations of dissolved iron in groundwater can reduce injection rates and complicate treatment for extracted water. The CROW process has been utilized at MGP sites to successfully remove coal tar from the subsurface. As a result, CROW was retained for screening as a potential remedial alternative for groundwater.

7.4.2.6 Removal

Removal of contaminated groundwater will consist of removal of NAPL and/or dissolved phase hydrocarbons from groundwater extraction wells. Removal technologies are also evaluated as ex-situ treatment in Section 7.4.2.6. Additionally, removal for groundwater could include the removal and treatment of saturated zone soil, described in Section 7.3.

Groundwater and NAPL

Groundwater extraction uses water as a carrier to remove both dissolved phase and NAPL contamination. Groundwater extraction is used as an active containment alternative to remove contaminants from source areas, or remove contaminants from throughout the plume. For containment, only down gradient extraction wells (barrier wells) are used to prevent contaminants from leaving the site. As described in Sections 7.3.3.3 and 7.4.2.4, existing down gradient extraction well EW-4 was installed in the backfilled ravine to minimize contaminants from discharging with the shallow ravine groundwater to the seep area at Kreher Park. It has been in operation since 2002. This extraction well will necessarily be operated for an extended period of time to prevent contaminants from migrating off-site with groundwater from the ravine fill. A vertical barrier wall could also be installed at the mouth of the backfilled ravine as described in Section 7.4.5. This barrier wall will require operation of EW-4 or a similar extraction system to reduce the hydraulic pressures on the up gradient side of the wall. An evaluation of the volume of groundwater discharged from the backfilled ravine along with a capture zone analysis for EW-4 will be required as part of the evaluation of the continued use of the extraction well, or use of an extraction system with a vertical barrier.

Groundwater extraction with NAPL removal from the source area was retained for screening... A groundwater extraction system consisting of three low flow extraction wells screened in the Copper Falls aquifer near the former MGP is currently used to remove contaminants from this source area. This system was installed in September 2000. Since that time, approximately 1.5 million gallons of groundwater mixed with emulsified NAPL have been treated on-site.

Treatment has included the removal and off-site disposal of approximately 8,300 gallons of NAPL, which is separated by an oil water separator; dissolved phase contaminants are treated on-site by carbon filtration prior to discharge to the sanitary sewer. NAPL recovered by these wells ranges from four to eight gallons per week (preliminary results of the in-situ chemical oxidation (ISCO) SITE demonstration has shown an increase to nearly 50 gallons per week since the demonstration was completed in early February 2007). At a minimum, this system will continue operation in the source area. Enhanced removal will consist of the installation of additional low flow extraction wells to increase NAPL removal rates. This alternative will not include down gradient contaminant extraction wells because in-situ remedial alternatives (e.g.., ozone sparging) may be more effective for low to moderate concentrations in the down gradient dissolved phase plume.

Multiphase Vacuum Recovery and Surfactant Injection

Multiphase vacuum recovery consists of the installation of small diameter well into NAPL zones. NAPL and groundwater are removed by an induced vacuum using a fixed or mobile extraction system. As with groundwater and NAPL extraction, dissolved and free-phase hydrocarbons are treated on-site. However, the volume of NAPL that can be recovered is increased by this technology because the induced vacuum lowers the interfacial tension that restricts the movement of mobile NAPL in the aquifer (conventional groundwater extraction relies on the gravity drainage of free and dissolved phase contaminants to the well). Multiphase vacuum recovery would be effective for shallow groundwater because NAPL is less than 29-feet (1 atmosphere vacuum) below grade. Although NAPL is encountered near the Miller Creek and Copper Falls aquifer at depths below 30 feet below grade, it could also be used for the underlying Copper Falls aquifer. The potentiometric surface is with 15 to 20 feet below ground surface due to strong upward gradients. However, long-term continued use of multiphase vacuum extraction could result in localized declines in the potentiometric surface below 29 feet.

Multiphase vacuum recovery and surfactant injection were retained for further evaluation as a two step approach. Multiphase recovery will remove the mobile fraction of the NAPL, followed by surfactant injection to mobilize the recalcitrant fraction of free-phase hydrocarbons. After the NAPL thickness decreases, a surfactant, or surface active agent, is injected into these wells to lower the interfacial tension that restricts the movement of non-mobile NAPL in the aquifer. After allowing the surfactant to penetrate the formation for 24 to 48 hours, NAPL and groundwater is then removed by an induced vacuum and treated on-site.

7.4.2.7 Ex-situ Treatment

Ex-situ treatment includes on- or off-site treatment of contaminated groundwater. The existing low flow groundwater extraction system currently uses gravity separation to remove NAPL from recovered groundwater. Separated groundwater is treated on-site by air stripping and carbon filtration before it is discharged to the sanitary sewer. This system may need to be modified for increased volumes, but will likely be used for the treatment of additional flow recovered by removal alternatives described above. No additional ex-situ treatment alternatives were retained for screening. Treatment technologies identified as ancillary technologies in Section 7.6 may require further evaluation.

7.4.3 Screening of Groundwater Remediation Alternatives

Potential remedial alternative alternatives retained for screening are summarized in Table 7-6, and are described below. Table 7-7 includes a summary of all alternatives, those retained and not retained for evaluation.

7.4.3.1 No Action

As previously described, the NCP requires consideration of the no-action alternative at every site. Implementation of the no action alternative would consist of no engineering, monitoring, or restrictions for contaminated groundwater encountered at the Site. The no action alternative could easily be implemented, and the relative cost is very low. Based on current site use, there are no existing direct contact or ingestion pathways for contaminant groundwater. Contaminated groundwater encountered in the backfilled ravine south of St. Claire Street at the upper bluff area is currently located beneath asphalt pavement and the central portion of the NSPW facility building. The pavement and facility buildings provide a surface barrier. Several feet of fine-grained low permeability fill soil at Kreher Park also provides a surface barrier for contaminants within the underlying fill. Two artesian wells that obtain water from the underlying Copper Falls aquifer are located at Kreher Park. These wells are currently restricted from use.

The long-term effectiveness of this alternative is considered low. This alternative will not reduce the toxicity, mobility, and volume of groundwater contaminants (beyond any passive biodegradation which may be occurring). Additionally, NAP will remain as a source for dissolved phase groundwater contamination. Because this option will not protect public health, safety and welfare and the environment over the long-term and will prevent future unrestricted use of the site, it will likely not be acceptable to the community or agencies.

7.4.3.2 Institutional Controls

Institutional controls include groundwater use/deed restrictions, or legislative action to prevent exposure to groundwater contamination at the upper bluff area and Kreher Park. Institutional controls could easily be implemented, and the relative cost is low. As described above, there are currently no exposure pathways for groundwater contamination. Institutional controls could be used to prevent exposure via direct contact and ingestion pathways in the future.

As with the no action alternative, the long-term effectiveness of this option is considered low because it will not reduce the toxicity, mobility, and volume of subsurface soil contaminants (beyond any passive biodegradation which may be occurring). Additionally, soil contamination would remain as a source for groundwater contamination at the upper bluff area and Kreher Park. Although, groundwater use/deed restrictions or legislative actions would protect public health, safety and welfare and the environment over the long term, future site use will be restricted. Institutional controls would likely be acceptable to the community and agencies in combination with other active remedial technologies described below.

7.4.3.3 Monitored Natural Attenuation

Monitored natural attenuation (MNA) was retained for further evaluation for contaminated groundwater encountered in the underlying Copper Falls aquifer. It can also be used for groundwater encountered in the ravine fill at the upper bluff area and at Kreher Park.

Natural attenuation is defined as:

> "..the reduction in the concentration and mass of a substance and its breakdown products in groundwater due to naturally occurring physical, chemical, and biological processes without human intervention or enhancement. These processes include, but are not limited to, dispersion, diffusion, sorption and retardation, and degradation processes such as biodegradation, abiotic degradation and radioactive decay."

To evaluate natural attenuation for a site, a "lines of evidence" approach is normally implemented as described in USEPA guidance [USEPA, 1999]. This approach forms the basis for current protocols and guidance documents. The lines of evidence are:

1) Documented decline in contaminant concentrations at the field scale.
2) Presence and distribution of geochemical and biochemical indicators of natural attenuation.
3) Direct microbiological evidence.

MNA would consist of the periodic baseline collection of geochemical and biochemical indicator parameters to demonstrate that site conditions are suitable for MNA. Prior to implementing MNA, source removal would be required for NAPL. Periodic groundwater samples would then be collected to demonstrate that contaminant concentrations are declining. Existing wells could be utilized, but additional monitoring water table observation wells and piezometers installed in the Copper Falls aquifer will likely be required.

Implementability

The implementability of this option is considered high for shallow and deep groundwater contamination. This alternative will result in little to no site disturbance, but will be required for an extended period of time. Existing monitoring wells along with additional wells installed for long term monitoring could be utilized for the collection of baseline and periodic groundwater samples. Although MNA is not feasible for remediation of NAPL in source areas, it would be feasible for dissolved phase plume contamination.

Effectiveness

The effectiveness of MNA is considered low. MNA is used to measure the effectiveness of natural occurring processes that reduce contaminant mass and toxicity over time. This alternative may not be acceptable at this time because NAPL remain on-site. However, MNA could be implemented with another remedial alternative, for widespread low contaminant levels in Kreher Park fill soils, or for down gradient dissolved phase plumes.

Cost

The relative cost to implement MNA is considered low. Costs will include long-term costs for sample collection, data analysis and reporting, and laboratory expenses.

7.4.3.4 Containment – Engineered Surface Barriers, Engineered Vertical Barrier Walls and Barrier Wells

Engineered surface barriers and vertical barriers were retained for further evaluation as potential containment alternatives for shallow groundwater contamination encountered in the ravine fill at the upper bluff area and at Kreher Park for the fill soils. Implementation of a vertical barrier wall for the underlying Copper Falls aquifer is feasible, but would require significant dewatering of the aquifer to lower the potentiometric surface. This aquifer is confined with strong upward gradients, and installation of a vertical barrier would require penetration of the overlying confining unit. This activity could jeopardize the integrity of the confining unit. As described in Section 7.4.2.4 hydraulic containment via barrier wells and vertical barrier walls were not retained for the Copper Falls aquifer, but were retained for shallow groundwater.

Engineered surface barriers and barrier walls will prevent direct contact with subsurface contamination and prevent the migration of contaminants with groundwater. Engineered surface barriers will prevent leaching of contaminants from the saturated zone, and reduce infiltration into contained areas. Preventing infiltration into contained areas will lower long term operation, maintenance, and monitoring costs; contaminant via vertical barrier wells will require groundwater extraction to lower the hydraulic head behind the barrier.

At Kreher Park, a vertical barrier wall installed along the shoreline will prevent contaminants from discharging to the nearby Chequamegon Bay inlet area. These vertical barrier walls would consist of a slurry wall or sheet piling installed around the perimeter of the contaminated soil zone. Both types of vertical barriers could be anchored into the underlying silty clay of the Miller Creek Formation to prevent contaminated groundwater in the shallow fill units from migrating off-site. Vertical barriers at Kreher Park would need to be installed to a depth of 15 feet to intersect the top of the underlying Miller Creek formation; however, it will be needed for the entire length of the shoreline adjacent to the inlet area. A vertical barrier installed at the bluff face will prevent contaminated groundwater from the upper bluff from continuing discharge to the Park. A groundwater diversion trench (i.e. subsurface drain) installed between the bluff and the southern-most barrier wall will divert this discharge. However, without an impermeable cap (engineered surface barrier), de-watering will be required to reduce the hydraulic head created within the enclosed area. A vertical barrier wall for contaminated groundwater at Kreher Park could also be used in combination with containment alternatives evaluated for near shore sediments described in Section 7.5.

At the upper bluff area, the vertical barrier wall would be placed at the mouth of the backfilled ravine. The ravine is less than 50 feet wide and 30 feet deep (at its deepest point) at this location. However, this would require continued operation of existing well EW-4 or an alternative groundwater diversion system installed in the backfilled ravine to reduce the hydraulic head behind the barrier wall.

Barrier wells could be installed for hydraulic control that would prevent contaminants from migrating off-site with groundwater. Barrier wells for shallow groundwater would consist of the continued operation of EW-4, which was installed in the backfilled ravine to prevent groundwater from discharging to the former seep area at Kreher Park. (As previously described, an evaluation of the volume of groundwater discharging from the backfilled ravine and a capture zone analysis for EW-4 will be required to evaluate the effectiveness of this existing well.) Barrier wells could also be used for shallow groundwater at Kreher Park. Wells or a subsurface drain installed in the saturated fill unit would be used to create a capture zone to prevent contaminants from discharging to the adjacent inlet area with groundwater. This remedy would necessarily be part of a sediment remedy involving removal and/or isolation of contaminated sediments.

Implementability

The implementability of engineered surface and vertical barrier walls is considered high for shallow groundwater in the backfilled ravine and the Kreher Park fill. However, the installation of vertical barrier walls for the underlying Copper Falls Aquifer is low. Hydrogeologic conditions (confined aquifer with strong upward gradients) would make installation formidable and potentially compromise the integrity of the confining unit.

The implementability of barrier wells for shallow groundwater at Kreher Park and the backfilled ravine would also be considered moderate because these wells would also need to be operated for an extensive period of time. The implementability of barrier wells in the Copper Falls aquifer is considered high (however, these were eliminated from further consideration as described in Section 7.4.2.4).

Effectiveness

The effectiveness of engineered surface and vertical barrier walls is considered high for shallow groundwater, but low for the underlying Copper Falls aquifer. The effectiveness of barrier wells for shallow groundwater contamination is considered moderate because long-term operation of barrier wells will be needed. The effectiveness of barrier wells in the Copper Falls is considered low because long term operation of the barrier wells will be needed. Additionally, site investigation results indicate that contaminants are not migrating beyond the shoreline. In Kreher Park, contamination is located beneath the Miller Creek formation, which is the confining unit for the Copper Falls aquifer. This contaminant distribution pattern is created by regional hydrogelogic conditions, which include strong upward vertical gradients a stagnation zone beneath the Park. Contaminants may migrate vertically or laterally if the potentiometric surface in this area is lowered.

Cost

The relative costs to implement vertical barrier walls at the upper bluff area would be low, but the relative cost to install a vertical barrier wall at Kreher Park would be moderate to high; a vertical barrier will likely be needed for the entire length of the Park shoreline. Additionally,

long-term operation will be required for de-watering if an impermeable cap is not placed over the enclosed area. Costs would include installation of the vertical barrier walls and long-term operation of dewatering wells to reduce the hydraulic head behind the barrier.

Costs for barrier wells in both shallow and deep groundwater are considered high. Costs would include installation of groundwater extraction wells, an on-site treatment system at Kreher Park, and long-term operation, maintenance and monitoring.

7.4.3.5 In-Situ Treatment – Chemical Oxidation

In-situ chemical oxidation could be used for unsaturated and saturated zone contamination at the upper bluff area and Kreher Park as described in Section 7.3. It was also retained for screening as potential in-situ treatment alternative for contaminated groundwater encountered in the underlying Copper Falls aquifer in Section 7.4.

Implementability – Chemical Oxidation

The USEPA's SITE program recently completed a demonstration pilot test to fully evaluate the implementability of this alternative at the Site. Additional data will be available in the near future following compilation of pilot test data.

Effectiveness – Chemical Oxidation

The effectiveness of chemical oxidation is considered high, but it is most effective when used in source areas. Chemical oxidation may also increase the mobility of NAPL recovered by extraction wells resulting in the removal of significant contaminant mass in short time frame. Preliminary results from the recent SITE program pilot test indicate that injection into areas with free-phase contaminants results in an initial vigorous reaction followed by an increase in the mobility and recovery of NAPL. Additional data is currently being collected and will be available in the near future to evaluate NAPL recovery and improvements to groundwater quality.

Cost – Chemical Oxidation

The relative cost for chemical oxidation would be high to very high because multiple applications are likely needed to reduce contaminants to acceptable concentrations. Capital costs for implementing this alternative include material and injection costs. Costs for NAPL recovery and treatment of contaminated groundwater and effluent gases will increase costs, but increased NAPL recovery should decrease the restoration time frame, and long-term operation, maintenance and monitoring costs.

7.4.3.6 In-Situ Treatment – Air/Ozone Sparging

Air/ozone sparging was retained for further evaluation as a potential in-situ treatment alternative for contaminated groundwater encountered in the underlying Copper Falls aquifer. This technology can also apply to contaminated groundwater in the ravine fill and at Kreher Park. If

used for NAPL contamination, groundwater extraction will likely be needed. Ozone/air injection may displace NAPL and/or cause a chemical reaction increasing the mobility of NAPL. This mobilized material is then recovered via extraction wells.

Implementability

The implementability of this option is considered high for shallow and deep groundwater contamination. Implementation will consist of the installation of clusters of sparge wells connected to control panels and the injection of ozone rich air into contaminated zones. Ozone sparging is used for low to moderate concentrations of dissolved phase contamination, or for NAPL contamination, which will require groundwater/NAPL extraction.

Effectiveness

The effectiveness of ozone sparging technology is considered high for dissolved phase contamination, and low for source areas containing NAPL. If used for NAPL contamination, groundwater extraction wells will likely be needed to recover NAPL displaced by injection and/or mobilized by chemical reactions with ozone.

Cost

The cost to implement ozone sparging technology is considered moderate. Costs include sparge well installation, operation, maintenance, and monitoring (sample collection, data analysis and reporting, and laboratory expenses). Additionally costs include NAPL recovery and groundwater extraction if used in an area containing NAPL.

7.4.3.7 In-Situ Treatment – Permeable Reactive Barrier Walls

Permeable reactive barrier (PRB) walls were retained for further evaluation as a potential in-situ treatment alternative for shallow contaminated groundwater encountered in the ravine fill and Kreher Park fill soils. It is not considered feasible for the underlying Copper Falls aquifer.

Implementability

The implementability of PRB walls is considered high. In the upper bluff area a PRB installed at the mouth of the backfilled ravine will treat contaminants and reduce off-site migration of groundwater contaminants as flow passes through the PRB. At Kreher Park, a PRB installed with engineered vertical barriers as a “gate and funnel” system would treat contaminants in a similar manner; sheet piling or slurry walls would be installed as “gates” to “funnel” contaminated groundwater through the PRB for treatment.

Effectiveness

The effectiveness of PRB walls is considered moderate to high for dissolved phase hydrocarbons but low for NAPL. Although this alternative will not result in a reduction on contaminant mass within the contained area, it will result in a reduction in contaminant toxicity as contaminated

groundwater passing through the PRB wall is treated. This will prevent the off-site migration of dissolved phase contaminants with groundwater and enhance the protection of human health and the environment. Bench scale studies will likely be needed to evaluate suitable material for construction of the PRB walls that will yield suitable treatment results. If a suitable material for construction of the PRB can be obtained, PRB walls would likely be acceptable to the community and agencies.

Cost

The costs to implement PRB walls at the upper bluff area would be low because it would be limited to the mount of the ravine. The costs to install a PRB at Kreher Park would be moderate to high. A PRB wall could be constructed for the entire length of the Park shoreline, or if used in combination with vertical barriers a gate and funnel system of PRB and vertical barrier walls could be constructed. However, long-term operation cost would be low because de-watering would not be needed. Costs would include installation of the PRB walls (funnel), vertical barrier walls (gates), and long-term monitoring costs.

7.4.3.8 In-Situ Treatment – Electrical Resistance Heating

Electrical Resistance Heating (ERH) was retained for further evaluation as a potential in-situ treatment alternative for shallow soil and groundwater contamination, and for contaminated groundwater in the underlying Copper Falls aquifer. However, existing site buildings, buried utilities, and buried structures at the upper bluff area and the wood waste layer at Kreher will affect implementation as described in Section 7.3 above.

ERH is an in-situ electrical heating technology that uses electricity and applies it into the ground through electrodes. The electrodes can be installed either vertically to about 100 feet or horizontally underneath buildings. ERH heats the contaminants up to 100 ^{0}C, which raises the vapor pressure of volatile and semi-volatile organic compounds in the soil. For soil and shallow groundwater, this enhances the recovery of volatilized contaminants by soil vapor extraction (SVE). At high temperatures, ERH can also be used to dry soil, which typically creates fractures that increase soil permeability resulting in improved recovery of contaminants by SVE. Saturated zone soils can also be heated to high temperatures to create steam that strips contaminants from soil. Treatment of effluent vapors and dissolved phase groundwater contamination will be required before discharge.

For shallow groundwater at Kreher Park and the underlying Copper Falls aquifer, ERH could be utilized with groundwater extraction to remove NAPL. Rather than heat soils to create steam, the saturated zone is heated to 30°C or 40°C to decrease the viscosity and increase the mobility of NAPL that is then removed from extraction wells.

Implementability

For deep groundwater contamination in the Copper Falls aquifer, the implementability of low temperature ERH to enhance NAPL recovery is considered high. Electrodes installed in the confined aquifer would be used for heating to increase the mobility of NAPL that can be

recovered by extraction wells. High temperature ERH could potentially be used in the Copper Falls area to target hot spot areas. However, the implementability of a full scale high temperature ERH system would be considered low to moderate. The depth of NAPL in the Copper Falls (greater than 75 feet) would require close spacing of electrodes and more energy for heating.

For soil and shallow groundwater contamination, the implementability of both low and high temperature ERH is considered moderate. Elevated contaminants and NAPL are encountered in the backfilled ravine in the vicinity of buried structures and in the wood waste layer underlying fill soil at Kreher Park. Buried structures and large wood planks would affect installation of electrodes and uniformity of the electric field generated by the system. This would ultimately restrict mobility of contaminants and/or NAPL trapped within the buried structures and wood waste layer, adversely affecting removal by SVE or groundwater extraction. As described in Section 7.3.2.5 above, if removal of buried structures is required, ERH may be less cost effective for soil and shallow groundwater as removal and ex-situ treatment alternatives. However, building demolition and removal of buried structures could enhance the implementability of ERH for the underlying Copper Falls aquifer.

Effectiveness

The effectiveness of both low and high temperature ERH is considered high. ERH can be used for both saturated zone and unsaturated zone contamination. It is also suited for sites with interbedded sands and clay layers. NICOR, Inc. installed a low temperature ERH system in May 2006 at a former MGP site in Bloomington, Illinois. At this site, a 200 electrode ERH system is being used to raise the temperature of the soil and groundwater to 35º C. This increases the mobility of NAPL which is subsequently recovered by a dual phase vacuum extraction system. The residual groundwater removed with the dual phase system is re-injected to maintain moisture and the resultant electric field. Current Environmental Solutions (CES) reported over 5,000 gallons of product was recovered after the first three months of operation. As demonstrated by this project, ERH can remove a significant contaminant mass in a short time frame. The removal of NAPL will also result in a reduction on the toxicity of the dissolved phase plume, and reduce the potential for continued down gradient migration with groundwater. Although the rate and volume of NAPL recovery from full scale application of ERH cannot be determined at this time, NAPL removal will enhance the protection of human health and the environment. ERH would likely be acceptable to the community and agencies

Cost

The cost for high temperature ERH is considered very high. Costs will include capital costs for the system design, installation, and energy application. Costs will also include NAPL disposal, and treatment of effluent vapors, and/or impacted groundwater before discharge. Costs for low temperature ERH is considered high. Costs will include system design, installation, and energy application. Although the energy costs for low temperature ERH will be lower than application of high temperature ERH, additional groundwater extraction wells will likely be required. However, ERH will result in enhanced NAPL recovery that will significantly reduce long-term operation, maintenance, and monitoring compared to conventional groundwater extraction.

7.4.3.9 In-Situ Treatment – Dynamic Underground Stripping

Dynamic underground stripping (DUS) was retained for further evaluation as a potential in-situ treatment alternative for contaminated groundwater encountered in the underlying Copper Falls aquifer. This is a hybrid use of steam injection. Conventional steam injection could also be used for soil and shallow groundwater encountered in the ravine fill at the upper bluff area and in Kreher Park fill soils, evaluated in Section 7.3.

DUS is a combination of technologies. DUS consists of the following integrated technologies: steam injection; electrical heating; underground imaging; and collection and treatment of effluent vapors, NAPL, and contaminated groundwater. These technologies are utilized as follows:

- Steam injection at the periphery of the contaminated area heating permeable zone soils, which then vaporizes volatile compounds bound to the soil causing contaminant migration to centrally located vapor/groundwater extraction wells;
- Electrical heating of less permeable clays and fine-grained sediments vaporizing contaminants causing migration into the steam zone;
- Underground imaging, primarily Electrical Resistance Tomography (ERT) and temperature monitoring, which delineates the heated area and tracks the steam fronts daily to monitor cleanup, and
- Treating effluent vapors, NAPL, and impacted groundwater before discharge.

Groundwater and NAPL are extracted by conventional groundwater extraction wells, and vapors are recovered by soil vapor extraction wells. A dual phase vacuum enhanced groundwater extraction system is used to recover groundwater, NAPL, and vapors concurrently. Volatilized contaminants are treated with vapor phase granular activated carbon prior to atmospheric discharge, or are incinerated in on-site boilers used to generate steam.

Hydrous Pyrolysis/Oxidation (HPO) is sometimes performed concurrent with DUS to target residual contamination after DUS efficiency declines. It consists of steam and air injection, which creates a heated, oxygenated zone in the subsurface. Condensed steam and contaminated ground water migrates to the heated zone where it mixes with oxygen. Although the process may destroy some microorganisms impeding natural biodegradation, HPO enhances biodegradation of residual contaminants by stimulating other micro-organisms that thrive at high temperatures (called thermophiles).

Implementability

The overall implementability of this option is considered high for groundwater contamination in the Copper Falls aquifer. DUS/HPO can be used for both saturated zone and unsaturated zone contamination. (Treatment of unsaturated zone contamination by steam injection was evaluated in Section 7.3.) The DUS technology has been available commercially through SteamTech Environmental Services since 1994 and has been used full scale at several sites. A pilot test would be needed to evaluate the effectiveness of HPO after DUS.

Effectiveness

The effectiveness of DUS/HPO is considered high. DUS can be used for both saturated zone and unsaturated zone contamination. (Treatment of unsaturated zone contamination by steam injection was evaluated in Section 7.3.6.) It is also suited for sites with interbedded sands and clay layers. DUS raises the temperature of the soil and groundwater, which increases the mobility of NAPL recovered by extraction wells. This results in the removal of a significant contaminant mass in a short time frame. In addition to NAPL collection and disposal, treatment of effluent vapors and dissolved phase contamination is required before discharge. The removal of NAPL also results in a reduction of the toxicity of the dissolved phase plume, and reduces the potential for continued down gradient migration with groundwater. DUS/HPO would likely be acceptable to the community and agencies.

Cost

The costs for DUS would be very high because few vendors provide this specialized technology, and energy usage would be significant. If implemented with DUS, HPO would increase costs. Capital costs for implementing this alternative would be the primary costs, but restoration costs should also be considered because this alternative would result in significant site disturbance. Costs for NAPL recovery and treatment of contaminated groundwater and effluent gases will increase costs, but increased NAPL recovery should decrease the restoration time frame, and long-term operation, maintenance and monitoring costs.

7.4.3.10 Removal – NAPL and Groundwater Extraction and Treatment

Groundwater and NAPL extraction using the existing on-site treatment system was retained for screening. This alternative will consist of contaminant removal from existing and additional extraction wells installed in areas containing NAPL.

Implementability

The implementability of an expanded NAPL and groundwater extraction system are considered high. Additional extraction wells would be installed, and the existing treatment system upgraded to treat the increased flow. However, since the extraction wells began operating, a drop in artesian pressure has been observed in the confined Copper Falls aquifer near the extraction wells (Figure 3-7 in the RI Report shows a decline of approximately 10 feet in the hydraulic head in the area of the existing extraction wells after pumping began). Excessive pumping may further lower artesian pressures, which would allow DNAPL to migrate deeper into the Copper Falls aquifer (artesian pressures have restricted DNAPL from migrating beyond approximately 75 feet in depth at the former MGP; the bulk of the DNAPL is found along the interface between the Miller Creek and the Copper Falls where the material has migrated furthest from the areas of the release). Consequently, any additional wells would be operated as low flow wells; wells would be spaced to minimize further pressure declines in the confined aquifer.

Effectiveness

The effectiveness of a NAPL and groundwater extraction is considered moderate to high. Although operation of the existing groundwater extraction system has resulted in the removal of contaminant mass in the source area, a significant volume remains. Extraction will be required for an extensive period of time to continue to remove the mobile fraction of the free-phase hydrocarbons, which will result in a reduction of the mass and toxicity of the dissolved phase plume. Additional extraction wells will shorten the restoration time frame. A source removal groundwater and NAPL extraction system would likely be acceptable to the community and agencies

Cost

The costs for continued operation of the groundwater and NAPL removal system would be considered low to moderate. The existing system is currently in use; implementation requires long-term operation, maintenance, and monitoring that would increase costs. The cost for an enhanced removal system would be moderate. Additional costs will be incurred for well installation and upgrading the treatment system, but increased NAPL recovery should decrease the restoration time frame, and long-term operation, maintenance and monitoring costs.

7.4.3.11 Removal – Multiphase Vacuum Recovery and Surfactant Injection

Multiphase vacuum recovery and surfactant injection was retained for further evaluation with surfactant injection as a two step approach. Multiphase recovery will remove the mobile fraction of the free-phase hydrocarbons, followed by surfactant injection to remove the immobile fraction.

Between 20 and 30 small diameter wells screened in NAPL zones will be installed at the Miller Creek / Copper Falls interface. (Existing piezometers MW-2AR, MW-4A, MW-10B, MW-13A, MW-15A, MW-19A, MW-21A, and MW-22A are screened at the Miller Creek / Copper Falls interface, and could be used as recovery/injection wells for a pilot test and/or full scale remediation system). These wells will be installed at depths between 30 and 40 feet below ground surface, and a small diameter pipe inserted into the wells will induce a vacuum to recover flow. Although the wells would be deeper than the maximum vacuum possible (28 feet below ground surface), the effective pumping level would be approximately 20 feet below ground surface in the confined aquifer. Surfactant injection would be performed after the NAPL thickness measured in the extraction wells/piezometers declines to an acceptable level.

A fixed system of lateral pipes will connect each well to a central manifold. Alternatively, a mobile system would consist of a truck mounted vacuum truck that could move between wells. The fixed system would be economical if extraction would be required for an extended period of time. A pilot test would likely be needed to determine if a fixed system is needed.

Implementability

The implementability of multiphase recovery and surfactant injection is considered high. It is best suited for the laterally extensive NAPL plume at the base of the Miller Creek down gradient from the source area near the former MGP. However, this remedial alternative could be also be used for groundwater contamination in the ravine fill and Kreher Park fill if used in conjunction with another remedial alternative. A pilot test will likely be needed to determine the number of extraction wells and NAPL recovery rates. The existing treatment system will need to be upgraded if the volume of recovered material significantly increases.

Effectiveness

The effectiveness of vacuum enhanced dual phase recovery and surfactant injection is considered high. A significant contaminant mass could be removed in a short time frame. Collection of NAPL and treatment of effluent vapors and dissolved phased groundwater will be required before discharge. The removal of NAPL will result in a reduction of the mass and toxicity of the dissolved phase plume, and reduce the potential for continued down gradient migration with groundwater. This alternative would likely be acceptable to the community and agencies.

Cost

The cost for vacuum enhanced dual phase recovery and surfactant injection is considered high. Costs will include the installation of additional small diameter extraction and recovery wells, along with contaminant recovery, treatment and surfactant injection. Costs will also include NAPL removal and disposal, and treatment of effluent vapors and groundwater before discharge. However, enhanced NAPL recovery will reduce long-term operation, maintenance, and monitoring for the treatment system.

7.5 Sediment

7.5.1 Chemicals of Potential Concern

The screening of sediment alternatives focuses on PAHs as the primary COPC. VOCs and metals are COPCs but the PRGs may be based on PAHs because VOCs and metals co-exist with PAHs.

7.5.2 Screening of Sediment Remediation Alternatives

General response actions, technologies and process options for sediment are summarized in Table 7-8. Those retained for further consideration are highlighted in this table. The alternative selected for sediments will likely require concurrence from the U.S. Army Corps of Engineers and from Great Lakes National Program Office.

7.5.2.1 No Action

A “no action” was retained as required by the NCP as a basis for comparing the other alternatives. No action requires no planning, maintenance, or monitoring. It is not the same as

"institutional controls" or "monitored natural recovery" each of which require some maintenance and monitoring. A "no action" alternative, however, does not meet the RAOs for the Site.

7.5.2.2 Institutional Controls

An institutional control alternative consists of engineering and/or legislative restrictions on the use of the Site such that exposure to Site contaminants is restricted or eliminated. Institutional controls can consist of fish consumption advisories, access restrictions or a moratorium on certain activities at the Site. They would be similar in some regard to the present institutional controls that restrict boating, swimming or fishing in aquatic portions of the Site. Institutional controls are implementable and are generally effective in limiting humans from using the Site. However, they have little effect on ecological receptors. The cost of institutional controls is low.

An institutional control alternative does not meet the RAOs for the Site by itself but institutional controls such as access limitations will be considered as supplementary alternatives for portions of the Site, perhaps in combination with other alternatives such as monitored natural recovery. Access control will be retained for detailed analysis for this reason.

7.5.2.3 Monitored Natural Recovery

Monitored natural recovery (MNR) relies upon naturally occurring processes to contain, reduce or eliminate the toxicity or bioavailability of sediment contaminants. These processes may include burial of contaminants by continued sedimentation or degradation of contaminants by biological, chemical or photoactivity. As implied by its name monitored natural recovery, this alternative also includes acquisition of information on the effectiveness of these natural processes over time to verify that risk due to sediment contaminants is decreased.

MNR is easily implemented and can be effective provided the appropriate conditions as discussed above are present. The costs for implementing MNR are low and consist primarily of monitoring costs. It is unlikely that MNR will meet the RAOs for the entire Site; however, it is possible MNR may be effective for some parts of the site where levels of contaminants are relatively low and NAPL is not present. In addition it may be possible to expedite burial through placement of engineered structures or placement of a thin cap for "enhanced natural recovery". For these reasons MNR will be retained for more detailed evaluation.

7.5.2.4 Containment

Subaqueous Capping

Subaqueous capping may consist of using a variety of materials, some reactive, to contain contaminants *in situ*. A properly designed cap can significantly decrease contaminant mobility and by covering the contaminated sediments, isolates the contaminants from the overlying water column and exposure to ecological receptors or humans.

For this alternative to be effective the following conditions are generally necessary:

- Source control must be completed;
- Contaminants generally must have low solubility and tend to sorb to sediment particles;
- Cap design should minimize transport by diffusion or advective flow up through the cap;
- There should be an absence of a strong vertical hydraulic gradient that would transport buried contaminants to the sediment surface; and
- Cap design must minimize the disruption of the cap from natural mechanisms, e.g., storms or human activities.

Capping is implementable and might be effective for the Site although the shallow nature of near shore portions of the Site will require that capping be implemented after some dredging or that capping be designed as a component of a confined disposal facility (CDF). In addition, because of the location, a cap would have to be armored to resist erosion.

According to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult.

Capping costs are expected to be moderate to high depending upon cap design. Capping will be retained for more detailed evaluation.

Confined Disposal Facility

The CDF will be built near shore area within the Chequamegon Bay of Lake Superior. This remedial alternative could be designed to cover most of the offshore sediments above the proposed cleanup level, particularly those that are impacted by presence of NAPL and substantial levels of wood debris. Sediments with unacceptably elevated levels of SVOCs and VOCs, including NAPL, as well as areas on upland portions of the Site that are impacted by wood material mixed with coal tar wastes would remain in place and be covered by the CDF. Contaminated sediments and potentially soils from portions of the Site that are not included in the “footprint” of the CDF can be removed by dredging or excavation and disposed of in the CDF.

Since this alternative will involve filling of the near shore area to levels above the lake level it will require compensatory mitigation for wetland loss.

A CDF is technically implementable for the Site although there may be barriers to administrative implementability that will need to be addressed. It can be designed to be an effective and comprehensive alternative that will address contaminated sediments, soils and groundwater.

According to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult. The CDF would likely require concurrence from U.S. Army Corp of Engineers and from Great Lakes National Program Office.

Costs for a CDF are expected to be high but substantially less than combined soil and sediment removal alternatives. A CDF will be retained for more detailed evaluation.

7.5.2.5 In-Situ Treatment

In-situ technologies use biological, chemical or physical processes to decontaminate the sediment in-situ. Although various approaches are being researched and are under development and even used on a pilot scale, none have been successfully demonstrated in project scale field applications. No in situ technologies for sediment remediation have been retained.

7.5.2.6 Removal

Dredging

Removal can be accomplished with either hydraulic or mechanical dredges or excavators working from land or off of boats or barges. Dredging is a well-established technology and is implementable. Several issues will have to be addressed in the design of a dredging alternative for the Site to maximize its effectiveness by preventing the release of NAPL and dispersal and volatilization of VOCs during dredging activities. Proper management of dredging residuals and handling of a substantial amount of wood debris will also be required. Some aspects of the Site favor use of mechanical dredges or excavators, e.g. debris removal. Other aspects favour hydraulic dredges, e.g. capture of NAPL and minimization of volatilization.

Because of site conditions the costs of an effective dredging alternative are expected to be high. The dredging alternative will be retained for further evaluation.

Excavation in the Dry

Excavation is discussed separately from other removal technologies to differentiate from removal technologies used from floating boats or barges. Excavation in the dry is implementable although the costs for excavation of the all contaminated sediments are considered to be very high because it would involve developing means to sequentially dewater large portions of the Site. However, excavation in the dry of limited portions of Site sediments may be effective when used in combination with other technologies. This alternative is retained for further revaluation for this reason.

7.5.2.7 Ex-Situ Treatment

Ex-situ treatment technologies fix, destroy or transform contaminants after removal of the sediment by dredging or excavation. Of the many ex-situ technologies reviewed the following were retained for further evaluation:

- Physical separation;
- High and low temperature thermal desorption; and
- Incineration.

Physical separation was retained only for pre-treatment to separate sand, NAPL, and wood material from sediments. These technologies are available and effective to separate wood debris, sand and NAPL from the sediments as a pre-treatment where additional other treatment will be

needed for the sediments. Physical separation is not eliminated as a treatment alternative for sediments and is also retained in Section 7.5.2.8 Ancillary Technologies.

High and low temperature thermal desorption and incineration are retained as effective technologies for the destruction of PAHs and VOCs. Transportable treatment systems are available, but are costly to mobilize and operate with high moisture sediments. Air emission permits may be difficult to get at a location so close to residents, public recreational facilities and downtown community.

In addition, incineration of wood debris at the nearby NSP Bayfield Power is being considered as an option and will be retained.

Biological treatment includes methods that include adding amendments and possible bacteria seeding to stimulate the biological degradation of Site contaminants. However, success with the higher molecular weight compounds such as many of the Site PAHs is limited and treating highly contaminated sediment to meet clean soil standards has not been found to be effective. Treatment costs are high compared to other technologies. Biological treatment is eliminated from further consideration.

Chemical treatment methods use the addition of acids, solvents and surfactants to extract contaminants from the sediment matrix to allow cleaning the sediment to levels suitable for fill material. Oxidizers may also be used to convert contaminants to less toxic compounds. Chemical extraction techniques have not been found to be very effective and have a high cost. The high organic content present in Site sediment in addition to characteristics of Site contaminants makes separation more difficult and would add oxidation demand for oxidizing chemicals. Chemical treatment has not been demonstrated at full project scale and is eliminated from further consideration.

Physical stabilization processes refer to the use of inorganic chemicals such as fly ash, cement, and kiln dust to react with the contaminants within the sediments to reduce their toxicity and mobility. Stabilization would be expensive because of the high moisture content and is not very effective in treating organics such as VOCs and PAHs because they are already hydrophobic and strongly associated with the sediment. This treatment would reduce consolidation and likely increase volume for subsequent disposal. Stabilization is eliminated from further consideration.

Vitrification is a thermal process that operates at high temperatures to destroy organic compounds by melting the sediment or soil into a glass like matrix. Since the process operates at higher temperatures in the range of 2,500 to 3,000 ^{o}F, the cost is higher than other thermal technologies. For the PAHs and VOCs and only limited heavy metals in the Site sediment, the other thermal methods are more cost effective and proven technologies. Vitrification is screened out from further consideration.

Other ex-situ treatment technologies were eliminated based upon their inability to effectively treat high water content sediments, relative costs or lack of project scale precedent.

The retained technologies are implementable and effective. Costs range from moderate to high.

7.5.2.8 Ancillary Technologies including Disposal

As indicated previously, ancillary technologies and processes are not screened, *per se*, as they are essential for a process to achieve its RAO. For instance, dewatering and wastewater treatment are required for any dredging technology prior to treatment of the sediment and disposal. Ancillary technologies include:

- Dewatering;
- Wastewater treatment;
- Disposal;
- Transportation; and
- Monitoring.

The first four of these technologies are required for any removal technology. On-site disposal options include confined aquatic disposal and disposal in a CDF. The only on-site disposal option retained was disposal in a CDF. Off-site disposal of solids remaining after treatment is implementable at several facilities including off-site municipal and industrial landfills. If treatment results in clean material various beneficial re-use alternatives may also be available.

While monitoring is not part of the screening process it will be needed in some form to assure that RAOs have been achieved for any of the selected remedial alternatives. The magnitude and nature of monitoring will depend upon the alternative selected. Monitoring can include verification monitoring to verify remediation objectives are met, operation and maintenance monitoring of disposal sites or long-term monitoring to verify achievement of RAOs.

7.5.3 Description of Retained Alternatives

Table 7-9 provides summaries of the descriptions of retained alternatives that follow. Table 7-10 includes a summary of all alternatives, those retained and not retained for evaluation.

7.5.3.1 No Action

The no action alternative was retained as a baseline against which other technologies are compared. The no action alternative assumes no cleanup or long-term monitoring. This alternative is not expected to meet the RAOs.

7.5.3.2 Institutional Controls

Institutional controls retained are limited to access control. This may take the form of fencing upland portions of the Site or restricting access of boats to aquatic portions of the Site. Institutional controls are retained for further consideration as a potential supplementary alternative to monitored natural recovery. While use of institutional controls alone will not achieve RAOs, institutional controls such as limiting access may be effective for portions of the Site, perhaps in combination with other alternatives such as monitored natural recovery.

Implementability

Institutional controls are relatively easy to implement, however, enforcement may be more difficult and would have to involve agreements with the City of Ashland (for access from land) and DNR (for boating access).

Effectiveness

If enforced properly, institutional controls can be effective for limiting human exposures; however they have no effect on ecological receptors.

Cost

Generally, the cost of implementing institutional controls is low compared to other alternatives.

7.5.3.3 Monitored Natural Recovery

The monitored natural recovery alternative has been retained although the effectiveness of these mechanisms in helping to meet RAOs has not been quantified. The potential for one natural recovery mechanism, burial through sediment deposition, was investigated as part of the Sediment Stability Investigation (Appendix D to the RI); however, the results of this part of the investigation were inconclusive. It appears that sediments at the Site are near equilibrium, i.e. little net deposition or erosion, however there is no evidence that natural sediment deposition will bury contaminated sediments over time.

While there is no evidence that net deposition will result in burial of contaminated sediments, exposure to contaminants in portions of the Site outside of the proposed sediment cleanup level of 2,295 µg PAH/g OC (9.5 µg PAH/g dry weight [dwt] at 0.415% OC) will be reduced over time through continuing time-varying sediment deposition[10] and the mixing of this new clean sediment with Site surface sediments by the activities of benthic organisms (=bioturbation). Although this mechanism implies periodic erosion and "dilution" of surface sediment through mixing, over time it should be effective to reduce surface sediment contaminant concentrations. As Site COPCs have low concentrations in these areas and are not bioaccumulative this mechanism should not be dismissed for sediments that based upon the BERA results doesn't pose a risk to ecological receptors even under current conditions.

Natural recovery by burial may also be enhanced or accelerated by engineering means. For example, flow control structures may be emplaced in areas of the Site outside of areas that exceed the sediment cleanup level to facilitate sediment deposition. Alternatively, a thin layer of clean sediment may be added to the sediment surface to reduce surface concentrations.

It is unlikely that other natural recovery mechanisms such as biodegradation or photodegradation, although they are expected to occur at the Site, act sufficiently rapidly to meet

[10] The absence of net deposition only implies that sediment deposition is balanced by erosion, it does not mean there is no sediment deposition.

RAOs, however these mechanisms may supplement mixing and burial to help reduce surface sediment concentrations over time.

Implementability

A monitored natural recovery alternative can be relatively easily implemented for portions of the Site.

Effectiveness

It is unlikely that MNR will meet the RAOs for the entire Site because the sediment depositional rate does not appear to be sufficiently high in areas of the Site that have the highest levels of contaminants and where there are sporadic releases of NAPL from the sediments that can re-contaminate surface sediments. However, it is possible MNR may be effective for some parts of the Site where levels of contaminants are below the site sediment PRG but above 5.6 µg PAH/g dwt and NAPL is not present. In addition it may be possible to expedite burial through placement of engineered structures. For that reason MNR will be retained for more detailed evaluation.

Cost

The cost of monitored natural recovery is expected to be low.

7.5.3.4 Containment –Subaqueous Capping

Given the characteristics of the Site potential subaqueous capping alternatives that will be evaluated more thoroughly for the Site include the following:

Capping subsurface sediments after surface sediments exceeding the sediment cleanup level have been removed by dredging or excavation. In this application, the top four feet of sediment in areas exceeding the proposed sediment cleanup level of 2,295 µg PAH/g OC (9.5 ug PAH/g dwt at 0.415% OC) and associated wood debris will be removed to provide sufficient depth for emplacement of an armored cap and not decrease the lake bottom depth in the area. Cap material considered in this application would be natural sand, organo-clays and/or carbon or other amendments to adsorb contaminants and rock armoring to resist erosion. Geomembranes will also be considered in the design of a cap.

Implementability

Capping is technically implementable and as long as the armored nearshore cap does not modify the present depth of the lake, it should be administratively implementable. There are many precedents for capping throughout the world (http://www.hsrc.org/hsrc/html/ssw/capsummary.pdf) and a number of engineering guidance references are available including:

- *Palermo et al., 1998. Guidance for In Situ Subaqueous Capping of Contaminated Sediments.*
- *Palermo. 1994. Placement Techniques for Capping Contaminated Sediments.*
- *Maynord and Oswalt. 1993. Design Considerations for Capping/Armoring of Contaminated Sediments In-Place.*

According to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult.

Effectiveness

Caps are effective for low solubility contaminants and can be engineered to be effective for higher solubility contaminants as well. The more soluble VOCs also have higher biodegradation rates. The retention time for diffusion and advection may be modeled to determine the thickness needed for the bioactive zone of the cap based on compound specific degradation rates and equilibrium partition coefficients. The best measure of these characteristics is made by using site sediments and performing sequential batch leach tests. Potential upward groundwater gradient in the area of cap will need to be evaluated to design the cap. If the potential upward groundwater gradient is low then diffusion will likely be the primary transport mechanism for soluble VOCs. Measurement of vertical gradient in the sediments at several locations will be needed to evaluate the effect of advective transport on the VOCs and determine if upward gradients will compromise the effectiveness of a cap.

The bench scale capping column flux treatability test that is presently being conducted will also evaluate the effectiveness of several capping alternatives (carbon mat and different cap thickness, etc.) that will take into account diffusion, low upward gradient, and gas ebullition transport of NAPL. This test will evaluate all of these transport mechanisms using the most impacted sediment at the Site. Of particular relevance, the Stryker Bay site in the St. Louis River near Duluth has implemented a cap with an integral carbon mat for sediments with virtually the same sediment contaminants as found at this Site. Because of the nearshore energy regime and potential for exposure to propeller wash at the Site, the cap design would have to include appropriate armoring to be effective.

Cost

Costs for an armored composite cap over nearshore sediments are expected to be high but not as high as the costs for a removal alternative that removed all sediments and associated wood debris to depths that may exceed ten feet in some places.

7.5.3.5 Containment – Confined Disposal Facility

This remedial alternative consists of a containment facility or CDF that covers the majority of offshore sediments that are impacted by substantial levels of wood debris as well as by elevated levels of SVOCs and VOCs, including NAPL, as well as areas on upland portions of the Site that are impacted by wood material mixed with coal tar wastes. The part of the CDF in the lake bed would extend to cover sediments that are relatively heavily impacted and/or associated with NAPL, VOCs or SVOCs and substantial amounts of wood debris at depth. Sediments outside this CDF footprint that exceed the sediment cleanup level of 2,295 µg PAH/g OC (9.5 µg PAH/g dwt at 0.415% OC) would be dredged or excavated and placed in the CDF where they would be permanently stored. Based upon a preliminary layout of the CDF there will be approximately 74,000 CY of sediment outside the footprint of the CDF that will have to be dredged and placed

in the CDF. This alternative also includes a cap and drainage system to eliminate or minimize infiltration from precipitation and eliminate groundwater infiltration. It can be designed as a comprehensive alternative that will address contaminated sediments, soils and groundwater. Since this alternative will involve filling of the nearshore area to levels above the lake level it will require compensatory mitigation for wetland loss.

The proposed CDF would consist of the following components:

Sheet Pile Enclosure

A 3,700 foot sheet pile wall will be constructed enclosing roughly 17 acres. The sheet piling on land will be driven below the water table to serve as a cut-off wall impeding the flow of groundwater through the contaminated sediments that are enclosed. The sheet piling in the lake will be driven through the water and impacted sediment/debris layer into unimpacted silty clays in the Miller Creek formation. The sheet piling will be sealed to achieve an average permeability of $1x10^{-7}$ cm/sec, using one of several commercially available sealing methods and products. The sealing processes involve directly filling the voids in the joints using a polymer or bentonite material. The material is most often applied prior to driving the pile and the pile can be installed through water. Other processes available involve driving the pile and adding the sealant afterwards, either into the joint or into an enclosure formed by a 2-inch angle iron welded to the outside of the sheet pile at the joint. Additional means of eliminating flux of contaminants for the CDF will be considered if treatability studies indicate they may be necessary.

Dredging

A mechanical dredge will be used that will either load directly to a barge or place sediment in a hopper with a screen/basket and grizzly connected to a high solids slurry pump. When the method of loading directly into a barge is used, the sediment would then be crane unloaded into the CDF. If a high solids slurry pump method is used, a pipeline is used to hydraulically transfer sediments to the CDF and discharged them under the water into the CDF. A discharge nozzle such as a tremie may be used to control the discharge velocity and minimize suspended solids entrainment within the CDF. Other dredging procedures and controls would be as described in Section 7.5.3.6.

Water Treatment

Treatment would be provided to treat the water from dredging during filling of the CDF. Water treatment could include polymer addition to improve settlement of suspended solids followed by sand filtration and carbon adsorption to allow discharge to the City POTW or to the lake at levels that conform to water quality guidelines.

Capping and Geomembrane Cover

After disposal of dredged sediments in the CDF, a geomembrane barrier layer will be installed to cover all sediments and minimize infiltration from precipitation. This cover will be installed over the entire 17 acre area, with provisions made to exclude the existing city wastewater treatment

plant unless it is demolished and removed. Contaminated sediments in the CDF will require time for consolidation and possible dewatering prior to installation of this layer. A subtitle C or an equivalent cap will be installed over the CDF. Limited use of stabilization of some sediment also may be a consideration. A drainage plan in the upland area may use alternative cap materials to minimize infiltration such as asphalt for a parking lot or clay layer.

Groundwater Control

Up gradient groundwater will be passively diverted around the CDF through use of drainage tiles, etc. This includes discharges to storm drainage systems that would be a part of the drainage plan for the upland and sediment capping area. This may also include vegetation plantings and landscaping to enhance trans-evaporation and drainage from the bluff hillside. Monitoring wells would be required to periodically monitor hydraulic heads within and outside the CDF. This is to ensure that a lower hydraulic head is maintained within the CDF, which may require operation of extraction well(s).

Implementability

This alternative is technically implementable and there are a number of precedents for shoreline CDFs in the US and Canada. Nearshore CDFs have been implemented at Waukegan Harbour, IL, Poplar Island in Chesapeake Bay, Port of Los Angeles and several sites in Puget Sound, WA. In addition, the SLRIDT Superfund site in Duluth Harbour, MN is in the construction phase for converting a ship slip into a confined aquatic disposal facility (CAD) that will contain dredged PAH contaminated sediments.
Recent USEPA management guidance for contaminated sediments (USEPA 2005) discusses the implementation and effectiveness of CDFs disposal facilities similar to what is being proposed for this Site. In addition the Army Corps of Engineers and USEPA have developed detailed guidance for construction and management of these facilities including the following:

- *USACE. 1987. Engineering and Design - Confined Disposal of Dredged Material.*
- *USEPA. 1994. Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document.*
- *USEPA. 1996. Design, Performance, and Monitoring of Dredged Material Confined Disposal Facilities in Region 5.*

A CDF can be technically designed to isolate the existing contaminated sediment and debris and overlying dredged contaminated sediment, as well as impacted soils in the upland area of the Site.

NSPW believes with proper planning and design and adequate mitigation for covering a limited portion of the lake bed a nearshore CDF can also be administratively implementable. However, according to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult. This will likely require concurrence from the U.S. Army Corps of Engineers and from Great Lakes National Program Office.

CDFs would have a significant advantage for cost savings and time to complete the remediation as compared to options involving complete sediment removal, dewatering, treatment and landfill disposal.

Effectiveness

Long-term effectiveness of CDFs has been shown to be protective of human health and the environment for containment of contaminated sediments. All contaminated sediment outside the CDF will be removed by dredging. Eliminating the sediment treatment used by other dredging alternatives is more effective in the short term because it reduces exposure of the local community to potential air emissions. Constructing a CDF over the top of the highly contaminated sediments that contain a large amount of wood debris as well as upland soils effectively reduces lower volatile emissions that may result from wood debris removal required for dredging this area In addition it would avoid a significant amount of resuspension of sediment-associated contaminants that would occur during dredging. However, it will not reduce contaminant mass or toxicity.

Cost

This alternative is lower in cost than other dredging alternatives with treatment and off-site disposal. Dewatering costs, water treatment costs and dredging costs (due to a smaller dredge area) will all be lower than other dredging alternatives with treatment and off-site disposal. The overall costs are considered high for this alternative but substantially less than other removal alternatives and certainly the combination of sediment and soil removal alternatives.

7.5.3.6 Removal

While removal of contaminated sediment with dredges or excavators has been successfully implemented at a number of contaminated sediment sites (See references in Table 7-1), site characteristics at Ashland provide several unique challenges. These challenges arise from the presence of large quantities of wood debris, including logs to depths of eight or more feet, and the presence of both NAPL and dissolved phase VOCs and SVOCs in sediments. These factors taken together result in a potential for release of volatile contaminants, in particular benzene, to the air as well as dissolved phase and NAPL contaminants to surface water. While this potential can often be addressed through use of hydraulic dredges, such as a double suction cutter head dredge with a shroud, that minimize the probability of escape and dispersion of these free phase and volatiles, the presence of large quantities of debris precludes effective use of hydraulic dredges in a large portion of the Site. Since debris removal would primarily be accomplished by mechanical dredges or excavators, volatilization would be expected to be significantly greater than what would occur if wood debris were minimal and hydraulic dredging alternatives could be utilized.

The presence of wood debris in the sediments will also contribute to generated residual sediments. The USACE and USEPA have recently defined generated residuals as contaminated post-dredge surface sediments (at concentrations above the action level) that are dislodged or suspended by the dredging operation and are subsequently redeposited on the bottom either within or adjacent to the dredging footprint. Residuals reduce the effectiveness of dredging and may

require management in the form of cleanup dredge passes or placement of a thin layer cap over the residuals. However, it may be possible to minimize residuals by removing wood debris first by mechanical dredge followed by hydraulic dredge.

Preliminary estimates indicate that if volatiles are not somehow controlled naphthalene and other potentially other volatiles would escape into the atmosphere and disperse beyond the immediate vicinity of dredging operations and onshore areas where sediments are being dewatered and treated. With the proximity of a relatively large population in Ashland, this presents the real possibility of short term exposure unless it is managed with appropriate engineering controls. However there is a potential that aged NAPL (which is expected to be potentially lower in volatility) may exist at this Site and may require minimal engineering controls where sediments are being dewatered and treated.

The removal alternative would therefore likely feature all three removal technologies, use of mechanical dredging and/or excavation to remove debris and hydraulic dredging once a sufficient amount of debris is removed[11]. To minimize volatilization of VOCs and SVOCs and dispersion of NAPL, the dredging operation would likely employ modular pontoon barges or scows that are configured in such a manner that turbidity "skirts" can be placed around them. Debris removal and dredging will take place in the "hole" made by the arrangement of pontoons or scows. Various equipment including boom cranes, ladder cranes, hydraulic heads or excavators will operate off of these platforms depending upon their effectiveness. In areas where the presence of debris does not interfere with hydraulic dredging, hydraulic pumps on excavators might be used. The scows or pontoon barges would be moved around using either a tug or wires connected to the shore. Anchor spuds may not be used in the NAPL areas as they may disturb the sediments and release NAPL and buried contaminants. Debris close to shore might also be removed by long-armed excavators operating from shore or even from temporary piers made from modularized barges.

Once dredged or excavated, debris and the sediment/ debris mixture can be passed through "grizzlies" to separate out large wood into hoppers or scows with mud locks. Water can be added to the sediment and moved hydraulically to dewatering and treatment areas.

Engineering controls for minimizing release of dissolved or NAPL contaminants to water beyond the Site would likely consist of redundant turbidity barriers and booms. Temporary sheet piling will also be considered if redundant turbidity barriers and booms are not effective. In addition, dredging operations can be suspended during conditions that render redundant turbidity barriers and booms ineffective.

Controls for minimization of volatile releases would have to be investigated further since tenting over working dredges on the water is difficult and would add significant impediments to maintaining reasonable dredge production rates. It is likely that remedial construction workers would have to use Class C PPE.

[11] Various hydraulic equipment such as cutterhead dredges can deal with a certain amount of wood debris provided it is relatively soft. A cutterhead dredge can crush the wood debris into smaller pieces and hydraulically move it with the sediment to separation and treatment facilities.

Because of the limitations on dredging in the winter, it is anticipated that 12 hour shifts would be used.

If dredging is selected as the preferred remedial alternative for sediment a pilot is almost certainly necessary to optimize effectiveness and determine whether engineering controls can be used to minimize volatilization and dispersal of NAPL. A pilot could be conducted separately or on the "front end" of the dredging project.

Implementability

Dredging and excavation are standard practices for removal of contaminated sediments so these alternatives are implementable.

Effectiveness

Although dredging effectiveness is generally good, characteristics of the Site including the presence of substantial quantities of debris may substantially diminish its effectiveness. In addition, the release of VOCs into the atmosphere, if it can not be controlled, might pose a health risk to the Ashland community.

Cost

Cost of removal alternatives are expected to be very high due to unique site conditions.

7.5.3.7 Excavation in the Dry

In some areas of the Site, particularly in nearshore areas that have large amounts of wood debris some of which may be saturated with VOCs and SVOCs, it may be more effective to dewater these areas behind sealed sheet pile caissons or coffer dams and excavate contaminated sediments in the dry using conventional earth moving equipment operating on low pressure tires or from mats. Excavation in the dry would have the advantage of controlling release of NAPL and facilitate removal of debris.

Implementability

While sealing off and dewatering nearshore portions of the lake is not a trivial endeavour on the shores of a lake that can have episodic high energy events, it can be engineered. Since such an alternative is accompanied by increased risk to remedial construction workers, excavation in the dry also has to be intensively monitored.

Effectiveness

Excavation in the dry may be effective for limited site areas, however cost and safety concerns probably precludes this alternative for use over the entire Site. It is a more effective alternative for controlling the release of NAPL to the lake than dredging alternatives.

Cost

Costs for this alternative are expected to be greater than dredging alternatives.

7.5.3.8 Ex-Situ Treatment

Physical Treatment

Physical separation includes processes that separate sediment fractions by screening, gravity settling, floatation and hydraulic separation such as with hydrocyclones. Many of these processes were developed in the mining industry for processing of ore. This equipment has been demonstrated at sediment sites in the US where a significant fraction of the sediment contains sands that tend to be cleaner than the organic and fine grain fractions of the sediment. Hydrocyclones and gravity settling typically reduce the volume of contaminated sediment and allows reuse of the sands for other purposes. The amount and contamination level of any sand expected to be recovered at this Site limits the effectiveness. Wood debris in the sediment would clog and interfere with the sand separation processes included in gravity settling and possibly in the hydrocyclones. The percentage of sand will vary with the areas and depth of dredging. It was observed in the sampling conducted for the treatability testing this year that samples high in sand also contain NAPL . The efficiency of separation of sand and NAPL using hydrocyclones would need to be tested to determine effectiveness in producing a decontaminated reusable material. Hydrocyclone technology will be retained for further consideration, and gravity settling for sand separation will be screened out.

The use of screening and floatation in an impoundment may be an effective pre-treatment method to remove the wood debris from the sediment. These technologies may be augmented with wood debris crushing equipment for the larger pieces of wood to aid in separation. Operation of this equipment in the open air would have potential air emission control concerns as a result of the high levels of benzene and naphthalene in the sediment. Additional treatment testing will be needed to determine effectiveness for treating wood debris. Separation methods suitable for wood waste removal from the sediment will be retained. Crushing equipment to pre-treat wood debris where needed will be retained.

In summary, hydrocyclones for sand separation, screening and floatation for wood debris separation and crushing or grinding for pre-treatment of wood debris will be retained.

Implementability

Hydrocyclones for separation of sand are readily available implementable as a result of operations in the mining industry. Stockpile areas and impoundments would be needed to feed and store separated products. Removal of wood debris though the use of screening at the dredge has been implemented where pumping of the sediment in a high solids slurry pump was used for mechanical dredging at the Bayou Bonfuca Site. Grinders have also been implemented to reduce the size of the wood debris at soil sites. Handling areas and impoundments would be needed to feed the screens and grinders for onshore processing to implement. All of these methods are implementable to remove wood waste, but will need to consider the air emissions impacts to the

area. The equipment is available commercially in this area. This alternative is only for support where wood debris removal is needed for other sediment alternatives from which a sufficient quantity of sand can be separated.

Effectiveness

These separation methods are primarily effective when combined with other alternatives where wood debris removal is needed or particle size reduction of the debris is needed. This separation alternative is more effective for larger size debris processing. Sand separation technology is only effective if a sufficient volume of sand relative to other material results.

Cost

Screening, grinding and hydrocyclone operations are moderately expensive. However, screening at the dredge can reduce the productivity and increase the dredging cost significantly. The hydrocyclone separation is only cost effective if there are significant quantities of sand in the dredged material and the sand product suitable for reuse.

Thermal Desorption

This alternative would include wood debris separation, dewatering, thermal desorption, dredge water treatment, off-site disposal of wood debris and treatment of soils and sediments. Thermal desorption is a process that separates the contaminants from the sediments by first heating indirectly such as on the outside of a rotating kiln containing sediments and causing the organics to vaporize. Temperatures are usually in the 600 to 1,200 ^{0}F range for removing PAHs. High and most low temperature thermal desorption equipment can achieve desorption chamber operating temperatures in the 600-1,200 ^{0}F range needed to volatilize PAHs. The sediment matrix (sand, silt, clay and wood debris), organic content and moisture will affect the energy requirement and operating temperature needed to meet required removal efficiencies. The residence time available for each equipment system to achieve the temperature requirements, and ability to handle the sediment matrix or the requirement for additives will affect the processing rate and determine cost and equipment selection.

A carrier gas or vacuum transports the vapors to either a condensing unit or after burner (secondary combustion chamber) to incinerate the organics. A condensing unit would be considered if the resultant condensate would have any reuse value. An afterburner is most often used and will combust and destroy the vaporized contaminants at a temperature range of 1,600 to 2,000 ^{0}F. Temperatures are controlled based on the residence time and concentrations of the contaminants.

The system includes an afterburner, solids quench and air pollution control system. The pollution control system is required on the off-gas system to remove particulates. Baghouses, venturi scrubbers and wet electrostatic precipitators are used to remove particulates. This treatment technique has been used successfully on soils and sediments in fixed facilities and in transportable equipment. At the SLRIDT site in Duluth, MN a thermal desorber with an afterburner was used to treat soils and a small amount of sediments (5,000 CY) that were

blended with the soils for a pilot scale demonstration. Initially the treated soils did not meet cleanup levels until some modifications in the process were implemented. The advantages are that organic contaminants are removed and destroyed. Afterburners emissions have been shown to meet destruction removal efficiencies (DRE) of 99.99% for PAHs.

The costs are high due to dewatering requirements and the high moisture content of the sediments. Use of desorption, unlike incineration, is limited to sediment with lower levels of organics. The smaller particle wood debris portion that may not be easily removed from the sediment would impact the organic content of the sediment feed which may make the economics less favorable than incineration. Further analysis of sediments will be needed for thermal analytical parameters to evaluate the feasibility of thermal treatment.

Implementability

Transportable thermal desorption systems are available from only a few contractors that have permits to handle PAHs and VOCs. System availability will depend on size of project and amount of lead time available for contractors to schedule and obtain permits. Dewatering would need to be performed in the area immediately onshore with stockpile ponds for sediment and stockpile areas for screened and dewatered sediment. The location of the discharge stack might be a concern since it would be located below the bluff next to the downtown Ashland area. Air quality from the stacks would have to conform to air quality standards to allow this and even then there may be community issues with this stack releases this close to residential areas. This alternative is considered implementable.

Effectiveness

The thermal process equipment is considered effective in removal of the VOCs and PAHs from the sediment to levels of 1 ppm or less and emissions can be reduced to a DRE of 99.99%. Since almost all of the organics are destroyed this is an effective alternative. The dewatering and screening operations will have some emissions of volatile compounds and potential odor issues. Controlling the emissions of these dewatering and screening operations will be less effective than with the thermal process.

Cost

Costs are high for this type of process due to dewatering requirement and high energy consumption. Mobilizing transportable systems and ensuring they conform to normal permitting requirements will impacts overall costs. Suitable fill locations for the thermally treated material may be problematic and could impact overall cost for off-site disposal.

Incineration

This incineration alternative includes wood debris separation/crushing, dewatering, incineration, dredge water treatment, and treatment of soil and sediments. Incineration is a process that is similar to thermal desorption, except that the soils and sediments are direct fired in the first stage, typically in a rotary kiln. Incineration temperatures are normally operated in the range of 1,400

to 2,200 ^{0}F. The system includes an afterburner, solids quench and air pollution control system. The pollution control system is required on the off-gas system to remove particulate and acid gasses when chlorinated compounds are present (chlorinated contaminants are not COPCs for this site). Baghouses, venturi scrubbers and wet electrostatic precipitators are used to remove particulates. This is the same type of pollution control system required for the afterburner of the thermal desorption process, but may be larger due to higher gas flow rates. The advantage of incineration is that it can handle higher organic content such as the wood debris. At Bell Pole and Lumber site in New Brighton, MN wood poles and debris were crushed as part of the feed to an incinerator used to treat creosote and PCP contaminated soils.

Implementability

Transportable incineration systems are available from only a few contractors that have permits to handle PAHs and VOCs. System availability will depend on size of project and amount of lead time available for contractors to schedule and obtain permits. Dewatering would need to be operated in the area immediately onshore with stockpile ponds for sediment and stockpile areas for screened and dewatered sediment. The location of the discharge stack might be a concern since it would be located below the bluff next to the downtown Ashland area. Air quality from the stacks would have to conform to air quality standards to allow this and even then there may be community issues with this stack releases this close to residential areas. This alternative is considered implementable.

Effectiveness

The incineration process equipment is considered effective in removal of the VOCs and PAHs from the sediment to levels of 1 ppm or less and emissions can be reduced to a DRE of 99.99%. Since all of the organics are destroyed this is an effective alternative. The wood debris can likely be incinerated with the sediment potentially making this more effective than thermal desorption. The dewatering and crushing operations will have some emissions of volatile compounds and potential odor issues. Controlling emissions from the dewatering and wood crushing operations likely will be less effective than the thermal process.

Cost

Costs are high for this type of process due to dewatering requirement and high energy consumption. Mobilizing transportable systems and ensuring they conform to normal permitting requirements will impacts overall costs. Suitable fill locations for the thermally treated material may be problematic and could impact overall cost for off-site disposal.

7.6 Ancillary Technologies including Disposal

Ancillary technologies discussed in this section include:

- Dewatering;
- Wastewater treatment;
- Disposal;

- Transportation; and
- Monitoring.

These technologies will address all relevant environmental media.

7.6.1 Dewatering

Dewatering technologies are commonly used to reduce volume or remove moisture prior to sediment treatment and disposal. Technological options for dewatering include settling, plate and frame filters, vacuum drum and filter presses and centrifugation. Sediment drying beds also may be used where weather conditions are favorable although high levels of volatiles may preclude this. Geotextile bag filters may also be used for on site or for off site disposal dewatering.

7.6.1.1 Settling (Hydraulic and Mechanical Dredging)

Settling is commonly used as an initial step for dredged sediment excess water removal. This may also be used for treating recirculation water from a CDF for reuse in slurrying of mechanically dredged and hydraulically transported sediment. This technology consists of placing or pumping the sediment into a CDF, tank or dewatering pond and allowing the sediment to gravity settle under quiescent conditions. Chemical additives may be added to enhance and expedite this settling process or to improve the sediment consolidation process. Coagulant aids are frequently used to reduce the charge on fine particles to allow more and faster settling to improve the quality of the supernatant water.

Chemicals are added through in-line mixing, at overflow structures or in a mixing chamber. These chemical aids are generally selected by conducting jar tests using site sediment slurries and testing with a wide range of organic and inorganic compounds typically used for this application. This determines effectiveness and helps define any subsequent sediment sludge and water treatment requirements. Due to the presence of naphthalene, benzene and possible NAPL, air emissions will be a concern and some emissions control methods likely will be needed. LNAPL may need to be removed from the water surface using other technologies such as oil/water separators, skimming or adsorbent material. Settling technology will be considered for sediment dewatering for both on-site containment and hydraulic dredging.

On-barge dewatering using gravity settling is commonly used for mechanical dredging. The sediment is loaded by the dredge into a barge and the water is allowed to drain by gravity. The process requires sufficient time to allow the particles to settle and the supernatant water be discharged or removed for additional treatment on-shore and then discharged. Dredge barges may be configured with a sloped floor to improve collection of the water. This type of barge may not be available without special construction. The sediment will not likely achieve dewatering much lower than in-situ moistures for fine grain sediments, but will reduce the free liquid content generated from the dredging activity. This technology could be used as a potential dewatering pre-step for sediment that is mechanically dredged.

7.6.1.2 Plate and Frame Filter Press

Plate and frame filter technology refers to the use of monofilament filters placed on each side of parallel vertical plates. The plates are placed in series and held in a frame between fixed and moving ends. The sediment slurry is pumped into the equipment and the water is forced through the filters while the solids form a cake on the filter's surface. The solids caked on the filters are periodically removed and the process continues. Wood debris may reduce the hydraulic distribution and effectiveness due to clogging and obstructions within the pump and filter system. Plate and frame filters have been demonstrated to be effective for dewatering sediments at other sites. Their primary disadvantages are low productivity, high cost and possible plate warpage that may reduce filter effectiveness (Averett 1990). Due to the presence of naphthalene and other VOCs, and possible NAPL in the sediment, air emissions may be a concern and the NAPL may cause binding or be difficult to remove from the filter. This technology has been effective in producing 30 to 55% by weight solid cakes from sediments and may meet the paint filter test for free liquids required for offsite landfill disposal. The plate and frame filter technology could be used in sediment dewatering and or for dewatering excavated saturated soils.

7.6.1.3 Filter Presses

Belt presses use porous belts used to compress and filter the sediments by pumping the sediment slurry into a sandwich between two belts. As with other filters, polymers and filter aids are used to improve the dewatering of the sediments. They are similar to plate and frame filter presses in production rates and cost. They have the potential to dewater sediments sufficient to meet off-site landfill requirements and will be retained. Diaphragm filter presses that use an inflatable diaphragm to add additional force on the filter are also effective for dewatering sediments. These filter units are costly and labour intensive, but can produce filter cakes suitable for landfill disposal and will be retained. Sediment dewatering bench tests will be needed to determine the most effective technology for the disposal alternatives selected.

In summary the retained technologies include the following:

1. Settling technology for dewatering dredge material;
2. Barge dewatering using gravity settling for mechanical dredging;
3. Plate and frame filter technology used for dewatering sediment and saturated soils; and
4. Belt presses using porous belts to compress and filter the sediments.

7.6.2 Waste Water Treatment

A groundwater extraction system consisting of three low flow extraction wells screened in the Copper Falls and one well in the backfilled ravine has been in operation since September 2000. This system has removed approximately over 1.5 million gallons of contaminated groundwater mixed with emulsified NAPL. Treatment has included the removal and off-site disposal of approximately 8,300 gallons of NAPL, which is separated by an oil water separator. Dissolved phase contaminants are treated on-site by carbon filtration prior to discharge to the sanitary sewer. Potential soil and/or groundwater remedial alternatives may include continued operation of this system. Limited excavation will result in an increase in treatment of a relatively small

volume of water for a short duration compared to unlimited removal, which could result in a large increase in the volume of water requiring treatment for a longer duration. The treatment system may need to be upgraded to treat any short term or long term increase in volume above current production levels.

Water generated from dredging operations and dewatering activities requires treatment before discharge to the City of Ashland Publicly Owned Treatment Works (POTW) or for discharge back to the lake. The sediments contain VOCs, PAHs, suspended solids and biological oxygen demand (BOD) that will need to be reduced to meet appropriate standards. With this type of sediment a large amount of contamination can typically be removed with suspended solids removal since the PAHs tend to adsorb to the particles. The dewatering technologies that may be used will reduce the suspended solids for subsequent treatment. A contaminant dissolved phase will also be present and require removal before discharge.

7.6.2.1 Settling

Settling was previously discussed for sediment slurries and water in the previous section. Additional sedimentation basins or lagoons may be needed for implementing this technology depending on the level of treatment and source of the dredge water. Multi-cells clarifiers with coagulating agents also maybe used to reduce the suspended solids if sufficient room is available. Clarifier tanks currently exist at the old POTW located at the Site and may be capable of being retrofitted for use. Jar bench testing would be needed to identify the most effective coagulant and concentration. This technology will be retained.

7.6.2.2 Filtration

Sand filters are often used in conjunction with carbon adsorbers to treat wastewater. The filters act as a pre-treatment technology to protect fouling and reduce the organic and contaminant load to the activated carbon beds. They have been shown to reduce suspended solids from dredge water from 60 to 98-percent. They can be regenerated with backwashing and re-circulating this water to a settling or filtration process. The sand can also be replaced with multi-layer filtering media to improve the filtering performance. Cartridge and bag filters contained in pressure vessels may also be used to remove particulate prior to a carbon bed. The cartridges and bags are replaced when the pressure loss across the filter media meets its maximum operating pressure. These technologies will be retained.

7.6.2.3 Activated Carbon

Granular Activated Carbon (GAC) may be used to remove dissolved organic compounds from the wastewater. By passing the waste stream though a filter bed of GAC, contaminants such as PAHs, VOCs and some metals will adhere to the carbon. Once breakthrough of the water being treated exceeds treatment standards, the carbon must be replaced and spent GAC disposed of in a landfill or thermally regenerated off-site. This is a well developed and reliable treatment method for the Site COPCs and will be retained.

7.6.2.4 Hydrocarbon Water Separation

Floating hydrocarbons may occur on the surface of CDFs, clarifiers or barge water since some NAPL may be present in the sediment. This separation technology follows the skimming process to pull hydrocarbons from the surface. The wastewater needs to be further treated to reduce the water content. Hydrocarbon/water separators are a proven technology where the hydrocarbon layer is not excessively emulsified. This technology will be retained for further consideration.

7.6.3 Disposal

Disposal alternatives vary depending upon the characteristics of the waste. Three general categories of waste are anticipated for alternatives selected to meet project RAOs:

Treatment residuals: These wastes consist of environmental media, primarily soil and sediment that have been treated in some manner, including by dewatering.

Wood waste: If certain alternatives are implemented, there is the potential for generating a substantial quantity of wood waste. The wood waste ranges in size from sawdust and chips to logs.

Ancillary solid wastes: Waste such as personal protective equipment (PPE), construction debris and other types of solid wastes generated during the conduct of remedial activities.

7.6.3.1 Treatment Residuals

On-site disposal

CDF: As previously discussed an on-site containment structure can provide for dewatering, water treatment and permanent storage of all Site residuals. Because residuals can be placed in a CDF without the level of treatment required for off-site disposal in landfills and because there are no transportation costs, on-site containment facilities provide a cost-effective disposal option. The Army Corps of Engineers and USEPA have developed detailed guidance for construction and management of these CDFs including the following:

- *USACE. 1987. Engineering and Design - Confined Disposal of Dredged Material.*
- *USEPA. 1994. Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document.*
- *USEPA. 1996. Design, Performance, and Monitoring of Dredged Material Confined Disposal Facilities in Region 5.*

Modern construction techniques can ensure these facilities are virtually water-tight and have negligible leaching of contaminants associated with either the in-situ sediments or soils that are covered by the facility or the soils and sediments removed from other parts of the Site and disposed in the facilities.

As discussed in Section 7.5.3.5, these facilities are technically implementable, effective and cost effective. However, according to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult.

On-site beneficial use: Dewatered and treated sediment or treated soils may be suitable as soil/sediment construction fill. The feasibility of these disposal techniques depends on the chemical and physical properties of the material, residual concentrations, local needs and ARARs.

Off-site disposal

Candidate municipal and industrial landfills were reviewed for:

- Ability to meet NR 500 WAC standards
- Distance from the Site;
- Rail and barge access;
- Seasonal capacity limitations;
- Projected operating life; and
- Published or verbally quoted disposal costs.

Municipal Landfills

Two municipal landfills are located within approximately 70 miles of the Site (Figure 7-2). These facilities have indicated that they will only accept clean soil and/or demolition debris.

Industrial Landfills

Five commercial landfills are located within approximately 125 miles of the Site and can accept contaminated soil and dewatered sediment from the Site (Figure 7-2). Two of the facilities operate biological treatment systems that result in the destruction of contaminants.

Upland Confined Fill

An upland confined fill is a disposal site located on an industrial or commercial property. Use of site media containing low levels of COPCs as fill meets regulatory requirements contained in WAC chapter NR 718, if the fill site contains media with similar COPCs.

Additionally, the Woodfield Ash Landfill operated by NSP, is located approximately 6 miles south of the Bayfield Power Plant and is currently permitted to accept ash from the plant. The landfill has a clay liner and reportedly has a remaining capacity of approximately 110,000 cubic yards. With appropriate modifications to the plan of operation, some of the remaining landfill sites could potentially be used for disposal of sediment from the Site. The construction of a new cell for the sediment, material excavated from the filled ravine, and material excavated from Kreher Park may be a potential off-site disposal option.

Upland (Clean) Fill

An upland clean fill site would be used for disposal of clean soil and/or dewatered sediment. These clean fill sites are considered separately from the aforementioned municipal landfills, since prior treatment reduces levels of COPCs to essentially background levels.

Wood Waste

There is the potential for generating a substantial quantity of wood waste if sediments are removed. The wood waste ranges in size from sawdust and chips to timber. Potentially, the larger debris could be burned as fuel at the NSP Bayfield Power Plant located in Ashland. Some additional maintenance at the plant would be required to accommodate the wood debris but this is considered a viable option at this time.

Ancillary Solid Wastes

Waste such as personal protective equipment (PPE), construction debris and other types of solid wastes generated during the conduct of remedial activities can be disposed of at a local municipal landfill. This management method will be used in all remedial alternatives. The quantity generated will depend on the remedial alternative. Personal protective equipment (PPE) will be evaluated and handled in accordance with EPA guidance document to handle investigation derived waste (USEPA 1992).

7.6.4 Transportation

Transportation methods will be needed for any remedial alternative that involves removal of the contaminated soil or sediment so no screening evaluation is necessary.

The following transportation methods are available to support the selected alternative.

Truck. Transport of soil or dewatered sediment over public roadways using dump trucks, roll-off boxes, or trailers. This technology applies to transport for relatively short distances, and can be used in remedial alternatives where soil or dewatered sediment, treated or untreated, are transported to an in-state landfill or upland disposal site.

Rail. Transport of soil or dewatered sediment using existing rail lines. This technology applies to large quantities of soil and/or sediment to be transported relatively large distances to disposal facilities located in close proximity to the rail system.

Barge. Transport of dewatered soil or sediment on navigable waterways (Lake Superior) using barges. This technology may be used in remedial alternatives where soil or dewatered sediment, treated or untreated, are transported on the lake to landfills or other disposal sites located in relatively close proximity to the shoreline. Barges may be used in combination with truck transport.

7.6.5 Monitoring

The magnitude and nature of monitoring will depend upon the alternative selected. Monitoring can include verification monitoring to verify remediation objectives are met, operation and

maintenance monitoring of disposal sites or long-term monitoring to verify achievement of RAOs. As part of the Feasibility Study and Remedial Action Plan, the following monitoring programs will be developed.

7.6.5.1 Baseline Monitoring

Once RAOs are established and prior to implementation of the remedy, the database of information from all Site studies will be reviewed to ascertain whether an adequate statistical database is available to provide the basis for determining whether performance criteria are achieved. Based upon this review additional baseline sampling may be necessary.

7.6.5.2 Implementation Monitoring

Monitoring during implementation of the remedy will be conducted to ensure that remediation is being conducted in accordance with the Remedial Action Plan and that all project design specifications including performance of the contractor and environmental controls are met.

Regular air monitoring will be conducted during RA.

7.6.5.3 Verification Monitoring

Of particular importance to removal alternatives, verification monitoring determines whether performance criteria established for environmental media cleanup levels are met.

7.6.5.4 Operations and Maintenance Monitoring

Operations and maintenance monitoring will be required for any on-site structures, e.g., CDFs, or continuing operations, e.g., hydraulic control, that are part of the Site remedy. This will verify continuing source control as well as ensure structures and/or control operations continue to perform as designed.

7.6.5.5 Long-term Monitoring

Long-term monitoring is primarily focused on verifying the continuing achievement of RAOs. It is of particular importance if any RAO is to be met through natural attenuation or natural recovery mechanisms. Generally long-term monitoring is associated with contingency plans for implementation in instances where expected results of remediation are not met.

8.0 REFERENCES

BB&L. 1998. Feasibility Study, Sheboygan River and Harbor, Sheboygan, Wisconsin.

Dames & Moore. 1999. Supplemental Facility Site Investigation and Remedial Action Options Evaluation Report prepared for Northern States Power, Ashland, Wisconsin.

Dames & Moore. Remedial Action Options Feasibility Study – Final Report for the Ashland Lakefront Site, prepared for Northern States Power, Ashland, Wisconsin for NSP.

FRTR. 2002. Remediation Technologies Screening Matrix. http://www.frtr.gov/matrix2/section3/table3_2.html

Maynord and Oswalt. 1993. Design Considerations for Capping/Armoring of Contaminated Sediments In-Place.

Palermo, Mike. 1994. Placement Techniques for Capping Contaminated Sediments.

Palermo, Mike et al., 1998. Guidance for In Situ Subaqueous Capping of Contaminated Sediments.

Palermo, Mike, et al. 2004. Operational Characteristics and Equipment Selection Factors for Environmental Dredging.

SEH. 1998. Remediation Action Options Feasibility Study - Ashland Lakefront Property and Contaminated Sediments

TAMS. 2000. Hudson River PCBs Reassessment RI/FS Phase 3 Report: Feasibility Study.

TAMS and Malcolm Pirnie. 2004. Lower Passaic River Restoration Project. Dredging Technology Review Report.

Thermoretec. 1999. Draft Feasibility Study. Lower Fox River, Wisconsin.

USACE. 1987. Engineering and Design - Confined Disposal of Dredged Material.

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA: Interim Final. EPA/540/G-89/004. OSWER Directive 9355.3-01.

USEPA. 1992. Guide to Management of Investigation-Derived Wastes. Publication 9345.3-03FS.

USEPA. 1994. Assessment and Remediation of Contaminated Sediments (ARCS) Program Remediation Guidance Document.

USEPA. 1996. Design, Performance, and Monitoring of Dredged Material Confined Disposal Facilities in Region 5

USEPA. 2005. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. EPA-540-R-05-012.

TABLES

Table 4-1. Volumes and Areal Extent of Contaminated Media

Media	Volume (cubic yards)	Assumptions
Soil		
Upper Bluff Area	32,600	Areal extent of contamination is approximately 2.02 acres, and thickness is 10 feet.
Former Gas Holder Area	7,600	Areal extent of contamination is approximately 0.28 acres, and thickness is 15 feet.
Kreher Park	83,700	Areal extent of contamination is approximately 10.38 acres, and average thickness is 5 feet.
Former Coal Tar Dump Area	4,000	Areal extent of contamination is approximately 0.49 acres, and layer is 5 feet thick.
Groundwater		
Upper Bluff Area	65,600	Areal extent of contamination is approximately 2.71 acres, and saturated thickness is 15 feet.
Kreher Park	133,900	Areal extent of contamination is approximately 10.38 acres, and saturated zone is 8 feet.
Copper Falls Aquifer	Upper Bluff 366,700 Kreher Park 133,500 Total 500,200	Areal extent of contamination is 6.9 acres, average thickness of 35 feet beneath Kreher Park, and 50 feet beneath upper bluff area.
Sediment		
Sediment exceeding 10 µg/g	77,800	Approximate areal extent of contamination is 16 acres, and includes removal of wood waste and all contaminated sediment to maximum depth of 4 feet.
Sediment exceeding 10 µg/g	133,900	Approximate areal extent of contamination is 16 acres, and includes removal of wood waste and all contaminated sediment to maximum depth of 10 feet.

Table 5-1. Chemical-Specific ARARs and TBCs for the Ashland/Northern States Power Lakefront Superfund Site

Program	Requirements	Citation	Description	Comment
Clean Water Act	Ambient Water Quality Criteria	CWA Section 304 Quality Criteria for Water, EPA 1986	Establishes non-enforceable guidelines for States to set water quality standards for surface water. Criteria based on protection of aquatic life and human health.	Applicable only if concentrations of surface water above sediments exceed these criteria; otherwise becomes a cross-media check.
Clean Water Act	Water Quality Standards	CWA Section 303 40 CFR 131	Requires states to develop water quality standards based on federal guidelines.	Applicable only if concentrations of surface water above sediments exceed these criteria; otherwise becomes a cross-media check.
Clean Water Act	Proposed Sediment Quality Criteria	CWA Section 304 Sediment Quality Criteria, EPA, 1991	Establishes Sediment quality standards that will not unacceptably affect benthic organisms.	Potentially applicable once promulgated.
Resource Conservation and Recovery Act	Definition of Hazardous Waste	40 CFR 261	Defines threshold levels and criteria to determine whether material is hazardous waste.	To be considered in evaluating which wastes would be classified hazardous. These regulations do not set cleanup standards, but would apply during various remedial actions.
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for protection of public health.	Applicable in evaluating air impacts prior to or during remediation.
Clean Air Act	National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	Establishes emission standards for sources emitting benzene, arsenic, asbestos, beryllium, mercury, radionuclides, and vinyl chloride.	Applicable in evaluating emission standards on treatment technologies.
USEPA Contaminated Sediment Management Strategy		EPA-823-R-98-001	Establishes goals to manage the problem of contaminated sediment.	To be considered.
USEPA Contaminated Sediment Management Guidance		EPA-540-R-05-012	Provides technical and policy guidance for management of contaminated sediment sites.	To be considered.
Agency for Toxic Substances and Disease Registry, US Public Health Service		NA	Toxicological Profiles	To be considered information regarding COPC toxicity.
Wisconsin State Environmental Protection Administrative Code (WAC)	Water Quality Standards for Wisconsin Surface Waters	WAC NR 102-105	Establishes definition of water use and criteria for protection of public health and enjoyment and protection and propagation of fish, shellfish, and wildlife.	Applicable only if concentrations of surface water above sediments exceed these criteria.
Wisconsin State Environmental Protection Administrative Code (WAC)	Groundwater Quality	WAC NR 140	Establishes groundwater quality standards for substances detected or having reasonable probability of entering groundwater resources.	Applicable for site groundwater and treatment, storage, or disposal facilities for contaminated sediments (impacts to groundwater).
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin State Air Pollutant Control Regulations	WAC NR 400-499	Establishes concentration levels, by chemical, for new sources. Section 419.07 specifically applies to organic compounds which are direct air contaminant sources. Manages construction and operation permits.	Applicable for removal and disposal of contaminated soil and/or sediments.
Wisconsin State Environmental Protection Administrative Code (WAC)	Soil Cleanup Standards	WAC NR 720	Allows for the calculation of site-specific risk-based cleanup standards based on the intended reuse of the property. Generally applied to unsaturated material or soils.	Likely managed under NR 500. Potentially applicable for vadose zone soil or if dewatered sediment is considered soil after treatment.
Sediment Quality Guidelines (CBSQGs)		Document Title: Consensus-Based Sediment Quality Guidelines Recommendations for Use & Application Interim Guidance; WDNR PUBL-WT-732 2003	Provides a framework for use of consensus based sediment quality guidelines in determining cleanup standards.	DNR Guidance Document (To be considered)
Guidance for Generic Soil PAH Cleanup Levels		Document Title: Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons Interim Guidance; WDNR PUBL-RR-519-97, April 1997	Provides interim guidance on suggested soil cleanup levels for PAHs.	DNR Guidance Document. (To be considered)

Table 5-2. Location-Specific ARARs and TBCs for the Ashland/Northern States Power Lakefront Superfund Site

Program	Requirements	Citation	Description	Comment
Clean Water Act	Great Lakes Critical Program Act of 1990 – Assessment of Remediation of Contaminated Sediments (ARCS) Program	CWA Section 118(c)(7) 40 CFR Part 132 (Appendix E)	Provide environmental managers at AOCs and elsewhere with the tools and information necessary for making informed cost-effective and environmentally sound decisions in addressing a local contaminated sediment problem.	To be considered in addressing existing and possible pollutant problems in the Great Lakes and their tributaries.
USEPA Contaminated Sediment Management Strategy		EPA-823-R-98-001	Establishes goals to manage the problem of contaminated sediment.	To be considered.
International Joint Commission (IJC)		IJC, 1992	Protection of fish tissue	To be considered
Rivers and Harbors Act		33 CFR 320 33 CFR 322	Establishes requirements for activities that will obstruct or alter any navigable water of the US.	Potentially applicable in evaluating actions that include construction and/or excavation in water.
Wisconsin State Environmental Protection Administrative Code (WAC)	Designated Waters Special Natural Resources Interest	WAC s. NR 1.05(4), and s. 30.01(1am), Wis. Stats.	Requires the Department to take into consideration potential effects of projects in the water on valuable natural resources such as Walleye, Muskellunge, Sturgeon spawning habitat, State Natural areas and others	Potentially applicable for removal, transport and disposal of sediments.
Solid Waste Management	Beneficial Reuse Solid Waste Exemption	WAC NR 500.08	Establishes criteria for possible beneficial use of solid wastes after treatment. Applies for on-site reuse options only.	To be considered for disposal of treated sediments and/or soil meeting disposal criteria.
Dredge and Fill Requirements		WDNR 1985, 1990	Report of the Technical Subcommittee on Determination of Dredge Material Suitability of In-Water Disposal.	To be considered for alternatives involving in-water disposal, such as confined aquatic disposal (CAD).
Local Permits (building, zoning, other)		---	Construction in floodplain or wetland and miscellaneous construction activities.	To be considered for implementation of a given remedial alternative.
Sediment Quality Assessment at Manufactured Gas Plant Sites		Document Title: Assessing Sediment Quality in Water Bodies Associated with Manufactured Gas Plant Sites; WDNR PUBL-WR-447-96, March 1996	Provides a framework for investigating potential surface water problems at Manufactured Gas Plant sites	DNR Guidance Document (To be considered)
Wisconsin State Environmental Protection Statutes	Landfill Siting and Approval Process	Wis. Stats. Ch. 289	State statute for solid waste facilities. Addresses the upland disposal of solid waste along with in-water disposal options. Landfill facilities are prohibited from shoreland and floodplain zone areas except by permits issued from WDNR.	Applicable for implementation of any given remedial alternative disposal option.
Wisconsin State Environmental Protection Statutes	Permit in Navigable Waters	Wis Stats. Ch. 30	State statute for navigable waters, harbors, and navigation. Substantive provisions that address minimizing adverse effects on navigable waterways resulting from work performed.	Applicable for work performed in navigable waterways.

Table 5-3. Action-Specific ARARs and TBCs for the Ashland/Northern States Power Lakefront Superfund Site

Program	Requirements	Citation	Description	Comment
Clean Water Act	National Pollutant Discharge Elimination System	CWA Section 401	Requires compliance with permit limitations for discharge to navigable waters, including water quality effluent limits, water quality standards, national performance standards, and toxic and pretreatment effluent standards.	NPDES program is administered by the state. (see Wisconsin NPDES Permit Regulations.) Applicable for actions involving discharges of liquid effluent to surface water.
Clean Water Act	Effluent Standards – Technology – Based Discharge Requirements	CWA Section 301 (b)	Requires all direct discharges to be treated with best control technology prior to discharge.	Applicable if surface water is channelled directly to a surface water body via a ditch, culvert, storm sewer, or other means; or treated water is discharged.
Clean Water Act	Dredge and Fill Requirements	CWA Section 404 (Inland Testing Manual)	Regulates discharge of dredged or fill material to U.S. waters, including wetlands. Testing manual establishes procedures for determining the potential for contaminant-related impacts associated with discharge of dredged material in inland waters.	Applicable for consideration of any practicable alternatives and may require protection of environmental values of the site.
Comprehensive Environmental Response, Compensation, and Liability Act	Procedures for Planning and Implementing Off-site Response Actions	40 CFR 300.440	Applies to any off-site transfer of hazardous substances conducted under CERCLA.	Allows EPA to determine acceptability of facilities selected for treatment, storage, or disposal of CERCLA wastes.
Resource Recovery and Conservation Act	Manifesting, Transport and Recordkeeping Requirements	40 CFR 262	Provides tracking requirements for transportation of hazardous wastes.	To be considered.
Resource Recovery and Conservation Act	Wastewater Treatment System Standards	40 CFR 264	Provides requirements for treatment of hazardous waste.	To be considered.
Resource Recovery and Conservation Act	Storage Requirements	40 CFR 264, 265	Provides requirements for storage of hazardous wastes in containers or tank systems.	To be considered.
Resource Recovery and Conservation Act	Subtitle D Non-hazardous Waste Standards	40 CFR 257	Criteria for classification of solid waste disposal facilities and practices	Potentially applicable for off-site disposal of material.
Resource Recovery and Conservation Act	Excavation and Fugitive Dust Requirements	40 CFR 264	Management of excavations to prevent fugitive dust emissions.	Potentially applicable for excavation of material for disposal.
Dept. of Transportation	DOT Rules for Hazardous Materials Transport	49 CFR 107-171	Requirements for transportation of hazardous materials	Potentially applicable for transport of excavated material for disposal.
Occupational Health & Safety	Occupational Safety and Health Standards	29 CFR Parts 1910.120, 1910.132, 1910.134, 1910.138	Establishes 8-hour time-weighted average concentrations for protection of worker breathing zones, PPE requirements, medical monitoring requirements, respiratory protection requirements, and HAZMAT training requirements.	Applicable for workers near areas of contamination.
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for protection of public health.	Applicable in evaluating air impacts prior to or during remediation.
Clean Air Act	National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	Establishes emission standards for sources emitting benzene, arsenic, asbestos, beryllium, mercury, radionuclides, and vinyl chloride.	Applicable in evaluating emission standards on treatment technologies.
USEPA Contaminated Sediment Management Strategy		EPA-823-R-98-001	Establishes goals to manage the problem of contaminated sediment.	To be considered.
Wisconsin State Environmental Protection Administrative Code (WAC)	Designated Waters Special Natural Resources Interest	WAC s. NR 1.05(4), and s. 30.01(1am), Wis. Stats.	Requires the Department to take into consideration potential effects of projects in the water on valuable natural resources such as Walleye, Muskellunge, Sturgeon spawning habitat, State Natural areas and others	Potentially applicable for removal, transport and disposal of sediments.

Table 5-3. Action-Specific ARARs and TBCs for the Ashland/Northern States Power Lakefront Superfund Site

Program	Requirements	Citation	Description	Comment
Wisconsin State Environmental Protection Administrative Code (WAC)	Plans and Specifications Review of Projects and Operations	WAC NR 108	WDNR approval of any reviewable project, general operation and control of specific water/wastewater system.	Applicable for community water systems, sewage systems, and industrial wastewater facilities.
Wisconsin State Environmental Protection Administrative Code (WAC)	Environmental Analysis and Review Procedures	WAC NR 150	Requires the Department to provide guidance for applicants seeking to conduct a proposed action and determine the need for Environmental Impact Reports or Statements	Potentially applicable if more than 3,000 cubic yards of sediment are dredged (Type II action under NR 150.03(8)).
Wisconsin State Environmental Protection Administrative Code (WAC)	Laboratory Certification and Registration	WAC NR 149	Requires certification or registration of laboratories submitting data to the WDNR.	Potentially applicable.
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin Pollutant Discharge Elimination Systems	WAC NR 200	Technology-based effluent limits (NR 220-297). Requires compliance with permit limitations for discharge to navigable waters, including water quality effluent limits, water quality standards, national performance standards, and toxic and pretreatment effluent standards.	Applicable action-specific ARAR for remedial alternatives involving discharges.
Wisconsin State Environmental Protection Administrative Code (WAC)	Water Quality Antidegradation	WAC NR 207	Establish implementation procedures for the antidegradation policy in s. NR 102.05(1)(a).	Applicable to proposed new and increased discharges.
Wisconsin State Environmental Protection Administrative Code (WAC)	Water Quality Antidegradation: Waste Load Allocated, Water Quality-related Effluent Standards and Limitations	WAC NR 212-220	Establishes permit limitations for effluent discharges.	Applicable for remedial alternatives involving effluent discharges.
Wisconsin State Environmental Protection Administrative Code (WAC)	Lining of Industrial Lagoons and Design of Storage Structures	WAC NR 213	Requires compliance with permit limitations for discharge to navigable waters from industrial treatment systems.	Potentially applicable for waste management of temporary sediment dewatering and treatment systems.
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin's General Permit Program for Certain Water Regulatory Permits	WAC NR 322	Establishes minimum design standards and specifications for projects permitted under a general permit.	Potentially applicable for implementation of a given remedial alternative.
Wisconsin State Environmental Protection Administrative Code (WAC)	Shoreline protection	WAC ch. NR 328	Establishes information needed and the standard for approval of shoreline protection.	Potentially applicable for implementation of a given remedial alternative.
Wisconsin State Environmental Protection Administrative Code (WAC)	Dredging Contract Fees	WAC NR 346	Establishes procedures applicable to the removal of material from the beds of natural lakes and outlying waters for which a contract is required between the state and person desiring to remove bed material.	Potentially applicable for removal, transport, and disposal of sediments.
Wisconsin State Environmental Protection Administrative Code (WAC)	Sediment Sampling and Analysis, Monitoring Protocol, and Disposal Criteria for Dredging Projects	WAC NR 347	Establishes procedures and protocols for sediment sampling and analysis, disposal criteria, and monitoring requirements for dredging projects regulated by the State of Wisconsin.	Potentially applicable for removal, transport, and disposal of sediments.
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin State Air Pollutant Control Regulations	WAC NR 400-499	Establishes concentration levels, by chemical, for new sources. Section 419.07 specifically applies to organic compounds which are direct air contaminant sources. Manages construction and operation permits.	Applicable for removal and disposal of contaminated soil and/or sediments.
Wisconsin State Environmental Protection Administrative Code (WAC)	Solid Waste Management	WAC NR 500-520	Provides definitions, submittal requirements, exemptions and other general information relating to solid waste facilities which are subject to regulations under s.2789.01(35) Stats. Applicable for off-site siting	Applicable for implementation of a given remedial alternative.

Table 5-3. Action-Specific ARARs and TBCs for the Ashland/Northern States Power Lakefront Superfund Site

Program	Requirements	Citation	Description	Comment
			processes. Applicable to new and existing facilities.	
Wisconsin State Environmental Protection Administrative Code (WAC)	Beneficial Reuse Solid Waste Exemption	WAC NR 500.08	Establishes criteria for possible beneficial use of solid wastes after treatment. Applies for on-site reuse options only.	To be considered for disposal of treated sediments and/or soil meeting disposal criteria.
Wisconsin State Environmental Protection Administrative Code (WAC)	Hazardous Waste Management	WAC NR 600-685	Provides definitions, general permit, application information, incorporation by reference citations and general information concerning the hazardous waste management program. Establishes procedures for handling, storage, and disposal of hazardous wastes.	To be considered for removal, transport, and disposal of contaminated sediments and/or soil, and for treatment units, regulated as incinerators.
Wisconsin State Environmental Protection Administrative Code (WAC)	Investigation of Remediation of Environmental Contamination	WAC NR 700	Management of contaminated media. Establishes standards and procedures that allow for site-specific flexibility, pertaining to the identification, investigation, and remediation of sites and facilities which are subject to regulation under s. 144.442, 144.76 or 144.77, Stats.	Applicable for implementation of a given remedial alternative.
Wisconsin State Environmental Protection Administrative Code (WAC)	Notification of the Discharge of Hazardous Substances	WAC NR 706	Notification procedures and responsibilities by discharger of hazardous substances including containment, cleanup, disposal, and restoration.	Applicable for removal, transport, and disposal of contaminated media.
Wisconsin State Environmental Protection Administrative Code (WAC)	Public Information and Participation	WAC Ch. NR 714	Responsible parties shall evaluate the need for and the level of public participation threats, public concern, the need to gather additional information and other factors relevant to the site.	May be met under project Community Involvement Plan.
Wisconsin State Environmental Protection Administrative Code (WAC)	Standard for Selecting Remedial Actions	WAC NR 722	Establishes standards for selection of remedial actions. Generally applied to soil and/or groundwater cleanup programs.	Potentially applicable, but likely managed under NR 500.
Wisconsin State Environmental Protection Administrative Code (WAC)	Remedial and Interim Action Design, Implementation, Operation, Maintenance and Monitoring Requirements	WAC Ch. NR 724	Specifies the requirements for the design, implementation, operation, maintenance and monitoring of remedial actions.	Potentially applicable for remedy implementation and post-remediation monitoring.
Dredge and Fill Requirements		WDNR 1985, 1990	Report of the Technical Subcommittee on Determination of Dredge Material Suitability of In-Water Disposal.	To be considered for alternatives involving in-water disposal, such as confined aquatic disposal (CAD).
Great Lakes Water Quality Initiative (GLI)		WAC 102 and 106 EPA 1995	Sets forth guidance for any remedial action in states bordering the Great Lakes. In general, minimize any lowering of water quality to the extent practicable.	To be considered with regard to remedial alternatives involving wastewater discharge.
Sediment Quality Assessment at Manufactured Gas Plant Sites		Document Title: Assessing Sediment Quality in Water Bodies Associated with Manufactured Gas Plant Sites;WDNR PUBL-WR-447-96, March 1996	Provides a framework for investigating potential surface water problems at Manufactured Gas Plant sites	DNR Guidance Document (To be considered)

Table 5-3. Action-Specific ARARs and TBCs for the Ashland/Northern States Power Lakefront Superfund Site

Program	Requirements	Citation	Description	Comment
Guidance for Cover Systems		Document Title: Guidance for Cover Systems as Soil Performance Standard Remedies; WDNR PUBL-RR-709, January 2007	Provides concepts for design, construction, and operation and maintenance of cover systems used as soil performance standards.	DNR Guidance Document (To be considered)
Sediment Quality Guidelines		Document Title: Consensus-Based Sediment Quality Guidelines Recommendations for Use & Application Interim Guidance. WDNR-PUBL-WT-732 2003	Provides a framework for use of consensus based sediment quality guidelines in determining cleanup standards.	DNR Guidance Document (To be considered)
Air Management, Public Participation and Risk Communication		Document Title: Health-based Guidelines for Air Management, Public Participation, and Risk Communication During the Excavation of Former MGP's, DHFS 2004	Public health expectations and recommendations for managing air quality at the perimeter of MGP sites.	Applicable in evaluation of air impacts during remediation
Wisconsin State Environmental Protection Statutes	Sediment Remediation Implementation Guidance	Strategic Directions Report, WDNR 1995	Addresses the sediment remediation approach recommended by WDNR for sediment remediation projects.	To be considered in risk management, technological feasibility and cost.
Wisconsin State Environmental Protection Statutes	Low-hazard Solid Waste Exemption	Wis. Stats. Ch. 289.43	Solid waste law that allows issuance of exemption from siting requirements in NR 500-520. Dredged material may be considered "exempt" after treatment if "new" product is created.	Potentially applicable if *ex-situ* treatment option is selected.
Guidance for Management of Investigation Derived Waste		Document Title: Interim Guidelines for the Management of Investigation – Derived Waste; WDNR PUBL-RR-556-93, May 1993	Provides interim guidance for management of wastes generated during investigation and response actions.	DNR Guidance Document. (To be considered)
Groundwater Discharge Requirements		Document Title: Informational Document for Wisconsin Discharge Permit; Contaminated Groundwater from Remedial Action Operations; WDNR PUBL- RR-583-01, May 2001	Permits discharge of treated groundwater to surface water during remedial actions.	DNR Guidance Document. (To be considered)
Management of Waste from Remediation of Manufactured Gas Plants		Document Title: Draft Management of Waste from Remediation of Manufactured Gas Plants; WDNR PUBL – RR – 768, Feb 2007	Provides guidance determining the proper procedures for identifying and managing hazardous waste from MGP site cleanups	DNR Guidance Document. (To be considered)

Table 6-1. Summary of Remedial Action Objective

Environmental Media	Receptor	Preliminary Remedial Action Objectives
Groundwater	Human Health	Protect human health by eliminating exposure (direct contact, ingestion, inhalation) to groundwater with COPCs in excess of regulatory or risk-based standards; reduce contaminant levels in groundwater to meet MCLs and State of Wisconsin Drinking Water Standards
	Environment (Ecological Receptors)	Protect the environment by controlling the off-site migration of contaminants in groundwater to surrounding surface water bodies which would result in exceedance of ARARs for COPCs in surrounding surface waters.
		Conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water.
Soil	Human Health	Protect human health by reducing or eliminating exposure (ingestion/direct contact/inhalation) to soil having COPCs representing an excess cancer risk greater than 10^{-6} as a point of departure (with cumulative excess cancer risks not exceeding 10^{-5}) and a hazard index (HI) greater than 1 for reasonably anticipated future land use scenarios.
		Ensure future beneficial commercial/industrial use of the site and recreational use of Kreher Park.
	Environment (Ecological Receptors)	Protect populations of ecological receptors or individuals of protected species by eliminating exposure (direct contact with or incidental ingestion of soils or prey) to soil with levels of COPCs that would pose an unacceptable risk.
		Conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water.
		Protect the environment by minimizing/eliminating the migration of contaminants in the soil to groundwater or to surrounding surface water bodies.
Surface Water	Human Health	Protect human health by minimizing exposures (direct contact, ingestion, and inhalation) to surface water that has been impacted by Site-related groundwater and sediment with concentrations of COPCs such that regulatory or risk-based surface water standards have been exceeded.
	Environment (Ecological Receptors)	Protect the environment by controlling the migration of contaminants in groundwater and in sediments to surface water which would result in exceedance of ARARs for COPCs in surface water.
		Reduce Site-related COPC levels in the surface water to meet State of Wisconsin Surface Water Quality Standards.
Sediments	Human Health	Protect human health by eliminating exposure (direct contact, ingestion, inhalation, fish ingestion) to sediment with COPCs in excess of regulatory or risk-based standards.
	Environment (Ecological Receptors)	Protect populations of ecological receptors or individuals of protected species by eliminating exposure (direct contact with incidental ingestion of sediments or of prey) to sediment with levels of COPCs that would pose an unacceptable risk.
		Conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water.

Table 6-2. Preliminary Remediation Goals for Site COPCs

Environmental Media	Receptor	Contaminant of Potential Concern[1]	Acceptable Contaminant Levels
Groundwater	Human Health	NAPL[2]	ARAR compliance.
	Ecological Receptors	N/A	
Soil	Human Health	See Table 6-3	
	Ecological Receptors	None	
Surface Water	Human Health	See Table 6-4	
	Ecological Receptors	None	
Sediments	Human Health	None	
	Ecological Receptors	Total PAHs	9.5 µg/g PAH/h dwt at 0.415% OC

[1] Contaminants determined not to pose a risk in the Human Health or Ecological Risk Assessment are not listed.

[2] Groundwater is not used as a potable water source; incidental exposure to construction workers in utility trenches at Kreher Park or trespassers to the WWTP is possible. These exposure pathways will be evaluated for the final HHRA.

Table 6-3. Preliminary Remediation Goals for Site COPCs in Soil

Soil Preliminary Remediation Goals for Construction Workers (mg/kg)					
Chemical	Carcinogenic Effects			Noncarcinogenic Effects	
	CR = 10^{-6}	CR = 10^{-5}	CR = 10^{-4}	HI = 0.1	HI = 1.0
SVOCs					
2-Methylnaphthalene	NA	NA	NA	1.13E + 02	1.13E + 03
Benzo(a)anthrancene	2.01E + 00	2.01E + 01	2.01E + 02	1.06E + 04	1.06E + 05
Benzo(a)pyrene	2.01E - 01	2.01E + 00	2.01E + 01	NA	NA
Benzo(b)fluoranthene	2.01E + 00	2.01E + 01	2.01E + 02	NA	NA
Dibenzo(a,h)anthracene	2.01E - 01	2.01E + 00	2.01E + 01	NA	NA
Indeno(1,2,2-cd)pyrene	2.01E + 00	2.01E + 01	2.01E + 02	7.06E + 03	7.06E + 04
Naphthalene	NA	NA	NA	3.81E + 00	3.81E + 01
VOCs					
Benzene	1.4E + 00	1.4E + 01	1.4E + 02	4.11E + 00	4.11E + 01

Soil Preliminary Remediation Goals for Residents (mg/kg)				
Chemical	Carcinogenic Effects		Noncarcinogenic Effects	
	CR = 10^{-5}	CR = 10^{-4}	HI = 0.1	HI = 1.0
SVOCs				
Benzo(a)anthrancene	6.21E + 00	6.21E + 01	NA	NA
Benzo(a)pyrene	6.21E - 01	6.21E + 00	NA	NA
Benzo(b)fluoranthene	6.21E + 00	6.21E + 01	NA	NA
Dibenzo(a,h)anthracene	6.21E - 01	6.21E + 00	NA	NA
Naphthalene	NA	NA	1.70E + 00	1.70E + 01
VOCs				
Benzene	7.37E + 00	7.37E + 01	1.80E + 00	1.80E + 01

Table 6-4. Preliminary Remediation Goals for Site COPCs in Surface Water

Surface Water Preliminary Remediation Goals for Swimmers (mg/L)					
Chemical	Carcinogenic Effects			Noncarcinogenic Effects	
	CR = 10^{-6}	CR = 10^{-5}	CR = 10^{-4}	HI = 0.1	HI = 1.0
SVOCs					
Benzo(a)anthrancene	2.04E - 04	2.04E - 03	2.04E - 02	NA	NA
Benzo(a)pyrene	1.17E - 05	1.17E -04	1.17E - 03	NA	NA
Benzo(b)fluoranthene	1.19E - 04	1.19E - 03	1.19E - 02	NA	NA
Dibenzo(a,h)anthracene	7.72E - 06	7.72E - 05	7.72E - 04	NA	NA
Indeno(1,2,2-cd)pyrene	1.17E - 04	1.17E - 03	1.17E - 02	NA	NA

Table 7-1. Sources for Screening of Potential Remedial Technologies

Sources Consulted
Soil and Groundwater
Remediation Action Options Feasibility Study - Ashland Lakefront Property and Contaminated Sediments (SEH, December 1998). Supplemental Facility Site Investigation and Remedial Action Options Evaluation Report prepared for Northern States Power, Ashland, Wisconsin (D&M, March, 1999). Remedial Action Options Feasibility Study – Final Report for the Ashland Lakefront Site, prepared for Northern States Power, Ashland, Wisconsin for NSP (D&M, March, 1999). Contaminants and Remedial Options at Wood Preserving Sites, EPA/600/R-92/182 (USEPA October 1992) Remediation Technologies Screening Matrix (US Federal Remediation Roundtable – FRTR 2002) http://www.frtr.gov
Sediment
Assessment and Remediation of Contaminated Sediments (ARCS) Program, Final Summary Report (EPA 1994a) ARCS Program, Remediation Guidance Document (EPA 1994b) Feasibility Study, Sheboygan River and Harbor, Sheboygan, Wisconsin (BB&L 1998) Draft Feasibility Study. Lower Fox River, Wisconsin. (Thermoretec 1999) Hudson River PCBs Reassessment RI/FS Phase 3 Report: Feasibility Study (TAMS 2000) Lower Passaic River Restoration Project. Dredging Technology Review Report. (TAMS and Malcolm Pirnie 2004) Remediation Technologies Screening Matrix (US Federal Remediation Roundtable – FRTR 2002) http://www.frtr.gov/matrix2/section3/table3_2.html Operational Characteristics and Equipment Selection Factors for Environmental Dredging (Palermo et al. 2004) Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. EPA-540-R-05-012. (USEPA 2005). U.S. Army Corps of Engineers. 2003. Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities — Testing Manual Phase IIIA Work Plan and Sampling and Analysis Plan for the Re-Opened RI/FS, Sediment Operable Unit, SLRIDT Site, Duluth, MN, December 20, 2000 (SERVICE Environmental Engineering) Draft Bench Test Report for SLRIDT, Duluth, MN, April 12, 2002. (SERVICE Environmental Engineering) Draft Alternatives Screening Report, Sediment Operable Unit, SLRIDT Site, Duluth, MN November 1997 (IT Corporation). Draft Feasibility Study Report, Sediment Operable Unit, SLRIDT Site, Duluth, MN, June, 1998 (IT Corporation).

Table 7-2. Summary of Soil Technologies Reviewed
(Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Option
No Action	**None**	**Not Applicable**
Institutional Controls	**Physical, engineering or legislative restrictions**	Fencing **Deed restriction** **Legislative action**
Monitored Natural Recovery	**Monitored Natural Attenuation**	Soil monitoring **Groundwater monitoring**
Containment	**Engineered Surface Barrier**	Installation of NR 500 Clay Cap, Geomembrane, or Geocomposite
		Existing asphalt pavement and facility buildings (upper bluff area) **Existing soil cover (Kreher Park)**
	Engineered Vertical Barrier	**Sheet piling and/or slurry wall.** Concrete barriers Natural barrier
In-Situ Treatment	**Enhanced Bioremediation**	**Oxygen enhancement (air/ozone sparging)** Oxygen enhancement (with chemical oxidation)
	Phytoremediation	Enhanced Rhizosphere Biodegradation Hydraulic Control Phyto-degradation Phyto-volatilization
	Soil Flushing	Cosolvent enhancement Surfactant flooding
	Soil Vapor Extraction (SVE)	Bioventing **Passive SVE** **Active SVE**
	Chemical Oxidation	Ozone sparging **Hydrogen peroxide injection/mixing** **Permanganate injection/mixing**
	Thermal Treatment	Radio Frequency/Electromagnetic Heating **Electrical Resistance Heating** **Steam Injection** Hot Air Injection Vitrification
Removal	**Excavation**	**Limited shallow excavation** Unlimited shallow excavation Deep excavation with shoring
Ex-Situ Treatment	**Disposal**	On-site disposal **Off-site disposal**
	Thermal treatment	Asphalt batch plant mixing **Thermal desorption** Vitrification
	Biological Treatment	Biopile treatment Land spreading
	Solidification /Stabilization	Bituminisation Emulsified asphalt Pozzolan / Portland cement Sludge stabilization
	Physical//Chemical Treatment	**Soil washing** Chemical Oxidation

Table 7-3. Description of Retained Remedial Alternatives for Soil Upper Bluff Area (Ravine Fill) and Kreher Park (Fill)

General Response Action	Remedial Technology	Process Option	Description
No Action	None.	Not Applicable.	• USEPA guidance requires this as a baseline for comparison. • Soil contamination would remain as a source for groundwater contamination. • Based on current site use there are no exposure path ways for human exposure, but unrestricted future site use may result in potential exposure. • Could be easily implemented, but would not reduce contaminant mass, toxicity, or mobility. • Would not be acceptable to community or Agency at this time.
Institutional Controls	Legislative or Deed Restrictions	Restrict property use with fencing, deed restriction, or legislative action to prevent exposure to subsurface soil contamination.	• Restrictions would be required on properties owned by multiple owners within Site boundaries, and would likely limit future site use to eliminate potential exposure to subsurface soil. • Restrictions could eliminate direct contact and ingestion pathways for contaminated soil, but would not reduce contaminant mass, toxicity, or mobility. • Would likely be acceptable to community and Agency in combination with other active remedial alternatives.
Containment	Engineered surface barriers	Use asphalt pavement or fine-grained low permeability soil caps, which would eliminate direct contact and ingestion pathways for subsurface contaminated soil.	• Asphalt pavement and building in the upper bluff area and a fine grained low permeability soil unit in Kreher Park and currently functioning as engineered surface barriers preventing potential exposure to subsurface contamination. • Barriers could eliminate direct contact and ingestion pathways for contaminated soil, but would not reduce contaminant mass, toxicity, or mobility. • Would likely be acceptable to community and Agency in combination with other active remedial technologies.
In-situ Treatment	Soil vapor extraction	Soil vapor extraction (SVE) uses vapor extraction wells and an induced vacuum that uses air as a carrier to remove volatile organic compounds from the unsaturated zone. It also increases the subsurface oxygen content available for bioremediation.	• SVE would require the installation of a series of extraction wells, which would be limited to unsaturated zone contamination in the ravine fill. The shallow depth to water and would prevent the effective use of SVE in Kreher Park, and it would not be effective in low permeability soils encountered in the former Coal Tar Dump Area. • SVE would remove volatile contaminants from the unsaturated zone, but would not remove all semi-volatile PAH compounds. The increased subsurface oxygen content would likely increase microbial activity and enhances bioremediation of constituents not removed by SVE, but not all PAH compounds are readably biodegradable. • SVE would reduce VOC contaminant mass, toxicity, or mobility, but would have limited impact on PAH compounds. • Would likely be acceptable to community and Agency in combination with other active remedial technologies.

Table 7-3. Description of Retained Remedial Alternatives for Soil
Upper Bluff Area (Ravine Fill) and Kreher Park (Fill)

General Response Action	Remedial Technology	Process Option	Description
In-situ Treatment (Cont.)	In-situ Chemical Oxidation	Oxidation adds chemical compounds to oxidize (i.e. chemical destruction) of organic contaminants and liberate free oxygen.	• In-situ chemical oxidation can be completed by injecting chemicals into the subsurface via borings or wells, or by mixing in chemicals in a shallow excavation. • The most common oxidizing agents are permanganate, hydrogen peroxide (H_2O_2) and ozone (O_3). Chemical oxidation degrades a wide variety of organic contaminants into CO_2 and H_2O end products in a rapid reaction. It also increases subsurface oxygen content available for bioremediation of residual contaminants. • Chemical oxidation may result in the generation of off-gases, and venting may be required. • Chemical oxidation is most effective in source areas containing elevated concentrations of constituents, and could be used in the saturated or unsaturated zone. • Would reduce contaminant mass, toxicity, and mobility is a short time frame. Would also provide long-term protection of human health and the environment, and would likely be acceptable to community and Agency.
	Steam injection	Steam extraction physically separates volatile and semi-volatile organic constituents from soil by thermal or mechanical energies.	• The process uses a combination of thermal and mechanical energies generated by steam, hot air, infrared elements, and electrical systems to volatilize and transport the contaminants to the desorbed phase. Steam extraction systems may be mobile or stationary. A mobile system injects steam through rotating cutter blades that disperse it through the contaminated medium. A stationary system injects steam into wells, and gases and liquids from are captured in recovery wells; stationary system work for soil work best with SVE. • Buried subsurface structures (i.e. former gas holders and wood waste) may prevent the use of a mobile system. Fine grained soil and shallow depth to groundwater may prevent effective use in Kreher Park because of the need for an SVE system to recover off-gases from treated areas. • Steam extraction is effective in removing the VOCs, and would be effective for PAHs in both saturated and unsaturated zone soils. • Would reduce contaminant mass, toxicity, and mobility is a short time frame. Would also provide long-term protection of human health and the environment, and would likely be acceptable to community and Agency.
Removal	Limited Soil Excavation	Remove contaminated soil from source areas by excavation.	• Would be limited to contamination in ravine fill near former gas holders in upper bluff area and former coal tar dump area in Kreher Park. Contaminated soil from the saturated zone could also be excavated, but excavation de-watering would be required. • Would results in significant site disturbance and restoration on NSPW property because former gas holders are currently covered by asphalt pavement and the central portion of the U-shaped building. This building will likely be removed to remove former gas holders in this area. However, will result in little site disturbance in Kreher Park near for former coal tar dump area. • Would also provide long-term protection of human health and the environment, and would likely be acceptable to community and Agency.

Table 7-3. Description of Retained Remedial Alternatives for Soil
Upper Bluff Area (Ravine Fill) and Kreher Park (Fill)

General Response Action	Remedial Technology	Process Option	Description
Ex-Situ Treatment	Off-site disposal	Transport contaminated soil off-site for disposal at an approved disposal facility.	• Selection of suitable off-site disposal facility would be required. • Excavation and off-site disposal would result in significant reduction in contaminant mass, toxicity, and mobility in a short time frame. • Would also provide long-term protection of human health and the environment, and would likely be acceptable to community and Agency.
	On-site Thermal Treatment	Thermal desorption physically separates volatile and some semi-volatile contaminants from excavated soil or sediment by using ambient air, heat, and/or mechanical agitation to volatilize contaminants from soil into a gas stream for further treatment.	• Would also require excavation as described above. • Thermal desorption systems create up to seven residual streams including the following: treated media, oversized contaminated debris, condensed contaminants, water, particulates, clean off-gas, and/or spent carbon. Treated material could be returned to the excavation as backfill, but debris may be suitable for disposal on site. Selection of suitable off-site disposal facility would be required. • Excavation and thermal treatment would result in significant reduction in contaminant mass, toxicity, and mobility in a short time frame. • Would also provide long-term protection of human health and the environment, and would likely be acceptable to community and Agency.
	Limited Soil Excavation and Soil Washing	Soil washing is a water-based process for mechanically scrubbing excavated soil to remove contaminants by dissolving or suspending them in the wash solution.	• Would also require excavation as described above. The process is best suited for sandy and sandy-loam soils that are low in organic matter and clay content. • Semi-volatile organics and hydrophobic contaminants may require the addition of a surfactant or organic solvent. • Site specific, bench or pilot-scale treatability tests will determine the best operating conditions and wash fluid compositions. • Complex contaminant matrix systems, which contain a mixture of metals, nonvolatile organics, and semi-volatile organics, may require sequential washing steps with variations in the wash formulation and operating parameters. Management of wastewater will be required. • Excavation and soil washing would result in significant reduction in contaminant mass, toxicity, and mobility in a short time frame. • Would also provide long-term protection of human health and the environment, and would likely be acceptable to community and Agency.

Table 7-4. Screening of Potential Remedial Technologies for Soil

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
No Action	None	Not Applicable.	Not acceptable.	Retained for screening per NCP requirement.	Would not achieve RAOs.	Low	Retain for further evaluation
Institutional Controls	Legislative or Deed Restrictions	Restrict property use with deed restriction or legislative action.	Not acceptable as stand alone alternative, but could be used with other active remedial alternatives.	Retained for screening.	Would prevent exposure but would not meet RAOs.	Low	Retain for further evaluation.
Monitored Natural Recovery	Monitored Natural Attenuation	Relies on reduction of contaminant mass, toxicity, or mobility by natural biological, chemical, or physical processes.	Not acceptable as stand alone alternative, but could be used with other active remedial alternatives.	Retained for Screening as potential remedial alternative for groundwater.	--	--	Retain for further evaluation (for groundwater contamination).
Containment	Engineered Surface Barrier	Installation of NR 500 clay cap, geomembrane, or geocomposite.	Would result in significant site disturbance, and may not be conducive for current or future Site use.	Not retained for screening.	--	--	Not retained for further evaluation.
		Existing asphalt pavement, facility buildings, and existing soil cover.	Could be used for shallow soil and groundwater contamination in upper bluff area and Kreher Park.	Retained for screening.	Would prevent exposure.	Low	Retain for further evaluation.
	Engineered Vertical Barrier	Sheet piling or slurry walls to eliminate direct contact and ingestion pathways for contaminated soil.	Could be used for shallow soil and groundwater contamination in upper bluff area and Kreher Park.	Retained for screening as potential remedial alternative for groundwater.	Would prevent exposure and off-site migration	Moderate to High	Retain for further evaluation (for groundwater contamination).
In-Situ Treatment	Enhanced Bioremediation	Increase the rate of bioremediation of organic contaminants by microbes by increasing the concentration of electron acceptors and nutrients in ground water.	Not acceptable as stand alone alternative, but could be used with other active remedial alternatives.	Not retained for screening.	--	--	Not retained for further evaluation.

Table 7-4. Screening of Potential Remedial Technologies for Soil

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
In-Situ Treatment (Cont.)	Phytoremediation	Uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. Contaminants may be either organic or inorganic.	Would not be conducive for existing or future Site use. This technology works best with low to moderate levels of contamination, and may not be suitable for MGP contamination.	Not retained for screening.	--	--	Not retained for further evaluation.
	Soil Flushing	Cosolvent or surfactant injection to mobilize contaminants.	Variable permeability of soils may limit implementability, and may not be effective for PAHs contamination.	Not retained for screening.	--	--	Not retained for further evaluation.
	Soil Vapor Extraction	Soil vapor extraction (SVE) uses vapor extraction wells and an induced vacuum that uses air as a carrier to remove volatile organic compounds from the unsaturated zone.	Variable permeability of soils and shallow water table may limit implementability, and may not be effective for PAHs contamination.	Retained for screening as potential remedial alternative for thermal and chemical treatment alternatives.	--	--	Retained for further evaluation with other in-situ treatment alternatives
	In-Situ Chemical Oxidation	Introduce strong oxidizing chemicals into the subsurface to degrade VOCs to CO_2 and H_2O end products.	Would require SVE system, but could be completed on saturated and unsaturated zone soils.	Retained for screening.	Effective for soil with high levels of contamination in source areas.	Moderate to High	Retain for further evaluation as an alternative for soil and groundwater.
	Thermal Treatment	Electrical resistance heating technology uses electricity applied into the ground through electrodes to mobilize contaminants.	Would require SVE system, but could be completed on saturated and unsaturated zone soils.	Retained for screening.	Effective for soil with high levels of contamination in source areas.	High	Retain for further evaluation as an alternative for soil and groundwater.
		Steam injection physically separates volatile and semi-volatile organic constituents from soil by thermal or mechanical energies.	Would require SVE system, but could be completed on saturated and unsaturated zone soils.	Retained for screening.	Effective for soil with high levels of contamination in source areas.	High	Retain for further evaluation as an alternative for soil and groundwater.

Table 7-4. Screening of Potential Remedial Technologies for Soil

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
Removal	Limited Shallow Excavation	Remove contaminated soil from source areas by excavation.	Would require partial removal of NSPW facility building, back filling excavation with clean fill, and site restoration.	Retained for Screening.	Effective for soil with high levels of contamination in source areas.	High to Very High	Retain for further evaluation.
	Deep/ Unlimited Shallow Excavation	Excavate all contaminated soil	Not feasible for widespread soil with low to moderate levels of contamination.	Not retained for screening.	--	--	Not Retained for further evaluation.
Ex-Situ Treatment	Unlimited Excavation and Off-Site Disposal	Excavation of all contaminated soil.	May be difficult locating facility capable of accepting large volume of excavated material. Would likely require construction of near by facility.	Retained for Screening.	**Effective for large volume of material.--**	**Very High**	Retain for further evaluation.
	Unlimited Excavation and On-Site Disposal	Remove all contaminated soil from backfilled ravine and Kreher Park, and place in new landfill constructed on-site.	Would result in significant site disturbance and require substantial restoration. No land available in upper bluff area for landfill construction. Permitting a new landfill in Kreher Park may be difficult, but landfill construction in this area is feasible.	Retained for Screening.	**Effective for large volume of material.**	**Very High**	Retain for further evaluation.
	Limited Excavation and on On-Site Disposal	Remove contaminated soil from source areas by excavation, and place in new landfill constructed on-site.	No land available in upper bluff area for landfill construction and permitting a new landfill in Kreher Park may be difficult, but could be implemented with containment alternatives evaluated for sediment.	Retained for Screening.	Effective for soil with high levels of contamination in source areas.	High to Very High	Retain for further evaluation.
	Limited Excavation and on Off-Site Disposal	Remove contaminated soil from source areas by excavation, and transport contaminated soil off-site for disposal at an approved disposal facility.	Would require partial removal of NSPW facility building, back filling excavation with clean fill, and site restoration.	Retained for Screening.	Effective for soil with high levels of contamination in source areas.	High to Very High	Retain for further evaluation.

Table 7-4. Screening of Potential Remedial Technologies for Soil

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
Ex-Situ Treatment (Cont.)	Limited Soil Excavation and Asphalt Batch Plant Mixing	Remove contaminated soil from source areas by excavation, and transported to asphalt batch plant for use as aggregate.	Fine grained and fill soil are not suitable as aggregate material	Not retained for screening.	--	--	Not retained for further evaluation.
	Limited Soil Excavation and On-site Thermal Treatment	Physically separates volatile and some semi-volatile contaminants from excavated soil by using ambient air, heat, and/or mechanical agitation to volatilize contaminants from soil into a gas stream for further treatment.	Could be completed for contaminated soil encountered at shallow depths in saturated and unsaturated zones. Would require removal of buried structures.	Retained for screening.	Effective for soil with high levels of contamination in source areas.	High to Very High	Retain for further evaluation.
	Limited Soil Excavation and Vitrification	Vitrification converts contaminants into a chemically inert high-strength glass or glass-like substance	Other source removal technologies are more cost effective, which would be easier to implement.	Not retained for screening.	--	--	Not retained for further evaluation.
	Excavation and Biopile Treatment	Limited or unlimited soil excavation and construction of biopiles to increase the rate of bioremediation of organic contaminants by microbes.	Not well suited for elevated concentrations with free-phase hydrocarbons, but could be used for areas with low to moderate levels of contamination.	Not retained for screening.	--	--	Not retained for further evaluation.
	Excavation and Land Spreading	Limited or unlimited soil excavation with treatment by land spreading, which then relies on reduction of contaminant mass, toxicity, or mobility by natural biological, chemical, or physical processes.	Not well suited for elevated concentrations with free-phase hydrocarbons, but could be for areas with low to moderate levels of contamination.	Not retained for screening.	--	--	Not retained for further evaluation.

Table 7-4. Screening of Potential Remedial Technologies for Soil

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
Ex-Situ Treatment (Cont.)	Limited Soil Excavation and Solidification /Stabilization	Stabilization and solidification (S / S) processes reduce the mobility of a contaminant, either by physically restricting its contact with a mobile phase (solidification) or by chemically altering/binding the contaminant to reduce its toxicity and/or mobility (stabilization).	Bench or pilot-scale treatability tests will need to evaluate suitable methods for washing. Could be used for contaminated soil in the saturated and unsaturated zones.	Not retained for screening.	--	--	Not retained for further evaluation.
	Limited Soil Excavation and Soil Washing	Soil washing is a water-based process for mechanically scrubbing excavated soil to remove contaminants by dissolving or suspending them in the wash solution.	Best suited for sandy and sandy-loam soils that are low in organic matter and clay content. Bench or pilot-scale treatability tests will need to evaluate suitable methods for washing. Could be used for contaminated shallow soil in the saturated and unsaturated zones.	Retained for screening.	Would require bench scale or pilot test to determine suitable treatment process; may not be suitable for MGP waste.	Very High	Retain for further evaluation.

Table 7-5. Summary of Groundwater Technologies Reviewed (Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Option
No Action	**None**	**Not Applicable**
Institutional Controls	**Physical, land use, or legislative restrictions.**	Fencing **Groundwater use/Deed restriction** **Legislative action**
Monitored Natural Recovery	**Monitored Natural Attenuation**	Soil monitoring **Groundwater monitoring**
Containment	Deep well injection	Inject liquid waste into deep geologic formation below usable aquifers.
	Engineered Vertical Barrier	**Sheet piling and/or slurry wall** Concrete barriers Natural barrier
	Groundwater Extraction	**Down gradient extraction wells (retained for upper bluff and Kreher Park only)** **Subsurface interceptor trenches/drains**
In-Situ Treatment	**Biological Treatment**	Oxygen enhancement (air/ozone sparging) Oxygen enhancement with chemical oxidation Injection/Re-circulation wells/in well stripping
	Chemical Treatment	**Ozone sparging** **Chemical oxidation**
	Physical//Chemical Treatment	**Surfactant** **Permeable Reactive Barrier Walls**
	Thermal Treatment	Radio Frequency/Electromagnetic Heating **Electrical Resistance Heating** **Steam Injection** **Dynamic Underground Stripping** Hot Air Injection
Removal	**NAPL Excavation** **Groundwater Extraction**	**Removal of saturated zone soils** **Removal of free-phase and/or dissolved phase contaminants (conventional pumping)** **Multiphase vacuum recovery** **Surfactant injection with multiphase vacuum recovery**
Ex-Situ Treatment	**On-site Treatment** Off-site Treatment	**Gravity Separation** **Air Stripping** **Carbon Filtration**

Table 7-6. Description of Retained Remedial Alternatives for Groundwater Ravine Fill in Upper Bluff Area, Fill Soils in Kreher Park, and Underlying Copper Falls Aquifer

General Response Action	Remedial Technology	Process Option	Description
No Action	None.	Not Applicable.	• USEPA guidance requires this as a baseline for comparison. • Not acceptable at this time, but may be used in combination with natural attenuation and long term monitoring.
Institutional Controls	Legislative of Deed Restrictions	Restrict property use with deed restriction on legislative action to eliminate direct contact and ingestion pathways for contaminated groundwater beneath the site. Would require that a groundwater use restrictions be recorded on deeds to prevent well installation and	• Restrictions would be required on properties owned by multiple owners within Site boundaries, and would prevent use of groundwater from the shallow fill aquifers and underlying Copper Falls aquifer. • Would prevent future well installation within Site boundaries, which may already be prevented by ordinance within City Limits. • Although not contaminated, groundwater use restriction may prevent future use of artesian wells in Kreher Park. • Restrictions would eliminate direct contact and ingestion pathways for contaminated groundwater, but would not reduce contaminant mass or toxicity. • Would likely be acceptable to community and Agency in combination with other active remedial technologies.
Monitored Natural Recovery	Monitored Natural Attenuation	Collect periodic groundwater samples to evaluate natural occurring subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions that can reduce contaminant concentrations to acceptable levels.	• The primary objective is to demonstrate that natural processes of contaminant degradation will reduce contaminant concentrations below regulatory standards or risk-based levels before potential exposure pathways are completed. • Requires evaluation of contaminant degradation rates and pathways and predicting contaminant concentration at down gradient receptor points, especially when plume is expanding or migrating. • Long term monitoring must be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting cleanup objectives. • This alternative works best for dissolved phase groundwater contamination because free-phase hydrocarbons behave as a long-term source for dissolved phase contamination. • Would not be acceptable at this time, but could be completed in conjunction with another remedial alternative following the removal of free-phase hydrocarbons.
Containment	Vertical barrier walls	Sheet piling or slurry walls to eliminate direct contact and ingestion pathways for contaminated soil.	• Sheet piling installed as a vertical barrier could be placed at the mouth of the backfilled ravine to prevent groundwater from the perched aquifer from discharge to the former seep area. • A slurry wall or sheet piling could be installed along the shoreline in Kreher Park to prevent groundwater within the fill material from discharging to the Chequamegon Bay inlet area. • Sheet piling and slurry walls may require de-watering extraction wells to reduce hydraulic head that would build up behind the impermeable barrier. • Vertical barriers would be needed only if unacceptable concentrations of contaminants are migrating off-site with groundwater.

Table 7-6. Description of Retained Remedial Alternatives for Groundwater
Ravine Fill in Upper Bluff Area, Fill Soils in Kreher Park, and Underlying Copper Falls Aquifer

General Response Action	Remedial Technology	Process Option	Description
Containment	Groundwater Extraction	Install down gradient extraction wells to prevent off-site migration of contaminants to eliminate direct contact and ingestion pathways for contaminated groundwater.	• Existing extraction wells EW-4 is currently extracting groundwater from mouth of the backfilled ravine preventing groundwater from discharging to former seep area. Could be improved by capping gravel lot area to reduce infiltration. • A subsurface drain could be installed in Kreher Park to prevent contaminants from discharging to the Chequamegon Bay inlet area. It would work best in combination with a vertical barrier to reduce seepage from the lake and a cap to reduce infiltration
In-situ Treatment	Air /Ozone Sparging	Inject air and/or ozone into the saturated zone of the contaminated aquifer to mobilize contaminants and enhance biodegradation.	• Install a series of sparge wells to inject air and/or ozone into the contaminated aquifer. • Air would help to mobilize contaminants that would then be collected by groundwater extraction (for the confined aquifer) or by soil vapor extraction wells (for the unconfined aquifer). • An ozone sparge system would also degrade organic contaminants; it is also considered an in-situ chemical oxidation technology as described below. • Ozone sparge system would need to be operated for several years for residual groundwater contamination remaining on-site, but would reduce the period of time that groundwater extraction would be required.
	In-Situ Chemical Oxidation	Introduce strong oxidizing chemicals into the subsurface to degrade VOCs to CO_2 and H_2O end products.	• Would reduce contaminant mass, toxicity, and mobility. • Numerous injection points would be required to adequately mix contaminated zone with chemical. Chemicals would be mixed in backhoe trenches in source areas. • Permit or Agency approval would be required to inject or mix chemicals in the subsurface. • Pilot test would be needed to evaluate best oxidizing chemicals to use and mixing rates. • Multiple applications may be needed. • Groundwater monitoring would be required for several years.
	Surfactant Injection	Remove NAPL with contaminated groundwater by using a surfactant (surface-active agent) to reduce the free-phase hydrocarbon-water interfacial tension by emulsifying free-phase hydrocarbons.	• Install a series of injection and extraction wells intersecting the Miller Creek and Copper Falls formations where NAPL is encountered. • Inject surfactant into zone containing NAPL, typically at a low flow rate to reduce interfacial tension that restricts NAPL movement in the aquifer. Allow to penetrate for 24 to 48 hours, and remove by pumping or vacuum extraction. • Can be completed by installing a permanent extraction system connected to a central recovery system, or by periodically removing fluids with a mobile system. • This alternative works best at removing non-mobile fraction of NAPL; it could be completed concurrent with vacuum enhanced dual phase recovery described below. • Treatment of effluent vapors, NAPL (e.g., coal tar), and impacted groundwater before discharge

Table 7-6. Description of Retained Remedial Alternatives for Groundwater
Ravine Fill in Upper Bluff Area, Fill Soils in Kreher Park, and Underlying Copper Falls Aquifer

General Response Action	Remedial Technology	Process Option	Description
In-situ Treatment (Cont.)	Permeable Reactive Barriers	Installation of a permeable reactive barrier that intersects the groundwater plume. Material placed in a trench, reacts with contaminants as groundwater passes through the trench.	• would be required, but enhanced NAPL recovery would reduce long-term operation, maintenance, and monitoring for treatment system. • May require installation of vertical barriers as gate and funnel system for shallow groundwater contamination. • Would not be feasible for Copper Falls aquifer. • Would require bench scale study to evaluate suitable materials for reactive barrier wall. • Would not reduce contaminant mass or toxicity in source area, but would reduce contaminant mass, toxicity and mobility of contaminants migrating away from source area. • Groundwater monitoring would be required for several years.
	Thermal Treatment (ERH)	Electrical resistance heating technology uses electricity applied into the ground through electrodes to heat the formation and mobilize contaminants.	• Electrical resistance heating technology uses electricity applied into the ground through electrodes to mobilize contaminants. • Could be used for saturated and unsaturated zone contamination, but may not be feasible for ravine fill or Kreher Park; it would be feasible for Copper Falls aquifer. • Treatment of effluent vapors, NAPL (e.g., coal tar), and impacted groundwater before discharge would be required.
	Thermal Treatment (DUS)	Dynamic underground stripping (DUS) consists of injection steam to volatilize and mobilize contaminants that area collected by extraction wells.	• Install a series of injection and extraction wells intersecting the Miller Creek and Copper Falls formations where NAPL is encountered, and inject steam to mobilize contaminants. • Could be used for saturated and unsaturated zone contamination, but may not be feasible for ravine fill or Kreher Park; it would be feasible for Copper Falls aquifer. • SVE system would be required to collect off gases. • Temperature monitoring would be required for plume control, and to ensure total cleanup. • Treatment of effluent vapors, NAPL (e.g., coal tar), and impacted groundwater before discharge would be required.
Removal	Groundwater Extraction	Continue to operate existing ground water extraction system to remove contaminated groundwater source area in Copper Falls aquifer near former MGP facility.	• Existing wells EW-1, EW-2, and EW-3 are currently removing NAPL and contaminated groundwater from the Copper Falls aquifer. Fluids are treated on-site prior to discharge to the municipal sanitary sewer. • Would likely be acceptable to community and Agency of implemented concurrent with other remedial alternatives.

Table 7-6. Description of Retained Remedial Alternatives for Groundwater
Ravine Fill in Upper Bluff Area, Fill Soils in Kreher Park, and Underlying Copper Falls Aquifer

General Response Action	Remedial Technology	Process Option	Description
Ex-situ Treatment	Groundwater and NAPL Extraction	Groundwater and NAPL extraction uses pumping wells that use water as a carrier to removed contaminants from the saturated zone.	• Install additional low-flow groundwater extraction wells in the Copper Falls aquifer to remove contaminated groundwater and NAPL from the ravine fill, Kreher Park fill, and underlying Copper Falls aquifer. • Capping may be needed to reduce infiltration if utilized for shallow saturated ravine fill soil. • Capping and vertical barriers may also be needed to prevent lake seepage if utilized for shallow saturated fill soil in Kreher Park. • Treatment of effluent vapors, NAPL, and impacted groundwater before discharge would be required. Long-term operation, maintenance, and monitoring for treatment system will be required.
	Multiphase Vacuum Recovery	Remove both NAPL and contaminated groundwater by an induced vacuum to overcome the free-phase hydrocarbon-water interfacial tension.	• Install a series of small diameter extraction wells with well screens intersecting the Miller Creek and Copper Falls formations where NAPL is encountered. • Remove both NAPL and contaminated groundwater via an inducing vacuum; NAPL recovery is enhanced because vacuum pressure is used to lower the interfacial tension that restricts NAPL movement in the aquifer. • Can be completed by installing a permanent system with a manifold connected to a central vacuum system, or by periodically removing fluids with a mobile system. • This alternative is best suited for the removal of the mobile fraction of NAPL; it could be completed prior to surfactant injection as described below. • Treatment of effluent vapors, NAPL (e.g., coal tar), and impacted groundwater before discharge would be required, but enhanced NAPL recovery would reduce long-term operation, maintenance, and monitoring for treatment system.

Table 7-7. Screening of Potential Remedial Technologies for Groundwater

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
No Action	None.	Not Applicable.	Not acceptable.	Retained for Screening per NCP requirement.	Would not achieve RAOs.	Low	Retain for further evaluation
Institutional Controls	Deed Restrictions / Legislative Action	Restrict property use with groundwater use/deed restriction or legislative action.	Not acceptable as stand alone alternative, but could be used with other active remedial alternatives.	Retained for screening.	Would prevent exposure but would not meet RAOs.	Low	Retain for further evaluation.
Monitored Natural Recovery	Monitored Natural Attenuation	Collection of groundwater samples to evaluate reduction of contaminant mass, toxicity, or mobility by natural biological, chemical, or physical processes.	Not acceptable as stand alone alternative, but could be used with other active remedial alternatives.	Retained for screening.	Would prevent exposure but would not meet RAOs.	Low	Retain for further evaluation.
Containment	Deep Well Injection	Use isolated geologic formation for disposal.	Not feasible for Site conditions.	Not retained for screening.	--	--	Not retained for further evaluation.
	Engineered Vertical Barrier	Sheet piling or slurry walls.	Could be used for shallow soil and groundwater, but not for deep groundwater.	Retained for screening.	Would prevent exposure and off-site migration for shallow groundwater.	Moderate to High	Retain for further evaluation.
	Groundwater Extraction	Down gradient extraction wells.	Currently being used for backfilled ravine in upper bluff area. Other remedial alternatives considered more effective for Copper Falls aquifer.	Retained for screening for upper bluff and Kreher Park only.	Would prevent exposure and off-site migration for shallow groundwater.	Moderate to High	Retain for further evaluation.
In-situ Treatment	Enhanced Bioremediation	Increase the rate of bioremediation of organic contaminants by microbes by increasing the concentration of electron acceptors and nutrients in ground water.	Not acceptable at this time, but could be implemented at a later time with other active remedial alternatives.	Not retained for screening.	--	--	Not retained for further evaluation.

Table 7-7. Screening of Potential Remedial Technologies for Groundwater

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
	Air /Ozone Sparging	Inject air and/or ozone into the saturated zone of the contaminated aquifer to mobilize contaminants and enhance the biodegradation of	Would require the installation of small diameter sparge wells, and on-site ozone generation panels.	Retained for screening.	Effective for dissolved phase plume but not for free-phase hydrocarbons.	Moderate	Retain for further evaluation.
In-situ Treatment (Cont.)	Groundwater Recirculation Wells	A remediation well with two screens is used to re-circulate groundwater. Contaminated groundwater (and NAPL) is removed from a contaminated zone, treated, and the injected back into the aquifer.	Would not be feasible for free-phase hydrocarbons source area, and may not be feasible for confined aquifer.	Not retained for screening.	--	--	Not retained for further evaluation.
	Surfactant Injection and Groundwater Extraction	Remove NAPL with contaminated groundwater by using a surfactant (surface-active agent) to reduce the free-phase hydrocarbon-water interfacial tension by emulsifying free-phase hydrocarbons.	Would be feasible for removal of free-phase hydrocarbons with multiphase vacuum recovery.	Retained for screening.	Would be completed to remove NAPL removal with multiphase vacuum recovery.	Moderate to High	Retain for further evaluation.
	Permeable Reactive Barriers	Installation of a permeable reactive barrier that intersects the groundwater plume. Material placed in a trench, reacts with contaminants as groundwater passes through the trench.	Could be used for shallow soil and groundwater, but not for deep groundwater.	Retained for screening.	Effective for dissolved phase plume but not for free-phase hydrocarbons.	Moderate to High	Retain for further evaluation.
	In-Situ Chemical Oxidation	Introduce strong oxidizing chemicals into the subsurface to degrade VOCs to CO_2 and H_20 end products.	Could be completed for shallow and deep groundwater.	Retained for screening.	Would require SVE (for shallow groundwater) and groundwater extraction (for shallow and deep groundwater).	Moderate to High	Retain for further evaluation.

Table 7-7. Screening of Potential Remedial Technologies for Groundwater

General Response Action	Remedial Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
	Electrical Resistance Heating	Electrical resistance heating (ERH) technology uses electricity applied into the ground through electrodes to heat the formation and mobilize contaminants.	Could be used for deep groundwater, but not for shallow contamination.	Retained for screening.	Would require groundwater extraction.	High to Very High	Retain for further evaluation.
In-situ Treatment (Cont.)	Dynamic Underground Stripping	Dynamic underground stripping (DUS) consists of injection steam to volatilize and mobilize contaminants that area collected by extraction wells.	Hybrid steam injection for use in Copper Falls to enhance NAPL removal.	Retained for screening.	Would require groundwater extraction.	High to Very High	Retain for further evaluation.
Removal	Groundwater Extraction	Groundwater and NAPL extraction uses pumping wells that use water as a carrier to removed contaminants from the saturated zone.	Continue to operate existing ground water extraction system to remove contaminated groundwater source area in Copper Falls aquifer near former MGP facility.	Retained for Screening.	Would require groundwater extraction for an extensive period of time.	Moderate to High	Retain for further evaluation.
Ex-Situ Treatment	Enhanced Groundwater and NAPL Extraction		Install additional groundwater extraction wells to enhance recovery, and upgrade existing treatment system.	Retained for screening.	May reduce time required for groundwater extraction.	Moderate to High	Retain for further evaluation.
	Vacuum Enhanced Dual Phase Recovery	Remove both NAPL and contaminated groundwater by an induced vacuum to overcome the free-phase hydrocarbon-water interfacial tension.	Install small diameter extraction wells in areas containing NAPL, and remove fluids with mobile or fixed based system.	Retained for screening.	Would be completed prior to surfactant injection to enhance NAPL removal.	Moderate to High	Retain for further evaluation.

Table 7-8. Summary of Sediment Technologies Reviewed
(Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999)
(Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Options
No Action	**None**	**Not Applicable**
Institutional Controls	**Physical, engineering or legislative restrictions**	Consumption advisories **Access restrictions** Dredging moratorium
Natural Recovery	**Reduction of toxicity, volume or mobility of contaminant by naturally occurring biological, chemical or physical processes**	**Sedimentation** **Resuspension and transport** **Mixing**
Containment	**Subaqueous capping**	**Thin layer cap** **Sand cap** **Composite cap** Engineered materials (cement) cap **Armored cap**
	Confined Disposal Facility	**Sheet pile** **Combination of sheet pile and slurry wall** **Impervious cap** **Groundwater management**
Removal	**Dredging**	**Hydraulic dredging** **Mechanical dredging** **Barge-mounted backhoes or excavators**
	Excavation in the dry	**Excavator, sheetpiling, etc. for specific areas**
In Situ Treatment	Biological	*In situ* slurry oxidation *In situ* aerobic biodegradation *In situ* anerobic biodegradation
	Chemical	*In situ* slurry oxidation Aqua MecTool oxidation *In situ* oxidation Electrochemical oxidation
	Physical Extractive process	Sediment flushing SVE/thermally enhanced SVE/bioventing Air sparging
	Physical-immobilization	Air sparging MecTool stabilization Vitrification Imbiber beads Ground freezing
Ex Situ Treatment	Biological	Landfarming/composting Biopiler Fungal degradation Slurry phase biological treatment Enhanced biodegradation

Table 7-8. Summary of Sediment Technologies Reviewed
(Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999)
(Alternatives in bold are retained)

General Response Action	Remedial Technology	Process Options
Ex Situ Treatment (Cont.)	Chemical	Acid extraction Solvent extraction Slurry extraction Reduction/oxidation
	Chemical/Physical	Dehalogenation **Sediment washing** Radiolytic dechlorination
	Physical	**Separation** **Hydrocyclone** Solidification
	Thermal	**Incineration** **High temperature thermal desorption** **Low temperature thermal desorption** Pyrolysis Thermal desorption High-pressure oxidation
Dewatering	**Mechanical**	Centrifugation **Belt press** **Filter press** Geobag
	Gravity	**Settling on-barge** **Settling dewatering impoundments** Solidification
Disposal	**On-site disposal**	Level bottom cap Confined aquatic disposal (CAD) **Confined disposal facility** Nearshore biofiltration cell **Upland confined fill** **Beneficial re-use**
	Off-site disposal	Dedicated new upland landfill **NR 500 landfill (county, private, industrial landfills)** **Upland confined fill (commercial/industrial)** **Upland fill (residential/clean)**

Table 7-9. Description of Retained Remedial Alternatives for Sediment

General Response Action	Technology	Description
No Action	No remedial action. No institutional controls.	Required as a baseline alternative by NCP
Institutional Controls	Site use restrictions.	Site use restrictions can be effective for preventing disturbance of sediments. May be combined with Natural Recovery strategy.
Monitored Natural Recovery	Reduction of toxicity, volume or mobility of contaminant by naturally occurring biological, chemical or physical processes	May be implemented in areas of the Site where natural recovery processes, e.g., sediment and mixing, have been observed or where levels of contaminants do not result in acute impacts to ecological receptors. May be combined with Institutional Controls to prevent sediment disturbances while Natural Recovery is progressing.
Containment	Subaqeous capping	Capping consists of using a variety of materials, some reactive, to contain contaminants *in situ*. A properly designed cap can significantly decrease contaminant mobility and toxicity by containment.
	Confined disposal facility	Permanent containment facilities to isolate contaminants in place and provide an on-site disposal alternative. May be used in selected locations of the Site to supplement other remedies.
Removal	Dredging	Removal of sediments by mechanical or hydraulic dredges or excavators working off of floating barges or scows. Specialty environmental dredges minimize sediment resuspension and release of sediment-associated contaminants. Need for significant engineering controls for dredging because of potential for volatilization of sediment-associated VOCs and SVOCs as well as dispersal of free phase.
	Excavation in the dry	Involves isolating an area and dewatering it so conventional excavation equipment can remove the contaminated sediment. Has greatest potential in shallow water where there is access to the shore. This alternative has substantial safety implications.
Ex-situ Treatment	Physical separation	Suitable for separation of wood waste through screening and floatation in impoundments. Crushers are also effective as pretreatment of wood debris.
	High and low temperature thermal desorption	Systems available and efficient in destroying the CPOC's. Requires dewatering and treated soil disposal area. Air emissions permitting may be difficult so close to downtown and area residents.
	Incineration	Systems available and efficient in destroying the CPOC's. Requires dewatering and treated soil disposal area. Air emissions permitting may be difficult so close to downtown and area residents.
Ex-situ Treatment (Cont.)	Incineration of wood waste	The larger wood debris potentially could be burned as fuel at the NSP Bayfield Power Plant located in Ashland. Some additional maintenance at the plant would be required to accommodate the wood debris but this is considered a viable option at this time.
Dewatering	Mechanical	Belt and diaphragm filter presses, and plate and frame filters are effective in dewatering sediments. They are also expensive and labor intensive.
	Gravity	Well suited for treating low solids slurries from hydraulic dredges. Also effective for dewatering CDF impoundment discharges. Dewatering barges may be used with mechanical dredges to remove free liquids.

Table 7-9. Description of Retained Remedial Alternatives for Sediment

General Response Action	Technology	Description
Disposal	Confined disposal facility	This containment facility includes all sediments that are impacted by unacceptably elevated levels of SVOCs and VOCs, including free phase, as well as areas on upland portions of the Site that are impacted by wood material mixed with coal tar wastes. Contaminated sediments and potentially soils from portions of the Site that are not included in the "footprint" of this containment facility can be removed by dredging or excavation and disposed of in the containment facility.
	On-site or off-site beneficial re-use	Dewatered and treated sediment or treated soils that are clean may be suitable as soil/sediment construction fill. Clean separated sand may be used for capping or other use.
	Off-site municipal or industrial landfill	Must meet NR 500 WAC standards. There are several within 125 miles but their capacity and costs for disposal need further evaluation.
	Off-site confined fill	Dewatered and treated sediment or treated soils that are clean may be suitable to dispose of on a confined fill off-site. The Woodfield Ash Landfill operated by NSP, is located approximately 6 miles south of the Bayfield Power Plant and is currently permitted to accept ash from the plant. The landfill has a clay liner and reportedly has a remaining capacity of approximately 110,000 cubic yards. With appropriate modifications to the plan of operation, some of the remaining landfill site could potentially used for disposal of sediment from the bay. The construction of a new cell for the sediment, potentially including a composite liner, may be a potential off-site disposal option.

Table 7-10. Screening of Potential Remedial Technologies for Sediment (Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999).

GRA	Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
No Action	None	N/A	Potentially applicable	Retained	Required	Low	Retained
Institutional Controls	Physical, Engineering or Legislative Restrictions	Consumption Advisories	Not applicable. No risk from eating fish.	Not retained			
		Access Restrictions	Potentially applicable	Retained	Potential protection for limited areas; used in combination with other alternatives	Low	Retained
		Dredging moratorium	Not applicable	Not retained			
Monitored Natural Recovery	Physical degradation	Desorption, diffusion, dilution, volatilization	Potentially applicable	Retained	Slow processes but for limited areas may be effective in combination with other natural recovery mechanisms	Low	Retained
	Biological/chemical degradation	Degradation (aerobic and anerobic)	Potentially applicable	Retained	Slow process but for limited areas may be effective in combination with other natural recovery mechanisms	Low	Retained
	Physical processes	Burial	Potentially applicable	Retained	Not much evidence of net deposition, however contribution of new clean sediments to areas of the Site and subsequent bioturbation would lead to reduced PAH levels in surface sediments. Also deposition might be facilitated by placement of engineering structures	Low	Retained
		Resuspension and transport	Potentially applicable	Retained	Slow process but for limited areas may be effective in combination with other natural recovery mechanisms	Low	Retained
Containment	Subaqueous capping	Sand cap	Potentially applicable	Retained	A cap utilizing aspects of these three types of caps could be effective in combination with removal of approximately the top four feet of sediment in the nearshore.	High	Retained
		Composite cap					
		Armored cap					
		Thin layer cap	Potentially applicable	Retained	A thin layer cap might be an effective supplementary alternative for facilitating natural recovery in areas outside the proposed sediment cleanup level of 53 µg PAH/g but above 12.2 µg PAH/g.	Low	Retained

Table 7-10. Screening of Potential Remedial Technologies for Sediment (Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999).

GRA	Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
Containment (Cont.)	Confined disposal facility	Sheet pile enclosure with impervious cap and groundwater management	Technically applicable, may be administrative barriers to implementation	Retained	Effective in reducing mobility of all Site contaminants. May have administrative implementability issues. Would require substantial mitigation.	High, but moderate compared to removal and treatment alternatives	Retained
		Combination of sheet pile and slurry wall enclosure with impervious cap and groundwater management	Technically applicable, may be administrative barriers to implementation	Retained	Effective in reducing mobility of all Site contaminants May have administrative implementability issues. Would require substantial mitigation.	High, but moderate compared to removal and treatment alternatives	Retained
Removal	Dredging	Mechanical	Yes	Retained	Dredging is standard practice and generally effective, however site conditions may limit effectiveness. Mechanical dredging is expected to be more effective for debris removal or for dredging in areas where there is debris, however it will also result in the maximum loss of VOCs and SVOCs to the atmosphere through volatilization.	Very High	Retained
		Hydraulic	Yes	Retained	Dredging is standard practice and generally effective, however site conditions may limit effectiveness. Hydraulic dredging will be ineffective in areas where there is a substantial amount of debris, however it is more effective for limiting volatilization and dispersal of free phase.	Very High	Retained
		Excavator	Yes	Retained	Excavation of sediments is standard practice and generally effective, however site conditions may limit effectiveness. Excavation is expected to have the same potential limitations that mechanical dredging would have.	Very High	Retained

Table 7-10. Screening of Potential Remedial Technologies for Sediment (Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999).

GRA	Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
	Excavation in the dry	Excavator	Yes	Retained	Can be effective but at very high cost for entire Site. May have applications at this Site for supplementing other removal technologies, perhaps for debris removal.	Very high.	Retained
In-situ Treatment	Several including biological, chemical and physical (stabilization)	Several	There are no proven technologies for project scale operations.	Eliminated			
Ex-situ Treatment	Biological	Several	There are no proven technologies for project scale operations.	Eliminated			
	Chemical	Several	There are no proven technologies for project scale operations.	Eliminated			
	Chemical/physical	Stabilization	Not generally effective for VOCs and SVOCs	Eliminated			
	Physical	Screening	Yes, for wood debris	Retained	Effective for wood debris as part of other alternative.	Moderate	Retained
		Crushing	Yes, for wood debris	Retained	Effective for wood debris as part of other alternative.	Moderate	Retained
		Floatation	Yes, may be useful in separation of wood debris in impoundments.	Retained	Effective for wood debris as part of other alternative.	Moderate	Retained
		Hydraulic separation	Yes	Retained	Limited amount of sand expected and limited effectiveness in generating clean material.	Moderate	Retained
	Thermal	High and Low Temperature Thermal Desorption	Yes	Retained	Effective at destroying organics. Effectiveness limited by supporting technologies and wood debris content	High	Retained
		Incineration	Yes	Retained	Effective at destroying organics. Effectiveness limited by supporting technologies	High	Retained

Table 7-10. Screening of Potential Remedial Technologies for Sediment (Partially Adapted from the Lower Fox River Feasibility Study - ThermoRetec 1999).

GRA	Technology	Process Option	Initial Screening		Final Screening		
			Implementability	Screening Decision	Effectiveness	Cost	Screening Decision
Ex-situ Treatment (Cont.)	Thermal (Cont.)	Vitrification	At a developmental stage with limited availability. High energy requirement compared to other thermal processes.	Eliminated			
Disposal	On-site disposal	Confined aquatic disposal	Not considered to be implementable because of site conditions	Eliminated			
		Engineered nearshore containment facility	Yes	Retained	Effective in reducing mobility and toxicity of all Site contaminants	High, but moderate compared to removal and treatment alternatives	Retained
		Beneficial use or fill	Yes	Retained	Effective provided residuals are "clean"	Low	Retained
	Off-site disposal	NR 500WAC Landfill	Yes	Retained	Effective and administrative implementable	High	Retained
		Upland confined fill	Yes	Retained	Effective provided it can be permitted	Moderate	Retained
		Upland beneficial use or fill	Yes	Retained	Effective provided residuals are "clean"	Low	Retained

FIGURES

FIGURES

BASE MAP SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, ASHLAND, WISCONSIN, DATED 1964, PHOTOREVISED 1975.

QUADRANGLE LOCATION

NORTH

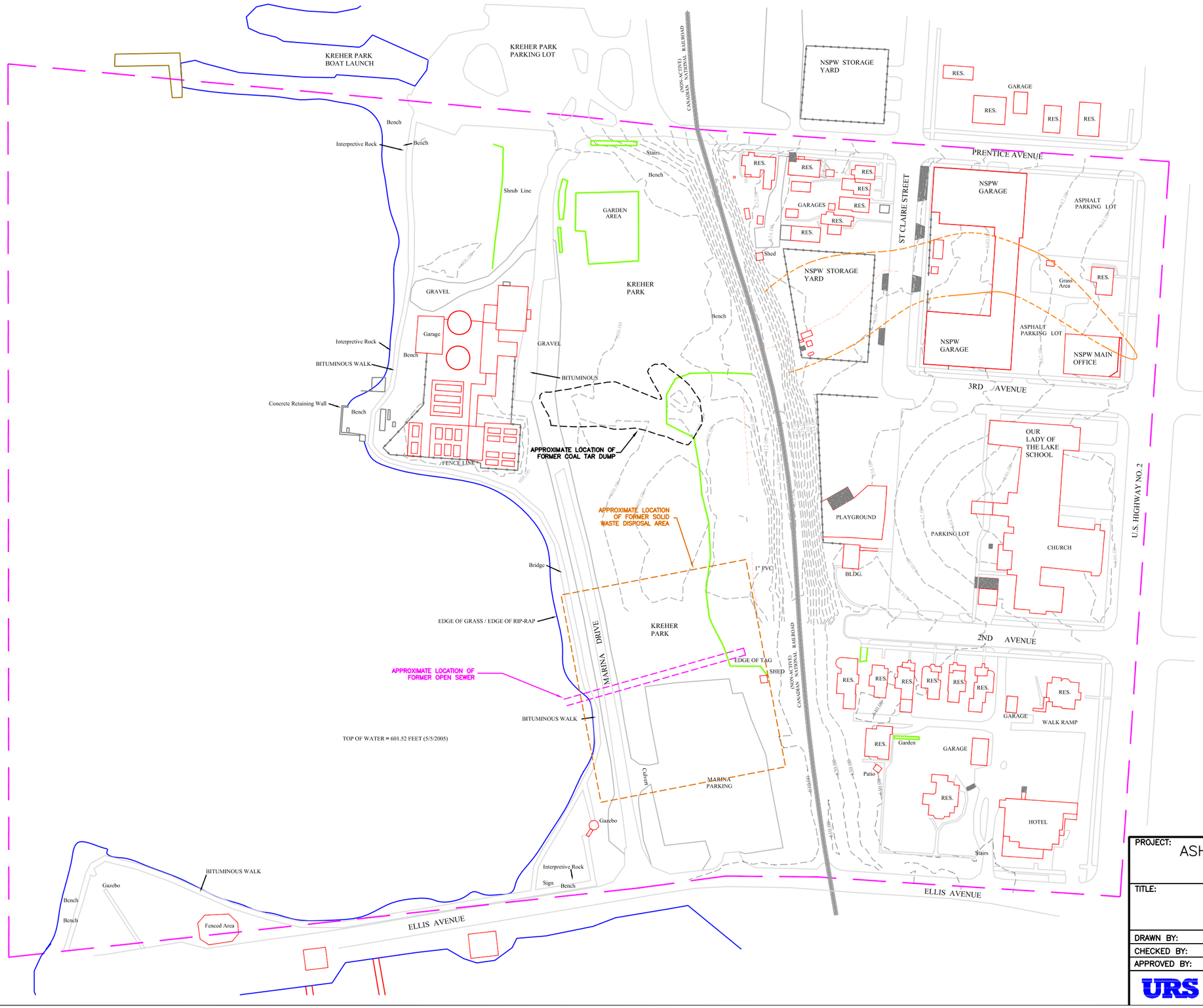
0 1320 2640 5280

SCALE IN FEET

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN		
TITLE: FIGURE 3–1 SITE LOCATION		
DRAWN BY: DDZ	SCALE: 1" = 2640'	PROJ. NO. 25688375
CHECKED BY: WSB	DATE: 30.JULY.2007	SHEET: 3–1
APPROVED BY: DPT		

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



NORTH

GRAPHIC SCALE

0 75 150 300

(IN FEET)
1 inch = 150 ft.

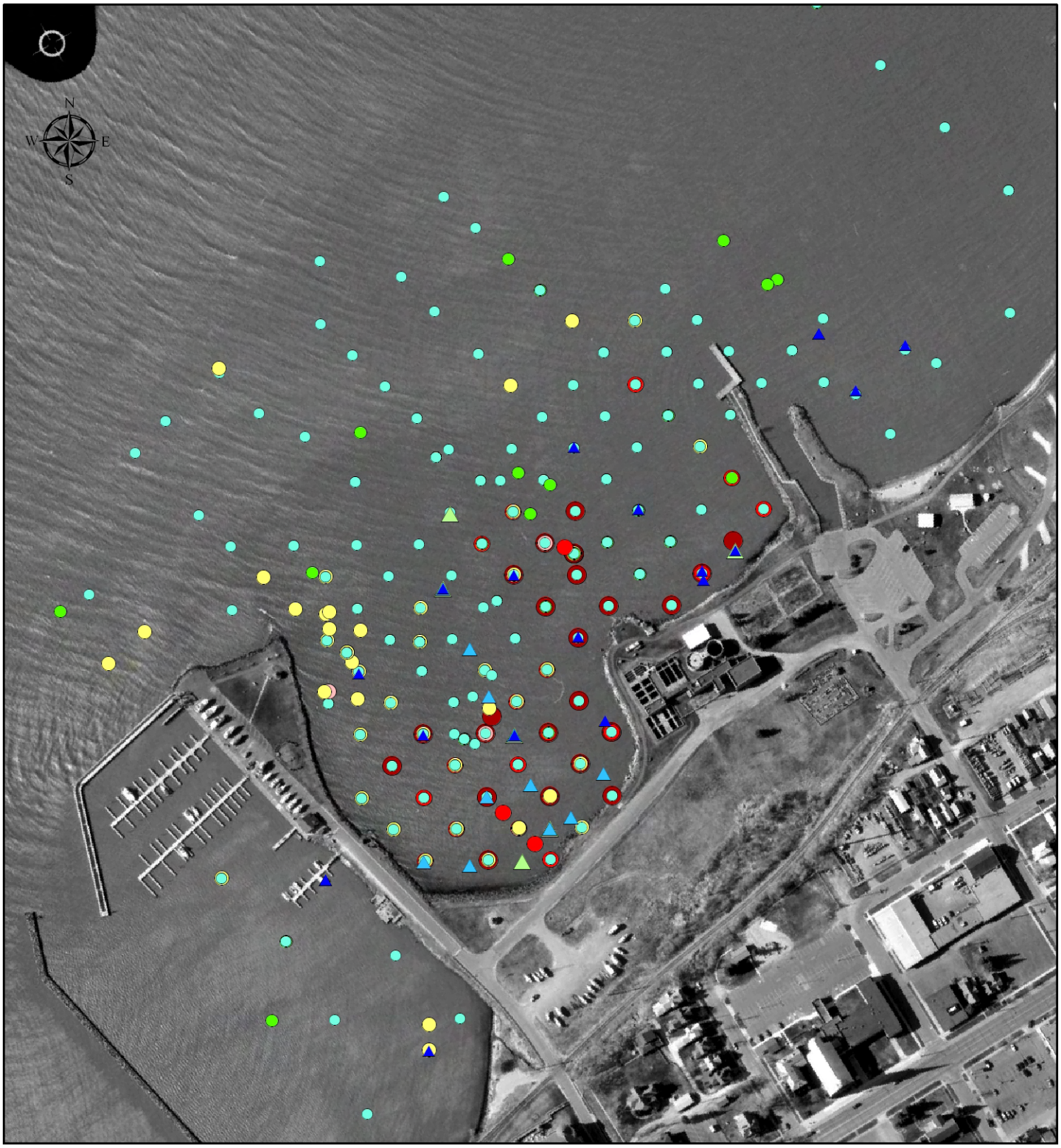
LEGEND

- NPL SITE BOUNDARY
- SURFACE CONTOUR MAJOR
- SURFACE CONTOUR MINOR
- FENCE LINE
- TREE/SHRUB LINE
- FILLED RAVINE EXTENT (APPROXIMATE)
- UNDERGROUND CLAY TILE REMNANTS

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: FIGURE 3–2 SITE FEATURES			
DRAWN BY: DDZ	SCALE: 1" = 150'	PROJECT: 25688375	
CHECKED BY: WSB	DATE: 30.JULY.2007	SHEET: 3–2	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



Legend

SW Results - Benzene ug/L

Benzene
- ND
- 0.01 - 0.34
- 0.35 - 5.0
- 5.1 - 11.4
- >11.4

All Sed Results - Total PAH ppm

Total PAH ppm
- ND
- 1 - 5
- 6 - 10
- 11 - 100
- 101 - 200
- 201 - 1000
- >1000

0 100 200 400 600 800 Feet

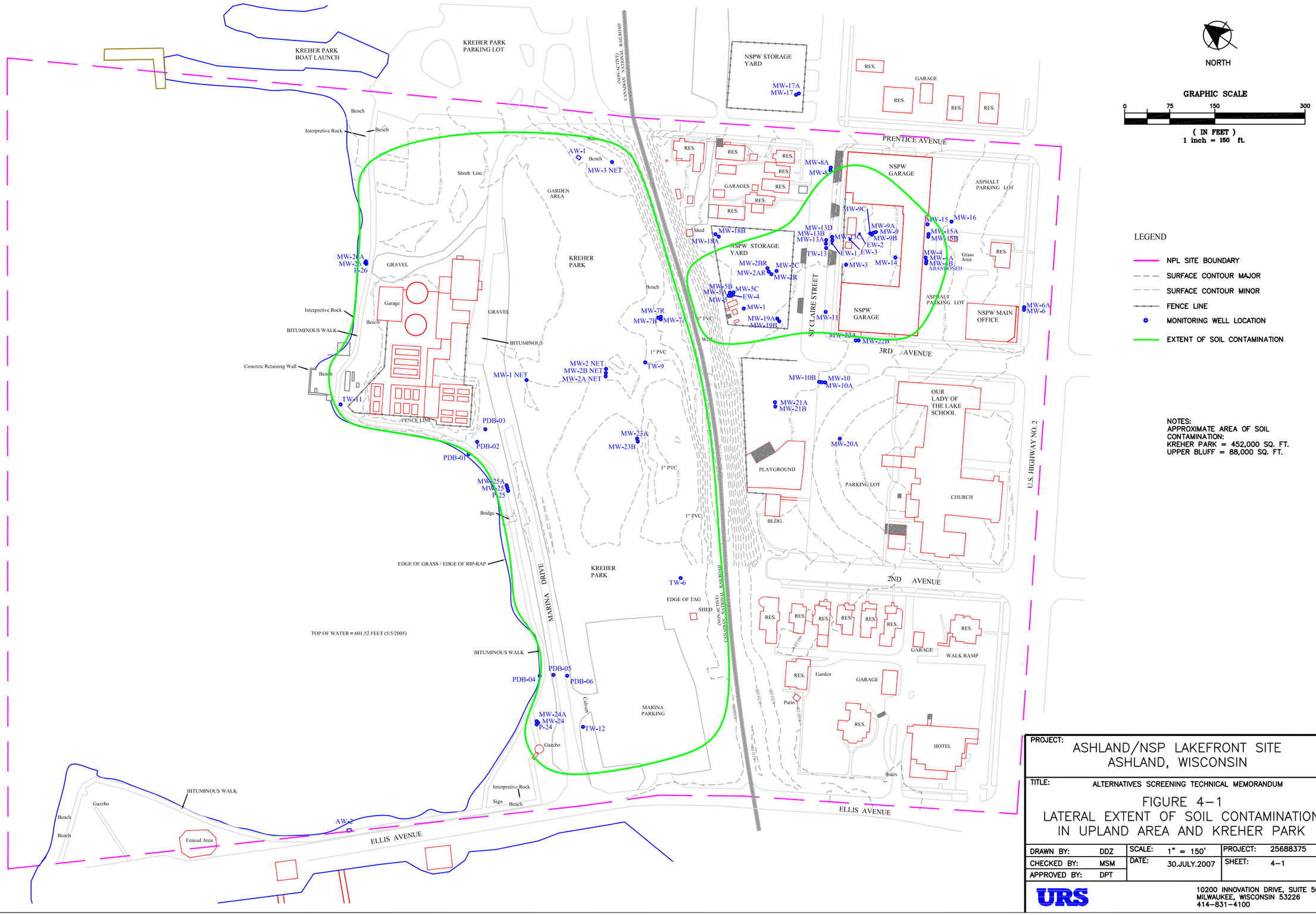
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: FIGURE 3-3
AREA OF IMPACTED SEDIMENT

DRAWN BY: DDZ	SCALE: AS SHOWN	PROJ. NO. 25688375
CHECKED BY: WSB	DATE: 30.JULY.2007	SHEET: 3-3
APPROVED BY: DPT		

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

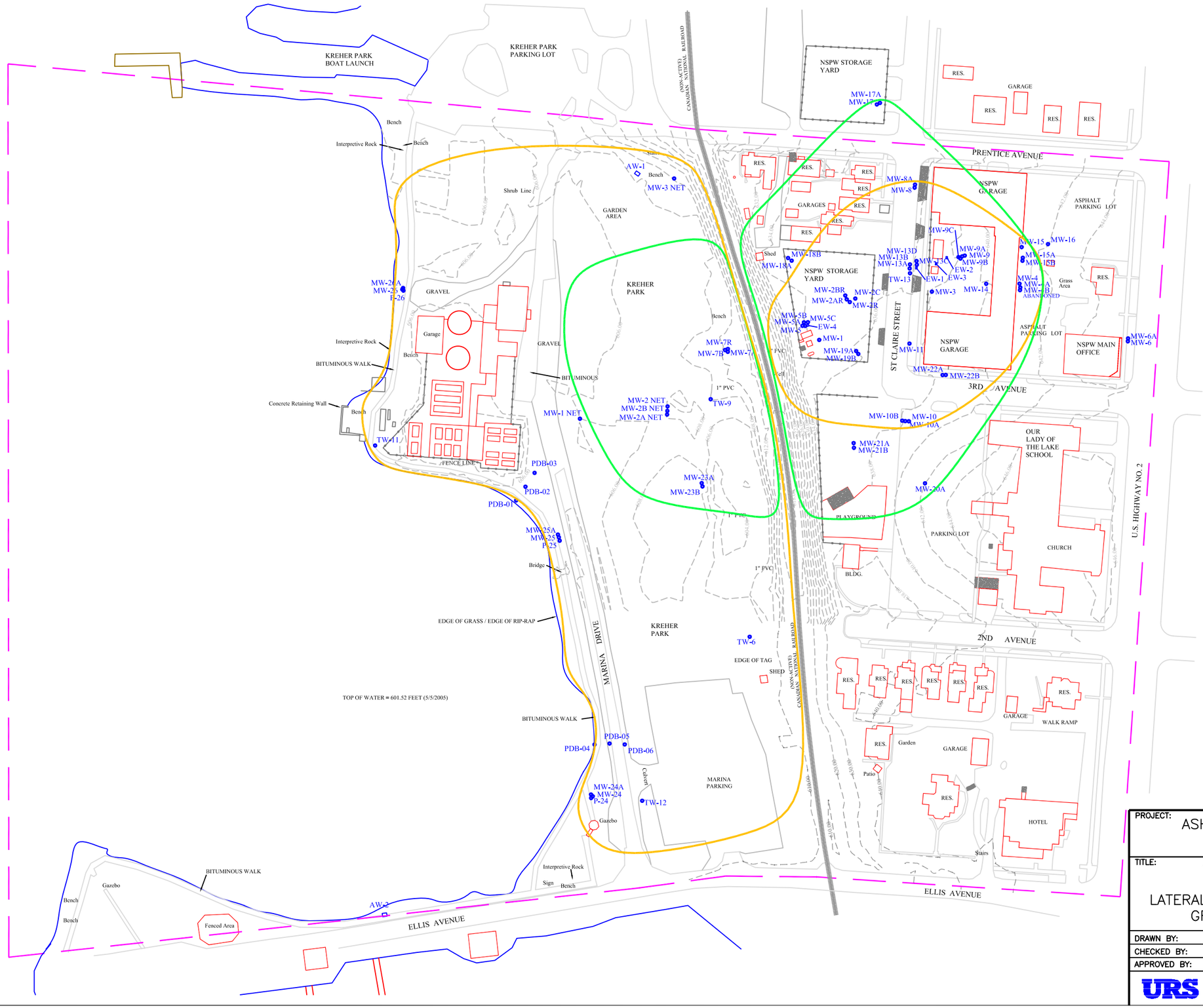
TITLE: ALTERNATIVES SCREENING TECHNICAL MEMORANDUM

FIGURE 4–1
LATERAL EXTENT OF SOIL CONTAMINATION IN UPLAND AREA AND KREHER PARK

DRAWN BY: DDZ	SCALE: 1" = 150'	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 30.JULY.2007	SHEET: 4–1	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



NOTES:
APPROXIMATE AREA OF GROUNDWATER CONTAMINATION FOR SHALLOW WELLS:
KREHER PARK = 452,000 SQ. FT.
UPPER BLUFF = 118,000 SQ. FT.

APPROXIMATE AREA OF GROUNDWATER CONTAMINATION FOR COPPER FALLS WELLS:
KREHER PARK = 103,000 SQ. FT.
UPPER BLUFF = 198,000 SQ. FT.

PROJECT:
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: ALTERNATIVES SCREENING TECHNICAL MEMORANDUM

FIGURE 4–2
LATERAL EXTENT OF SHALLOW AND DEEP GROUNDWATER CONTAMINATION

DRAWN BY:	DDZ	SCALE:	1" = 150'	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	30.JULY.2007	SHEET:	4–2
APPROVED BY:	DPT				

URS
10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100

Figure 7-1.RI/FS Alternatives Screening Process (From USEPA 1988).

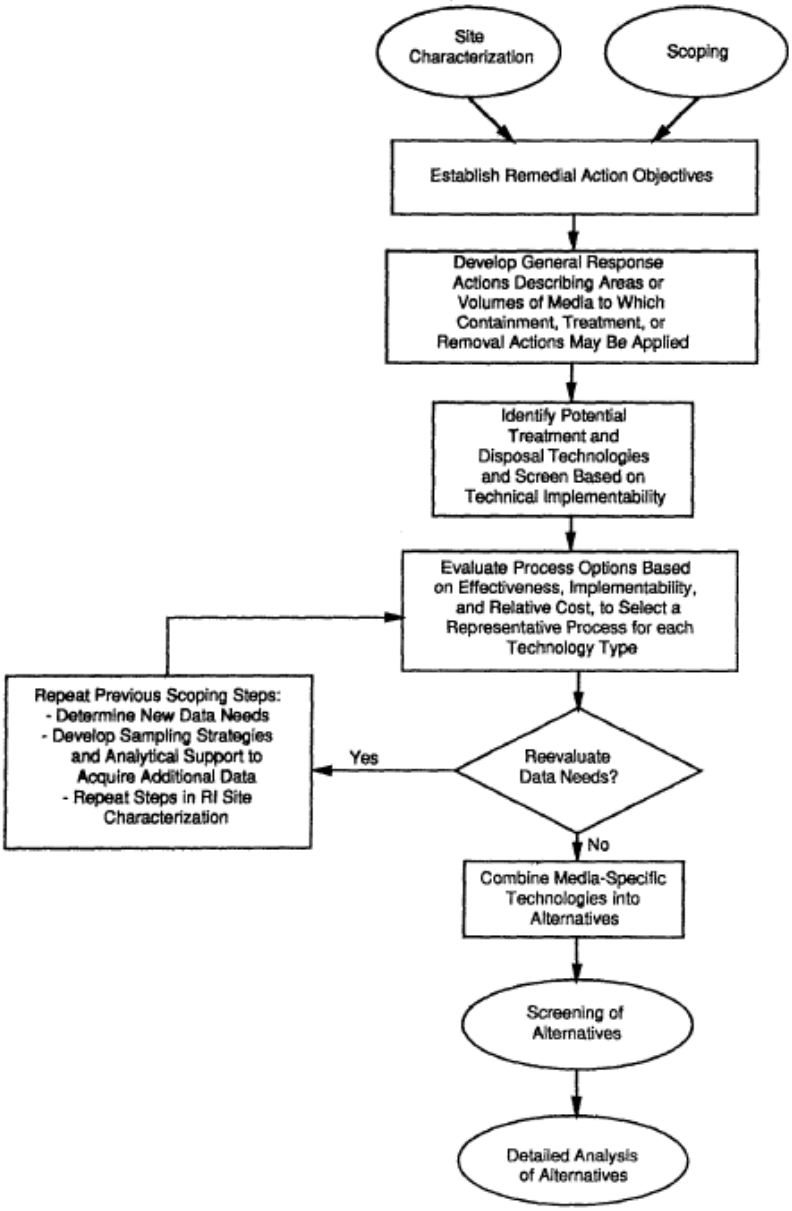
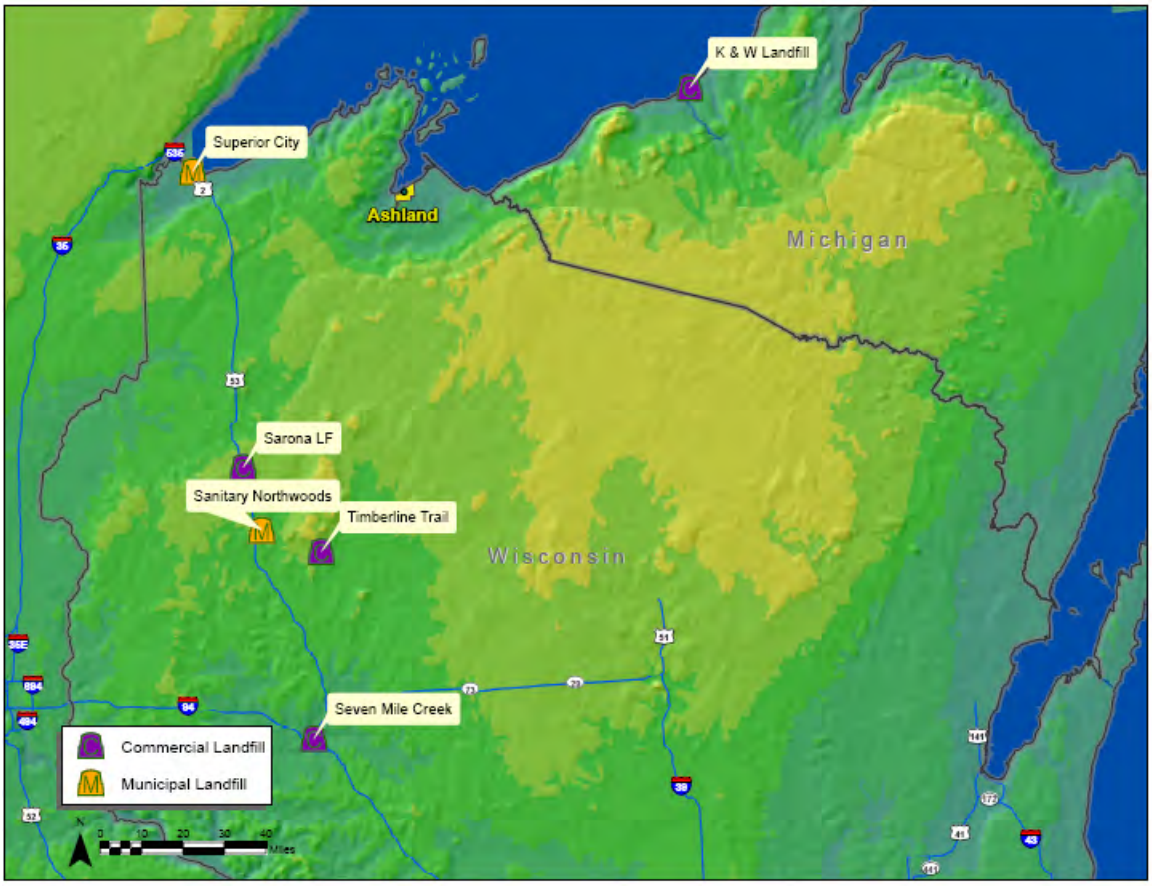


Figure 4-1 Alternative development.

Figure 7-2. Disposal Facilites within 125 Miles



Appendix A: Volume and Area Computations

NSPW Ashland
Lateral Extent and Volume of Contaminated Media Estimates

Soil

Upper Bluff Area	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Area1	Assumptions
Lateral Extent - Upland Area	88,000	2.02	10	32,593	32,600	Lateral extent (2.02 acres) where benzene exceeded RCL. Average thickness of plume is 10 feet.
Former Gas Holder Area	12,350	0.28	15	6,861	7,600	Area south of St. Claire Street is 135 by 100 feet. Average depth is 15 feet. (Includes saturated and unsaturated zone soil.)

Kreher Park	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Area1	Assumptions
Lateral Extent - Kreher Park	452,000	10.38	5	83,704	83,700	Lateral extent (10.38 acres) where benzene exceeded RCL. Average thickness of plume is 5 feet.
Former Coal Tar Dump Area	21,250	0.49	5	3,935	4,000	Area is 85 by 250 feet. Thickness above wood waste layer is 5 feet. (Includes saturated and unsaturated zone soil.)

Groundwater and Saturated Soil Media

Upper Bluff Area	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Area1	Assumptions
Lateral Extent - Upland Area	118,000	2.71	15	65,556	65,600	Lateral extent (2.71 acres) where benzene exceeds ES. Average thickness of plume is 15 feet.

Kreher Park	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Area1	Assumptions
Lateral Extent - Kreher Park	452,000	10.38	8	133,926	133,900	Lateral extent (10.38 acres) where benzene exceeds ES. Average thickness of plume is 8 feet.

Copper Falls Aquifer	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Area1	Assumptions
Lateral Extent - Upland Area	198,000	4.55	50	366,667	366,700	Lateral extent (4.55 acres) where benzene exceeds ES. Average thickness of plume is 50 feet.
Lateral Extent - Kreher Park	103,000	2.36	35	133,519	133,500	Lateral extent (2.36 acres) where benzene exceeds ES. Average thickness of plume is 35 feet.
	301,000	6.91		500,185	500,200	Sum of Kreher Park and Upland Area plume volumes.

Sediment

	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Area 1	Assumptions 2
Lateral Extent - Total PAH > 10 ppm	696,960	16.0	0 - 4	71,163	77,800	Lateral extent (16 acres) where total PAH > 10 ppm. Removal of all contaminated media up to 4 feet.
Lateral Extent - Total PAH > 10 ppm	696,960	16.0	0 - 10	103,805	133,900	Lateral extent (16 acres) where total PAH > 10 ppm. Removal of all contaminated media up to 10 feet.

1 Rounded to nearest 100 cubic yards.
2 Not all sediment between 4 and 10 feet has total PAH exceedanaces above 10 ppm.
Wood waste layer included in all volume calculations.
See Section 4.3 of Alternative Screening Technical Memorandum for further explanation.

APPENDIX A2

COMPARATIVE ALTERNATIVES ANALYSIS TECHNICAL MEMORANDUM

REVISED DRAFT REPORT

COMPARATIVE ANALYSIS OF ALTERNATIVES TECHNICAL MEMORANDUM - ASHLAND/NORTHERN STATES POWER LAKEFRONT SUPERFUND SITE

Prepared for

Northern States Power Company - WI
1414 West Hamilton Avenue
Eau Claire, WI 54701

October 5, 2007

URS

6737 W. Washington Street, Suite 2265
Milwaukee, WI 53214
25688375.70000

Table of Contents

1.0 Introduction 1-3
- 1.1 Background 1-3
- 1.2 Nature and Extent 1-4
- 1.3 Summary of Site Risks 1-6
  - 1.3.1 Current and Future Site Use 1-6
  - 1.3.2 Risks to Human Health 1-6
  - 1.3.3 Risks to Ecological Receptors 1-8
- 1.4 Document Purpose 1-8
- 1.5 Document Organization 1-10

2.0 Remedial Alternatives for Soil 2-1
- 2.1 Remedial Action Objectives for Soil 2-1
- 2.2 Potential Remedial Technologies for Soil 2-1
- 2.3 Development of Potential Remedial Alternatives for Soil 2-2
  - 2.3.1 Alternative S1 - No Action 2-2
  - 2.3.2 Alternative S2 – Containment Using Engineered Surface Barriers 2-2
  - 2.3.3 Alternative S3 - Removal and Off site Disposal 2-3
  - 2.3.4 Alternative S4 - Removal and On site Disposal 2-7
  - 2.3.5 Alternative S5 – Ex-situ Thermal Treatment 2-8
  - 2.3.6 Alternative S6 – Limited Removal and On site Soil Washing 2-12
- 2.4 Evaluation of Potential Remedial Alternatives for Soil 2-16
  - 2.4.1 Threshold Criteria 2-16
  - 2.4.2 Balancing Criteria 2-16
  - 2.4.3 Modifying Criteria 2-31
- 2.5 Comparative Analysis of Potential Remedial Alternatives for Soil 2-32
  - 2.5.1 Overall Protection of Human Health and the Environment 2-34
  - 2.5.2 Compliance with ARARs and TBCs 2-34
  - 2.5.3 Long-term Effectiveness and Permanence 2-34
  - 2.5.4 Reduction of Toxicity, Mobility, and Volume Through Treatment 2-35
  - 2.5.5 Short-term Effectiveness 2-36
  - 2.5.6 Implementability 2-36
  - 2.5.7 Cost 2-36
  - 2.5.8 Agency and Community Acceptance 2-37

3.0 Groundwater 3-1
- 3.1 Remedial Action Objectives for Groundwater 3-1
- 3.2 Potential Remedial Technologies for Groundwater 3-2
- 3.3 Development of Potential Remedial Alternatives for Groundwater 3-3
  - 3.3.1 Alternative GW1 - No Action 3-3
  - 3.3.2 Alternative GW2 -Containment Using Engineered Surface and Vertical Barriers 3-3
  - 3.3.3 Alternative GW3 - In-situ Treatment Using Ozone Sparging 3-6
  - 3.3.4 Alternative GW4 - In-situ Treatment using Surfactant Injection and Dual Phase Recovery 3-7
  - 3.3.5 Alternative GW5 - In-situ Treatment using Permeable Reactive Barrier Walls 3-8
  - 3.3.6 Alternative GW6 – Treatment using Chemical Oxidation 3-10
  - 3.3.7 Alternative GW7 - In-situ Treatment using Electrical Resistance Heating 3-12

Table of Contents

3.3.8 Alternative GW8 - In-situ Treatment using Steam Injection / Dynamic Underground Stripping / Contained Recovery of Oily Wastes (CROW) Process 3-13
3.3.9 Alternative GW9 – NAPL Removal using Groundwater Extraction Wells 3-15
3.4 Evaluation of Potential Remedial Alternatives for Groundwater 3-20
3.4.1 Threshold Criteria 3-20
3.4.2 Balancing Criteria 3-20
3.4.3 Modifying Criteria 3-32
3.5 Comparative Analysis of Potential Remedial Alternatives for Groundwater 3-32
3.5.1 Overall Protection of Human Health and the Environment 3-34
3.5.2 Compliance with ARARs and TBCs 3-34
3.5.3 Long-term Effectiveness and Permanence 3-34
3.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment 3-34
3.5.5 Short-term Effectiveness 3-35
3.5.6 Implementability 3-35
3.5.7 Cost 3-35
3.5.8 Agency and Community Acceptance 3-36

4.0 Sediment 4-1
4.1 Remediation Action Objectives for Sediment 4-2
4.2 Potential Remedial Alternatives for Sediment 4-2
4.2.1 No Action 4-5
4.2.2 Containment 4-5
4.2.3 Removal 4-7
4.2.4 Dewatering, Treatment, and Disposal Process Options 4-9
4.2.5 Monitoring 4-14
4.3 Development of Remedial Alternatives for Sediment 4-14
4.3.1 Alternative SED-1: No Action 4-15
4.3.2 Alternative SED-2: Sediment Containment within a Confined Disposal Facility 4-15
4.3.3 Alternative SED-3: Subaqueous Capping 4-23
4.3.4 Alternative SED- 4: Removal 4-30
4.4 Detailed Analysis of Remedial Alternatives 4-35
4.4.1 Threshold Criteria 4-35
4.4.2 Balancing Criteria 4-40
4.4.3 Modifying Criteria 4-51
4.5 Comparative Analysis of Alternatives 4-52
4.5.1 Overall Protection of Human Health and the Environment 4-54
4.5.2 Compliance with ARARs and TBCs 4-54
4.5.3 Long-term Effectiveness and Permanence 4-54
4.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment 4-55
4.5.5 Short-term Effectiveness 4-55
4.5.6 Implementability 4-56
4.5.7 Cost 4-56

5.0 Summary and Conclusions 5-1
5.1 Soil 5-1
5.2 Groundwater 5-1
5.3 Sediment 5-2

6.0 References 6-1

TABLES

Table 2-1 Summary of Potential Remedial Alternatives for Soil
Table 2-2 Evaluation of Long-term Effectiveness and Permanence for Potential Soil Remedial Alternatives
Table 2-3 Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Soil Remedial Alternatives
Table 2-4 Evaluation of Short Term Effectiveness for Potential Soil Remedial Alternatives
Table 2-5 Evaluation of Implementability for Potential Soil Remedial Alternatives
Table 2-6 Evaluation of Cost for Potential Soil Remedial Alternatives
Table 2-7 Comparison of Potential Soil Remedial Alternatives
Table 3-1 Summary of Potential Groundwater Remedial Alternatives
Table 3-2 Evaluation of Long-term Effectiveness and Permanence for Potential Groundwater Remedial Alternatives
Table 3-3 Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Groundwater Remedial Alternatives
Table 3-4 Evaluation of Short Term Effectiveness for Potential Groundwater Remedial Alternatives
Table 3-5 Evaluation of Implementability for Potential Groundwater Remedial Alternatives
Table 3-6 Evaluation of Costs for Potential Groundwater Remedial Alternatives
Table 3-7 Comparison of Potential Groundwater Remedial Alternatives
Table 4-1 Screening and Assembly of Remedial Technologies for Sediment
Table 4-2 Cost Summary – Alternative SED-2:CDF.
Table 4-3 Cost Summary – Alternative SED-3: Dredge/Cap.
Table 4-4 Cost Summary – Alternative SED-4: Dredge All.
Table 4-5 Evaluation of Long-term Effectiveness and Permanence for Potential Sediment Remedial Alternatives
Table 4-6 Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Sediment Remedial Alternatives
Table 4-7 Evaluation of Short Term Effectiveness for Potential Sediment Remedial Alternatives
Table 4-8 Evaluation of Implementability for Potential Sediment Remedial Alternatives
Table 4-9 Cost Summary of Remedial Alternatives for Potential Sediment Remedial Alternatives
Table 4-10 Summary of Comparative Analysis for Potential Sediment Remedial Alternatives

List of Tables, Figures, and Attachments

FIGURES

Figure 1-1 Site Map
Figure 1-2 Site Features
Figure 2-1 Limited Removal and Off site Disposal – Upper Bluff Area and Kreher Park
Figure 2-2 Unlimited Removal and Off site Disposal – Upper Bluff Area and Kreher Park
Figure 3-1 Containment & Engineered Using Surface and Vertical Barriers
Figure 3-2 In-situ Ozone Sparging
Figure 3-3 Surfactant Injection and Dual Phase Recovery – Copper Falls Aquifer
Figure 3-4 Permeable Reactive Barrier Wall & Containment Using Engineered Surface and Vertical Barriers
Figure 3-5A In-situ Chemical Oxidation – Shallow Soil and Groundwater in Upper Bluff Area
Figure 3-5B In-situ Chemical Oxidation – Copper Falls Aquifer
Figure 3-6A In-situ Electrical Resistance Heating – Shallow Soil and Groundwater in Upper Bluff Area
Figure 3-6B In-situ Electrical Resistance Heating – Copper Falls Aquifer
Figure 3-7A In-situ Steam Injection – Shallow Soil and Groundwater in Upper Bluff Area
Figure 3-7B In-situ Steam Injection – Copper Falls Aquifer
Figure 3-8A Removal Using Groundwater Extraction – Shallow Groundwater in Kreher Park
Figure 3-8B Removal Using Groundwater Extraction – Copper Falls Aquifer and Ravine Fill
Figure 4-1 Alternative SED-2: Construct CDF over Sediment
Figure 4-2 Ashland / NSP Lakefront Site – Section Concept (for CDF)
Figure 4-3 Ashland / NSP Lakefront Site – Redevelopment Concept Plan A (for CDF)
Figure 4-4 Alternative SED-3 – Remove Sediment to a Depth of 4 Feet, Cap, Treat Sediment On site, and Dispose of Sediment Off site
Figure 4-5 Elements of a Subaqueous Cap
Figure 4-6 Alternative SED-4 – Remove Sediment, Treat On site, Dispose of Sediment Off site

ATTACHMENTS

Attachment 1 Summary of Applicable or Relevant and Appropriate Requirements
Attachment 2 Preliminary Analysis of Volatilization
Attachment 3 White Paper: Precedent Sites and Technical Considerations for Placement of CERCLA Sediments in Confined Disposal Facilities (CDFs)

1.0 Introduction

As required by the Statement of Work (SOW) appending Administrative Order on Consent CERCLA Docket No. V-W-04-C-764 for the Ashland/Northern States Power Lakefront Superfund Site (Site) this document provides a description of remedial alternatives and process options that could be applied to contaminated soil, groundwater and sediment at the Site to reduce the toxicity, mobility or volume of contaminants in these media. These options vary by types of treatment, the amount of contaminated material treated and the manner in which long-term treatment residuals are managed. The options include the statutorily required "no-action" alternative as well as other remedial alternatives which were retained from the Alternatives Screening Technical Memorandum (URS 2007) following USEPA review and comment.

1.1 Background

The Site consists of property owned by Northern States Power Company – Wisconsin (NSPW, a Wisconsin corporation doing business as Xcel Energy, which is a subsidiary of Xcel Energy Inc.), a portion of Kreher Park[1], and sediments in Chequamegon Bay of Lake Superior which is an offshore area adjacent to Kreher Park. The Site is located in Section 33, Township 48 North, Range 4 West in Ashland County, Wisconsin, as shown on Figure 1-1. Existing site features showing the boundary of the site are shown on Figure 1-2.

The NSPW facility is located at 301 Lake Shore Drive East in Ashland, Wisconsin. The facility lies approximately 1,000 feet southeast of the shore of Chequamegon Bay of Lake Superior. The NSPW property is occupied by a small office building and parking lot fronting on Lake Shore Drive, and a larger vehicle maintenance building and parking lot area located south of St. Claire Street between Prentice Avenue and 3rd Avenue East. There is also a gravel-covered parking and storage yard area north of St. Claire Street between 3rd Avenue East and Prentice Avenue, and a second gravel-covered storage yard at the northeast corner of St. Claire Street and Prentice Avenue. A large microwave tower is located on the north end of the storage yard. The office building and vehicle maintenance building are separated by an alley. The area occupied by the buildings and parking lots is relatively flat, at an elevation of approximately 640 feet above mean sea level (MSL). Surface water drainage from the NSPW property is to the north. Residences bound the site east of the office building and the gravel-covered parking area. Our Lady of the Lake Church and School is located immediately west of Third Avenue East. Private homes are located immediately east of Prentice Avenue. To the northwest, the site slopes abruptly to the Canadian National (formerly known as Wisconsin Central Limited) Railroad property at a bluff

[1] Reference to this portion of the Site as Kreher Park developed colloquially over the course of this project. Kreher Park consists of a swimming beach, a boat landing, an RV park and adjoining open space east of Prentice Avenue, lying to the east of the study area of the Site. For purposes of this document and to be consistent with past reports referenced, the portion of the Site to the west of Prentice Avenue, east of Ellis Avenue and north of the NSPW property is referred to as the "Kreher Park Area" or simply Kreher Park.

that marks the former Lake Superior shoreline, and then to the City of Ashland's Kreher Park, on the shore of Chequamegon Bay.

Based on current data, the impacted area of Kreher Park consists of a flat terrace adjacent to the Chequamegon Bay shoreline. The surface elevation of the park varies approximately 10 feet, from 601 feet above MSL, to about 610 feet above MSL at the base of the bluff overlooking the park. The bluff rises to an elevation of about 640 feet above MSL, which corresponds to the approximate elevation of the NSPW property. The lake elevation fluctuates about two feet, from 601 to 603 feet above MSL. At the present time, the park area is predominantly grass covered. A gravel overflow parking area for the Ashland Marina occupies the west end of the property, while a miniature golf facility formerly occupied the east end of the site. The City of Ashland former waste water treatment plant (WWTP) and associated structures front the shoreline on the north side of the property. The impacted area of Kreher Park occupies approximately 13 acres and is bounded by Prentice Avenue and a jetty extension of Prentice Avenue to the east, the Canadian National Railroad to the south, Ellis Avenue and the marina extension of Ellis Avenue to the west, and Chequamegon Bay to the north.

The offshore area with impacted sediments is located in a small bay created by the Prentice Avenue jetty and marina extensions previously described. For the most part, contaminated sediments are confined within this small bay by the northern edge of the line between the Prentice Avenue jetty and the marina extension. The affected sediments consist of lake bottom sand and silts, and are mixed with wood debris likely originating from former log rafting lumbering operations. The wood debris layer is up to seven feet thick in areas, with an average thickness of nine inches. Wood debris overlays approximately 95% of the sediment that is impacted. Based on current data, the entire area of impacted sediments encompasses approximately sixteen acres based upon a Preliminary Remediation Goal (PRG) for sediment of 9.5 µg PAH /g @0.415% OC.

1.2 Nature and Extent

Site characterization began in 1989 when apparent contamination was discovered at Kreher Park. The primary contaminants at the Site are derived from tar compounds[2], including volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). Soils, groundwater, and offshore sediments have been impacted. The predominant sources of contamination at the Site consist of discrete free-phase hydrocarbons (free-product) derived from the tars that is present as a non-aqueous phase liquid (NAPL) at the following locations:

1. In the filled ravine on the NSPW property;
2. At areas at Kreher Park including the former "seep" area and former coal tar dump area;
3. In the offshore sediments; and
4. In the upper elevations of the deep Copper Falls aquifer.

[2] The term "tar" is used generically in this document to refer to a suite of VOC and PAH compounds the sources of which are the former MGP and other lakefront industrial operations including wood treatment activities.

The upper bluff/filled ravine has a free-product mass at the base of the ravine located south of St. Claire St. below the NSPW service center building. Part of the building includes an older section incorporating the former manufactured gas plant. The free-product is found at the base of the ravine varying in depth from 15 to 20 feet. A perched water table has formed within the filled ravine within four to six feet of the ground surface. This is part of the regional water table that extends across the area within the Miller Creek Formation, a low permeability silty-clay/clayey silt that forms the surficial geologic unit underlying the fills in the Ashland area. Soil and groundwater in the filled ravine are contaminated largely by contact/proximity with the free-product mass. The fill is variable consisting of typical MGP wastes including cinders, debris, and other locally derived detritus.

Within the filled ravine, migration in the down gradient direction toward Kreher Park occurred through both the fill as well as a 12-inch clay tile that extended along the base of the ravine to its mouth. This discharge was eliminated in 2002 with the installation of an interception well (EW-4) at the mouth of the former ravine. Groundwater extracted from the filled ravine is conveyed to the existing tar removal system for treatment prior to discharge to the sanitary sewer

Although the lateral extent of the free-product zone is limited, contaminated soil and groundwater conditions are widespread across the entire Park area. Free-product is present at the seep area and in the former coal tar dump area north of the mouth of the filled ravine at Kreher Park. This material is found at the base of the fill/wood waste layer which underlies the entire Park. In the seep area, contaminated soil above the wood waste layer was removed in 2002 and replaced with clean fill. In the former coal tar dump area, contaminated soil was encountered beneath several feet of clean fill overlying the wood waste layer. Elsewhere in Kreher Park, contaminants were encountered in the wood waste layer beneath several feet of clean surficial soil; oily sheen was observed in several test pits during the test pit investigation in Kreher Park when the underlying wood waste was encountered.

A free-product mass is present underlying the Miller Creek Formation in the same area of the NSPW service center. This material is found within the upper reaches of the Copper Falls aquifer, a sandy, coarse grained unit. Free-product extends from depths of approximately 30 to 70 feet. The greatest thickness of free product is present directly south of St. Claire Street within the main access drive of the NSPW service center. It thins in all directions from this area. Since 2000, NSPW has maintained a free-product recovery system consisting of three extraction wells which have removed over 8,000 gallons of free-product/water emulsification (approximately 10% oil/tar and 90% water from the aquifer.

North of the alley behind the service center, the Miller Creek Formation increases in plasticity creating an aquitard to the Copper Falls aquifer. Vertical gradients in the Copper Falls aquifer south of the alley are downward, indicating this is a zone of recharge. North of the alley, vertical gradients at nested wells screened in the Copper Falls aquifer indicate strong upward flow. These gradients increase in magnitude with both depth and distance toward Chequamegon Bay. Wells screened in the aquifer north of the bluff face forming the boundary between Kreher Park and the NSPW property are flowing (artesian) wells. Additionally, the aquitard thickens toward

the shoreline. This creates an apparent convergent flow condition beneath the center of Kreher Park near MW-2B(NET). Flow in the upper Copper Falls aquifer in this area is potentially restricted because of the configuration of the Miller Creek Formation, which thickens to the north toward the shoreline. Upward vertical discharge through the Miller Creek occurs as shown by the artesian wells at the Park. However, the same condition indicates that the volume of discharge is low due to the low permeability of the aquitard.

Free-product is also present in sediments in the offshore zone along the Kreher Park shoreline, mainly at the sand/wood waste interface (historic lakebed). The greatest mass of material extends between the marina and an area north of the former WWTP from 100 to 300 feet from the shore. Free-product is found at depths up to four feet below the sediment/water interface in this zone. A separate free product area is found at depths up to 10 feet between the former WWTP and the boat launch.

Section 4.0 in the RI provides specific detail on the distribution of specific contaminants

1.3 Summary of Site Risks

1.3.1 Current and Future Site Use

Current and future uses of the Site include recreational users/visitors, residential (in established residential areas on top of bluff near Xcel Energy office), fishers (both recreational and potentially subsistence), and construction, maintenance and industrial workers. Trespassers are also likely under current conditions in the abandoned WWTP area. Future use of the Kreher Park portion of the Site does not include a residential scenario.

1.3.2 Risks to Human Health

The results of the HHRA indicate that seven exposure pathways result in estimated risks that exceed USEPA's target risk levels (an incremental cancer risk [CR] of 10^{-4} to 10^{-6} and a hazard index [HI] ≤ 1) and eight exposure pathways result in estimated risks that are either equivalent to or exceed the Wisconsin Department of Natural Resources' (WDNR's) threshold of (i.e., CR $\leq 1\times10^{-5}$ and HI] ≤ 1). These exceedances are indicated below.

Exceeds USEPA Risk Range ($\geq 1\times10^{-4}$)	**Exceeds Wisconsin Threshold ($\geq 1\times10^{-5}$)**
Residents (Soil[0-3 feet and all soil depths] - Cancer)	Residents (Soil[0-3 feet and all soil depths] - Cancer)
	Residential Child (Soil – Noncancer)
Construction Worker (Soil [0-10 feet bgs]/Groundwater)	Construction Worker (Soil [0-10 feet bgs]/Groundwater)
Construction Worker (Trench Air)	Construction Worker (Trench Air)
Adult Swimmer (Surface Water with Oil Slicks)	Adult Swimmer (Surface Water)
Adult Wader (Surface Water with Oil Slicks)	Adult Wader (Surface Water with Oil Slicks/Sediment)
Industrial Worker (Indoor Air)	Industrial Worker (Indoor Air)
Subsistence Fisher (Biota)	Subsistence Fisher (Biota)

These include estimates for the reasonable maximum exposure (RME) scenarios for potential cancer risks and non-cancer risks. These conclusions are based on assumed exposures to soil in the filled ravine area (for residential receptors) and the filled ravine, upper bluff and Kreher Park area (for construction worker receptors), and to indoor air samples collected at NSPW Service Center. Carcinogenic risks based on central tendency evaluation (CTE) scenarios indicate that only the residential receptor exposure to soil (all soil depths to 10 feet bgs) are estimated to be at a CR of 1×10^{-4}, the upper-end of the USEPA target risk range or greater than the WDNR threshold. Noncarcinogenic risks for the residential receptor (for soil depths 0-1 foot and 0-3 foot bgs) and risks associated with the construction scenario are within acceptable levels. However, residential receptor exposure to subsurface soil is not expected, given the current and potential future land use of the Site. For this Site, residential risks associated with exposures to surface soil (0 to 1 foot bgs) are within the target risk ranges.

Although the results of the HHRA indicate risks for the construction workers under the RME conditions exceed USEPA's target risk levels, the assumptions used to estimate risks to this receptor were conservative and assumed the worst case. Given both the current and future land use of the Site, it is unlikely that construction workers would be exposed to soil in the filled ravine and Upper Bluff. The most likely scenario for the future construction worker is exposure to soil within 0 to 4 feet below ground surface (bgs) in Kreher Park (a typical depth for the installation of underground utility corridors), as most activities associated with the implementation of the future land use would be associated with regrading, landscaping, and road or parking lot construction. Therefore, risks to this receptor population are most likely overstated in this HHRA.

An HI of 3 was calculated for the general industrial worker exposure to indoor air pathway under the RME conditions. This risk level is likely to be an overestimate because:

- It was estimated using the maximum detected concentrations as the concentrations at points of exposure.
- It was calculated based on USEPA default exposure parameters for the industrial /commercial workers (i.e., an individual works at the Site for 8 hours per day, 5 days per week, 50 weeks per year for a total of 25 years). The NSPW Service Center is used as a warehouse; there is an office space inside the building, but used only on a part-time basis.

Cancer risks to subsistence fisher (finfish) are equivalent to the upper-end of the USEPA target risk range, but greater than the WDNR threshold of a CR of 1×10^{-5}. Noncarcinogenic risk is within acceptable limits for both USEPA and WDNR.

Risks to recreational children (surface soil) are equivalent to the WDNR risk threshold. However, risks to adolescent and adult receptors exposed to surface soil are below the USEPA acceptable risk range and below the WDNR risk threshold.

Risks to waders and swimmers (sediments), industrial workers (surface soil), and maintenance workers (surface soil) are all within USEPA's target risk range of 10^{-4} to 10^{-6} for lifetime cancer risk and a target HI of less than or equal to 1 for non-cancer risk and are less than the WDPH threshold of 1×10^{-5} for lifetime cancer risk and a target HI of less than or equal to 1 for non-cancer risk.

At the request of the WDHFS, risks were also estimated for construction workers exposed to "oily materials" in groundwater via dermal contact and swimmers and waders who may be exposed to oil slicks in surface water via ingestion and dermal contact. Because no media-specific concentrations are available for either scenario, risks were estimated using analytical data collected from the product stream from the active free product recovery system for the Copper Falls aquifer or chemical-specific solubility values detected in the DNAPL sample. Risks to construction workers exposed to "oily material" in groundwater and adult swimmers and waders exposed to "oil slicks" in surface water is greater than both the USEPA upper risk range (CR 1×10^{-4} and HI of 1) and than WDNR threshold (CR 1×10^{-5} and HI of 1). However, it is important to note that there is much uncertainty associated with estimating risks to oily material in groundwater or oil slicks in surface water. The primary uncertainties are associated with the lack of established methodology for estimating this exposure pathway.

1.3.3 Risks to Ecological Receptors

The BERA concluded that the potential for adverse effects to ecological receptors other than benthic macroinvertebrates was not sufficient to result in significant adverse alterations to populations and communities of these ecological receptors. Unacceptable impacts to the benthic macroinvertebrate community in aquatic portions of the Site are possible. Two lines of evidence, bulk sediment chemistry and sediment toxicity testing, indicated that the probability of impairment at the community level was likely.

However, the fact that hydrocarbons are sporadically released as sheens from Site sediment during some high energy meteorological events or when disturbed indicates the potential for impact to the benthic community that may not have necessarily been fully measured by the studies conducted to support the RI. While there is no evidence that effects from these releases will lead to impairment of populations and communities of these receptors inhabiting the waters of Chequamegon Bay, the presence of this continuing source degrades the functioning of a healthy aquatic community in the Site area.

In addition, if normal lakefront activities, i.e., wading, boating etc., were not presently prohibited, the disturbance of sediments and concomitant release of subsurface COPCS would increase. This potentially could lead to greater impacts than were measured during these RI/FS studies.

1.4 Document Purpose

This document presents a comparative analysis of remedial alternatives that could be implemented to manage impacted environmental media at the Site. In accordance with USEPA guidance, remedial alternatives that have been retained from the Alternatives Screening will be evaluated against a set of nine evaluation criteria, and a comparative analysis of all options using the same nine criteria as a basis for comparison. These nine criteria can be divided into three categories: threshold criteria, primary balancing criteria and modifying criteria.

Threshold criteria, which relate to statutory requirements that each alternative must satisfy in order to be eligible for selection, include:

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).

The *primary balancing criteria*, which are the technical criteria upon which the detailed analysis is primarily based, include:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

The third group, the *modifying criteria*, includes:

- State/support agency acceptance
- Community acceptance.

These last two criteria are typically formally evaluated following the public comment period, although they can be factored into the identification of the preferred alternative to the extent practicable.

The nine evaluation criteria will be applied to the assembled remedial alternatives to ensure that the selected remedial alternative will:

- protect human health and the environment and meet remedial action objectives;
- comply with or include a waiver of ARARs;
- be cost-effective;
- utilize permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable; and
- address the statutory preference for treatment as a principal element.

In addition, each alternative will provide:

- a description of the alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative, and
- a discussion of the individual criterion assessment.

If there is no direct input on state (or support agency) acceptance and community acceptance, USEPA will address these criteria.

Once each alternative is compared to the nine criteria, a comparative analysis between the remedial alternatives is performed using the evaluation criteria as a basis of comparison. Using this comparative analysis, USEPA will identify and select the preferred alternative.

1.5 Document Organization

This document is organized in the following manner:

Section 1 – Introduction
Section 2 – Remedial Alternatives for Soil
Section 3 – Remedial Alternatives for Groundwater
Section 4 – Remedial Alternatives for Sediment
Section 5 – Summary and Conclusions
Section 6 – References

2.0 Remedial Alternatives for Soil

This section on Comparative Analysis of Soil Alternatives is organized as follows:

Section 2.1: Remedial Action Objective for Soil
Section 2.2: Potential Remedial Technologies for Soil
Section 2.3: Development of Potential Remedial Alternatives for Soil
Section 2.4: Evaluation of Potential Remedial Alternatives for Soil
Section 2.5: Comparative Analysis of Potential Remedial Alternatives for Soil

2.1 Remedial Action Objectives for Soil

The general goal of RAOs is to protect human health and environmental receptors at risk due to unacceptable concentrations of constituents of potential concern (COPCs) at the Site. These objectives are subject to the criteria evaluated in the FS. As described in the RAO Tech Memo (URS 2007) preliminary remedial action objectives for soil are as follows:

- Protect human health by reducing or eliminating exposure (ingestion/direct contact/inhalation) to soil having COPCs representing an excess cancer risk greater than 10^{-6} as a point of departure (with cumulative excess cancer risks not exceeding 10^{-5}) and a hazard index (HI) greater than 1 for reasonably anticipated future land use scenarios.
- Ensure future beneficial commercial/industrial use of the Site and recreational use of Kreher Park.
- Protect populations of ecological receptors or individuals of protected species by eliminating exposure (direct contact with or incidental ingestion of soils or prey) to soil with levels of COPCs that would pose an unacceptable risk.
- Conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water.
- Protect the environment by minimizing/eliminating the migration of contaminants in the soil to groundwater or to surrounding surface water bodies.

2.2 Potential Remedial Technologies for Soil

This section presents a description of remedial technologies retained for additional evaluation based on the results of the ASTM (revised May 9, 2007). The following remedial technologies for soil were retained for screening, and are described in detail in Section 2.3.

1. No Action
2. Containment
3. Removal and Off site Disposal
4. Removal and On site Disposal
5. On site and Off site Thermal Treatment

6. Ex-situ Soil Washing

As noted in the Alternatives Screening Technical Memorandum (URS 2007), the following technologies for soil remediation were also evaluated for groundwater.

- Institutional Controls
- Monitored Natural Attenuation
- Containment using Engineered Surface and Vertical Barriers;
- In-situ Treatment using Soil Vapor Extraction
- In-situ Treatment by Chemical Oxidation
- In-situ Treatment by Thermal Desorption

Institutional controls and monitored natural attenuation were not retained for screening as stand alone remedial responses; both technologies were evaluated as elements of other active remedial responses for soil and groundwater. Containment of contaminated soil encountered at the Site will be implemented with existing barriers that meet the ARAR's, or the construction of engineered surface barriers to eliminate the direct contact exposure pathway. Surface barriers could also be designed and constructed to restrict or minimize infiltration to reduce contamination leaching into groundwater from the unsaturated zone. Consequently surface barriers were evaluated as a stand alone remedial response for soil, and in combination with other soil and groundwater remedial responses. Containment using engineered surface and vertical barriers were also evaluated as a potential remedial technology for groundwater. Additionally, in-situ treatment by soil vapor extraction (SVE) was evaluated with other in-situ (chemical oxidation and thermal treatment) groundwater remedial technologies. Potential remedial alternatives for groundwater are described in Section 3.0 below.

2.3 Development of Potential Remedial Alternatives for Soil

Conceptual designs for potential remedial alternatives for soil retained for screening and evaluated in this report are as follows. Remedial alternatives presented in this report are summarized in Table 2-1, included at the end of this Section.

2.3.1 Alternative S1 - No Action

The National Contingency Plan (NCP) at Title 40 Code of Federal Regulations (40 CFR §300.430(e)(6)) provides that the no-action alternative should be considered at every site. Implementation of no further action consists of leaving contaminated soil in place; no engineering, maintenance, or monitoring will be required. The "no action" alternative for soil was retained as required by the NCP as a basis for comparing the other alternatives.

2.3.2 Alternative S2 – Containment Using Engineered Surface Barriers

Surface barriers that would prevent direct contact with subsurface soil contamination include the following:

- Asphalt cap;
- Clay cap;
- Multi-layer cap with a minimum two-foot thick clay barrier, drainage layer, soil and vegetated top soil cover; and,
- Multi-layer cap with geomembrane or equivalent (geocomposite fabric layer or GCL).

Key elements of the conceptual design for the use of engineered surface barriers for source areas at the upper bluff area and at Kreher Park are as follows:

1. In the upland area the existing building and asphalt pavement will be repaired, upgraded or replaced to improve the integrity of the barriers on the south side of St. Claire Street.
2. New asphalt pavement on the north side of St. Claire Street (NSPW storage yard) and in Kreher Park (marina parking lot) could be installed as surface barriers for these areas to replace existing gravel surfaces.
3. A RCRA class C or D cap will be placed over the former coal tar dump area. This will be an extension of the fine grained low permeability soil cap installed in the adjacent former seep area (following the removal of contaminated soil) as an interim response in 2002.
4. Existing fill soils covering the remainder of Kreher Park are currently preventing contact with contamination in the underlying wood waste layer. Because no VOC or SVOC contaminants exceeded PRGs is fill soils there is no need to cap the remainder of Kreher Park.
5. The former waste water treatment plant is also preventing contact with the subsurface. In the event that the building is removed, the area will be covered with a clay cap or asphalt pavement.
6. Surface barriers will be periodically inspected and repaired or replaced as needed to ensure they are performing as designed.

Surface barriers would not reduce contaminant mass or toxicity of contaminants remaining in place, but they would prevent direct contact with contaminated soil. However, surface barriers would reduce infiltration minimizing the potential migration of contaminants from the unsaturated zone to the saturated zone. Consequently, surface barriers were evaluated in combination with remedial responses for soil described below, and in combination with groundwater remedial alternatives described in Section 3.0.

2.3.3 Alternative S3 - Removal and Off site Disposal

Removal consists of the excavation of contaminated soil with conventional earth moving equipment. Off site disposal consists of the transportation of excavated material to an off site landfill for disposal. Off site disposal may include the selection of one or more existing landfill facilities for disposal, or alternatively siting and constructing a landfill in the Ashland area in accordance with ch. NR 500, WAC. Off site disposal options will be evaluated in the Feasibility

Study, and will depend on the disposal volume of all material from the Site. Off site disposal options are further described in Section 4.3.5.

Following excavation, residual soil and groundwater contamination may remain, which may require natural attenuation and institutional controls for site closure if contaminants remain above RAOs. Both limited and unlimited removal alternatives were retained for evaluation as potential remedial alternatives as described below.

Alternative S3A - Limited Removal and Off site Disposal

Limited removal involves the excavation of material from areas with the highest levels of contamination. At the upper bluff area, this will require the removal of material from the two areas in the filled ravine. The first and largest area is the former gas holder area on the south side of St. Claire Street where NAPL has been encountered. The second and smaller area is at the base of the filled ravine on the north side of St. Claire Street; NAPL was encountered at the base of the ravine at this location in and around a former clay pipe encountered during a 2001 site investigation. The lateral extent of these excavations are shown on Figure 2-1. Key elements of the conceptual design for limited removal at the upper bluff area are as follows:

1. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
2. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
3. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.
4. Removal will be limited to the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders south of St. Claire Street and the clay tile north of St. Claire Street) at the upper bluff area.
5. Removal south of St. Claire Street will include the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 to 9,400 cubic yards.
6. Removal north of St. Claire Street will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
8. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the existing on site treatment system prior to discharge to the sanitary sewer.
9. Excavated material will be transported off site for disposal at an existing licensed landfill facility.

10. Site restoration will include backfilling excavated areas with clean fill material and installation of new asphalt pavement as a surface barrier over the excavated area south of St. Claire Street to prevent contact with residual soil contamination. On the north side of St. Claire Street, fill soil (overlying NAPL contaminated soil) will be returned to the excavation, and clean soil will be used as to backfill the excavation to grade. Asphalt pavement will be then be placed over the entire gravel covered storage yard as a surface barrier to prevent exposure to fill material left in place on this side of the street. The existing street will be upgraded as needed to provide a surface barrier for this portion of the filled ravine.

At Kreher Park, limited removal will require the excavation of approximately 4,000 cubic yards of contaminated soil overlying the saturated wood waste layer at the former coal tar dump area. The lateral extent of this excavation is also shown on Figure 2-1. Key elements of the conceptual design for limited removal at Kreher Park are as follows:

1. Site preparation will include clearing and grubbing of small trees and bushes near the south side of the former coal tar dump area.
2. Clean fill soil overlying contaminated soil at the former coal tar area will be removed and used as backfill material following the removal of contaminated soil above the saturated wood waste layer.
3. Removal will include the excavation of unsaturated and saturated zone soils approximately 5 feet thick for an area approximately 280 feet by 130 feet, yielding approximately 4,000 cubic yards.
4. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the on site treatment system prior to discharge to the sanitary sewer.
5. Excavated material will be transported off site for disposal at an existing licensed landfill facility.
6. Site restoration will include backfilling with clean fill material, and installation of a new RCRA Class C or D cap over the excavated area.

Existing fill soils covering the remainder of Kreher Park are currently preventing contact with contamination in the underlying wood waste layer. As described for Alternative S-2 above (Section 2.3.2), new asphalt pavement could be installed in Kreher Park as a surface barrier in the marina parking lot area to replace the existing gravel surface. The former waste water treatment plant is also preventing contact with subsurface materials. In the event that the building is removed, the area will be covered with a clay cap or asphalt pavement. These surface barriers are evaluated as potential groundwater remedial alternatives in Section 3.0.

Alternative S3B - Unlimited Removal and Off site Disposal

Unlimited removal will consist of the removal of all fill material and contaminated soil above RAOs. At the upper bluff area, this will require the excavation of all fill material from the filled ravine. The lateral extent of the filled ravine is shown on Figure 2-2. Key elements of the conceptual design for unlimited removal at the upper bluff area are as follows:

1. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
2. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
3. Removal and replacement of the section of St. Claire Street overlying the filled ravine (including underground utility realignment) will also be required.
4. Removal will include the excavation of soil containing NAPL, and the removal of all underground structures (i.e. former gas holders) at the upper bluff area.
5. Removal will include the excavation of approximately 32,500 cubic yards of unsaturated and saturated zone fill material from the filled ravine, including an estimated 15,000 cubic yards of fly ash material from the area on the north side of St. Claire Street.
6. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
7. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the on site treatment system prior to discharge to the sanitary sewer.
8. Excavated material will be transported off site for disposal at an existing licensed landfill facility. (Fly ash material may be transported to NSPW's fly-ash landfill for disposal.)
9. Site restoration will include backfilling with clean fill material, replacement of St. Claire Street and utilities, and the installation of new asphalt pavement over excavated areas on the north and south side of St. Claire Street as a surface barrier for any residual soil contamination.

At Kreher Park, this will require the removal of the wood waste layer and overlying fill soil between Prentice and Ellis Avenues. The lateral extent of the excavation area is shown on Figure 2-2. Key elements of the conceptual design for unlimited removal at Kreher Park are as follows:

1. Site preparation will include clearing and grubbing small trees and bushes near the south side of the former coal tar dump area.
2. Clean fill soil overlying the wood waste layer will be removed, salvaged and used to backfill the excavated former ravine at the upper bluff area.
3. Removal will include the excavation of the wood waste layer and the overlying fill soil. The estimated volume of fill soil and wood waste material is approximately 223,000 cubic yards.
4. Because the excavation will be completed below lake level, a temporary sheet pile wall will constructed on the north, east, and west sides of the construction area to allow a dry excavation.
5. Groundwater removed from the saturated portion of the excavation and any seepage into the excavation will be collected and treated by an on site treatment system prior to discharge to the sanitary sewer[3].

[3] If sediment removal is selected, on site treatment equipment from sediment de-watering activities will be utilized for the on site treatment of groundwater encountered in the unlimited excavation of Kreher Park.

6. Excavated material will be transported off site for disposal at a new landfill facility sited and constructed for the disposal of this material. If possible, wood suitable for fuel at the Bayfront power plant will be salvaged and used for power generation.

Removal of all fill material in the Kreher Park would likely require the construction of an off site landfill. Unlimited removal will result in significant site disturbance, which may result in temporary or permanent loss of the current use of Kreher Park.[4] Kreher Park could be restored to pre-filling conditions (i.e. wetland area or shallow lakebed), backfilled with clean fill to restore it to present elevations, or backfilled with contaminated sediment. Backfilling with contaminated sediment would require the construction of an onshore confined disposal facility (CDF) for the placement of material removed from the adjacent inlet area. Wisconsin Administration Code Chapter 30 does not prohibit construction of a nearshore CDF and disposal of dredged sediments into a newly constructed CDF. Because contaminated soil will be excavated from the saturated zone encountered below lake level, removal and treatment of contaminated groundwater seeping into the excavation will be required.

2.3.4 Alternative S4 - Removal and On site Disposal

Removal will consist of the excavation of contaminated soil with conventional earth moving equipment. On site disposal consists of the transportation of excavated material to an on site landfill for disposal. Residual soil and groundwater contamination may remain above RAOs, which may require natural attenuation and institutional controls for site closure if contaminants remain above RAOs. Inadequate space is available for on site disposal at the upper bluff area, but adequate space is available at Kreher Park for the construction of an on site disposal cell. The on site disposal cell in Kreher Park could accommodate all or a portion of the material removed from the filled ravine at the upper bluff area previously described for Alternatives S3A (limited removal) and S3B (unlimited removal). It could also accommodate the limited removal of contaminated soil from the former coal tar dump area. Additionally, on site disposal could accommodate the disposal of dredged sediment from the inlet area. On site disposal would need to be completed in combination with containment alternatives for shallow groundwater at Kreher Park described in Section 3.0, and/or in conjunction with sediment containment alternatives described in Section 4.0. Key elements of the conceptual design for limited and unlimited removal of material from the filled ravine at the upper bluff and limited removal of contaminated soil from the former coal tar dump area are described above. The conceptual design for the construction of an on site disposal facility at Kreher Park follows:

1. Site preparation will include clearing and grubbing of small trees and bushes near the south side of the former coal tar dump area.
2. A disposal cell will be constructed at Kreher Park adjacent to the former coal tar dump area for the disposal of material excavated from the upper bluff area. The size of the disposal cell will be approximately one acre for limited excavation, and four acres for unlimited removal at the upper bluff area. Contaminated soil from the former coal tar

[4] Kreher Park is currently utilized as a recreation area, but it also contains the marina boat storage area, a City street adjacent to the shoreline, and the former waste water treatment building.

dump area would also be placed in the disposal cell. A RCRA class C or D cap will then be placed over the disposal cell. This soil remedial alternative could be combined in combination with containment alternatives evaluated for groundwater and sediment in Sections 3.0 and 4.0, respectively.[5].

3. Clean fill soil overlying the wood waste layer at Kreher Park will be removed for the construction of the disposal cell and used to backfill excavated areas. Fill soil outside the foot print of this area will be left in place.
4. Any groundwater seeping into the disposal cell during construction will be collected, temporarily placed in holding tanks, and treated by an on site treatment system prior to discharge to the sanitary sewer[6].
5. Site restoration at the upper bluff will include backfilling with salvaged clean fill material and installation of a RCRA cap or new asphalt pavement over the excavated area south of St. Claire Street, the existing street, and the gravel covered courtyard area on the north side of the street.
6. Long-term operation and maintenance for the disposal cell or CDF will include the groundwater monitoring and periodic inspection and repair of all asphalt and soil caps.

2.3.5 Alternative S5 – Ex-situ Thermal Treatment

Thermal treatment physically separates volatile and some semi-volatile contaminants from excavated soil or sediment by using ambient air, heat, and/or mechanical agitation to volatilize contaminants from soil into a gas stream for further treatment. Thermal treatment is achieved by either low temperature thermal desorption (LTTD), high temperature thermal desorption (HTTD), or incineration. The type of thermal treatment selected will be based on RAOs for VOCs and PAHs in treated soil. Another consideration is the suitability of treated soil as backfill material; soil treated by LTTD will retain pre-treatment physical properties (i.e. organic content) whereas soil treated by HTTD and incineration will not. Soils thermally treated on site can be returned to the excavation as backfill. Clean fill will be needed to replace soils transported off site for treatment and disposal.

LTTD is highly effective for VOCs; PAH compounds can also be treated, but at a reduced effectiveness. HTTD is effective for PAH compounds, but is not as cost effective as LTTD for VOCs. Incineration is effective for both VOCs and PAH compounds, but treating contaminated soil at high temperatures (1,400 to 2,200 ºF) to volatilize and combust organic compounds would require significantly more effort than LTTD or HTTD. An on site mobile incinerator would operate in a similar fashion as HTTD except the kiln would be direct-fired[7] and would cause

[5] A larger disposal cell would be needed for on site disposal of sediment in an on site confined disposal facility (CDF). The on site disposal of an additional 134,000 cubic yards of sediment would require a CDF 8 acres in size with a waste thickness of approximately 13 feet. The on site disposal of an additional 78,000 cubic yards of sediment would require a CDF 6 acres in size with a waste thickness of approximately 12 feet.

[6] If sediment removal is selected, on site treatment equipment from sediment de-watering activities may also be utilized for the on site treatment of groundwater seeping into the excavation during construction.

[7] Medium and high temperature thermal desorption may also be direct-fired, but at a lower temperature than incineration.

some COPCs to be destroyed before the vapors reach the secondary combustion chamber. In addition the gas flow rates are higher since the fuel and air combustion gases are included in the gases sent from the kiln to the secondary combustion chamber. Additional soil tests such as sieve analysis, soil fusion temperature, and soil heating value are generally needed to achieve proper incineration. Although mobile incinerators are available, most incineration is achieved at off site facilities due to the substantial amount of equipment involved. Transportation costs, energy costs to sustain high temperatures, and regulatory compliance for incineration would be significantly higher than LTTD and HTTD costs. For this analysis we have assumed that on site treatment will be completed by LTTD or HTTD, and that incineration will be completed at an off site facility.

Alternative S5A - Limited Removal and On site Thermal Treatment

On site thermal treatment will require excavation of contaminated material at the upper bluff area as previously described for the limited removal alternatives described above (Alternatives S-3A and S-4). Excavated soil could be transported off site, but most likely would be treated on site by a mobile unit. Debris must be separated by size from material suitable for thermal treatment and transported off site for disposal. Consequently, wood waste at Kreher Park and fly-ash and cinders in the filled ravine at the upper bluff area must be separated from NAPL contaminated material encountered in these areas. Thermal treatment by LTTD or HTTD will be completed for suitable NAPL contaminated fill material, and contaminated material not suitable for thermal treatment will be transported off site for disposal.. Fill material including fly ash and cinders that is not contaminated with VOC and PAH compounds will be returned to the excavation. Residual soil and groundwater contamination may remain, which may require natural attenuation and institutional controls for site closure if residual contaminants remain above RAOs.

Thermal treatment will be performed on suitable fill material from areas with the highest levels of contamination. This includes the former gas holder area at the upper bluff, the free product in the ravine and contaminated soil encountered above the wood waste layer at Kreher Park. The lateral extent of these excavations are shown on Figure 2-1. Key elements of the conceptual design for ex-situ thermal treatment of material removed from these areas follows:

1. A mobile unit and ancillary equipment will be set up at Kreher Park because inadequate space is available at the upper bluff area.
2. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath this building at the upper bluff area.
3. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
4. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.

5. Removal will include the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders) at the upper bluff area south of St. Claire Street. This area includes the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 and 9,400 cubic yards. Also included for removal will be soil containing NAPL in the ravine on the north side of St. Claire Street. This will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
6. Removal will also include the excavation of unsaturated and saturated zone soils at the former coal tar dump area. This includes approximately 5 feet of contaminated soil in an area approximately 280 feet by 130 feet, yielding approximately 4,000 cubic yards.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
8. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the on site treatment system prior to discharge to the sanitary sewer.
9. Saturated and unsaturated zone material will be thermally treated to reduce contaminant mass and toxicity and returned to the excavation as back fill. Material unsuitable for thermal treatment will be transported off site for landfill disposal. Fill material not contaminated with VOC and PAH compounds will be returned to the excavation as backfill.
10. Site restoration at the upper bluff area will include the installation of new asphalt pavement as a surface barrier over the excavated area on both sides of St. Claire Street, and new asphalt pavement at the gravel covered courtyard area on the north side of the street. The existing street (inspected for water tightness and sealed or replaced as needed) and new asphalt pavement on the NSPW property will prevent exposure to fill material beneath St. Claire Street and the NSPW storage yard.
11. Site restoration at Kreher Park will include backfilling excavated areas with clean fill material and installation of a new RCRA Class C or D cap over the excavated area.
12. Long-term operation and maintenance of backfilled areas will include groundwater monitoring, cap maintenance including the periodic inspection and repair of all asphalt and soil caps.

Alternative S5B - Limited Removal and Off site Incineration

Incineration will require excavation of contaminated material at the upper bluff area and the former coal tar dump area at Kreher Park as previously described for the other limited removal alternatives (Alternatives S-3A, S-4, and S-5A). Contaminated soil suitable for incineration would be transported off site to a licensed facility for treatment and disposal. Wood waste at Kreher Park and fly-ash and cinders in the filled ravine at the upper bluff area must be separated from contaminated soil selected for incineration. Debris will be separated by size from material suitable for incineration and transported off site for disposal, and fill material not contaminated with VOCs and PAHs will be returned to the excavation as backfill.

As with thermal treatment, incineration will be performed on suitable fill material from areas with the highest levels of contamination. This includes the former gas holder area at the upper bluff, the free product in the ravine and contaminated soil encountered above the wood waste layer at Kreher Park. The lateral extent of these excavations are shown on Figure 2-1. Key elements of the conceptual design for ex-situ thermal treatment of material removed from these areas follows:

1. All contaminated material will be separated from debris and transported off site for incineration and/or off site disposal. Ancillary equipment needed to separate material suitable for incineration will be set up at Kreher Park because inadequate space is available at the upper bluff area.
2. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
3. Removal of existing asphalt pavement in the alley and courtyard area will also be required.
4. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.
5. Removal will include the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders) at the upper bluff area south of St. Claire Street. This area includes the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 and 9,400 cubic yards. Also included for removal will be soil containing NAPL in the ravine on the north side of St. Claire Street. This will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
6. Removal will also include the excavation of unsaturated and saturated zone soils at the former coal tar dump area. This includes approximately 5 feet of contaminated soil in an area approximately 280 feet by 130 feet, yielding approximately 4,000 cubic yards.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
8. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the existing on site treatment system prior to discharge to the sanitary sewer.
9. Saturated and unsaturated zone material will be transported off site for incineration and subsequent off site disposal. Material unsuitable for incineration will be transported off site for landfill disposal. Fill material not contaminated with VOC and PAH compounds will be returned to the excavation as backfill.
10. Site restoration will include backfilling the excavation with clean fill material and installation of new asphalt pavement as a surface barrier over the excavated area south of St. Claire Street to prevent contact with residual soil contamination. On the north side of St. Claire Street, fill soil (overlying NAPL contaminated soil) will be returned to the

excavation, and clean soil will be used as to backfill the excavation to grade. Asphalt pavement will be then be placed over the entire gravel covered storage yard as a surface barrier to prevent exposure to fill material left in place on this side of the street. The existing street will be upgraded, as needed, to provide a surface barrier for this portion of the filled ravine.

11. Long-term operation and maintenance of backfilled areas will include groundwater monitoring, cap maintenance including the periodic inspection and repair of all asphalt caps.

2.3.6 Alternative S6 – Limited Removal and On site Soil Washing

Soil washing is a water-based process for mechanically scrubbing excavated soil to remove contaminants by dissolving or suspending them in the wash solution. Contaminated soil from the saturated and unsaturated zones will be treated by soil washing following removal by excavation. Contaminants are either removed by dissolving or suspending them in a wash solution, or reducing concentrations in smaller volumes of soil by gravity separation. Wastewater used for soil washing is treated on site prior to discharge. A bio-slurry reactor is a hybrid soil washing technique that is used to treat a slurry of wastewater and contaminated soil. An aqueous slurry is created by combining soil, sediment, or sludge with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. Upon completion of the process, the slurry is dewatered and the treated soil is disposed or returned to the excavation. Material processing equipment (mixing unit and batch tanks) and water treatment equipment will require room for setup near one of the excavation areas. A mobile unit will be used to treat (wash) soil on site. Treated soil will be returned to the excavation as backfill material. Semi-volatile organics and hydrophobic contaminants may require the addition of a surfactant or organic solvent. A bench or pilot-scale treatability test may be needed to determine the best operating conditions and wash fluid compositions for soil washing and or bio-slurry treatment.

On site soil washing can also be applied to contaminated material in the upper bluff area, and limited areas in Kreher Park, as described for the limited removal alternatives previously described (Alternatives S-3A, S-4, S-5A, and S-5B). As with on site thermal treatment, man-made fill material (i.e. ashes, cinders, bricks, concrete, wood debris, and glass) is not suitable for soil washing and will require separation and off site disposal. The presence of wood waste in Kreher Park and fly-ash and cinders in the filled ravine (on the north side of St. Claire Street in the upper bluff area) will preclude the use of soil washing of debris from these areas. Consequently, soil washing will be used for contaminated fill soil removed from areas with high concentrations of VOCs and PAH compounds at Kreher Park and the upper bluff area. Residual soil and groundwater contamination may remain, which may require natural attenuation and institutional controls for site closure if contaminants remain above RAOs.

Limited removal and on site soil washing will be limited to areas with the highest levels of contamination. This includes the former gas holder at the upper bluff area where NAPL has been encountered, and the former coal tar dump area at Kreher Park. The lateral extent of these

excavations are shown on Figure 2-1. Key elements of the conceptual design for limited removal and ex-situ soil washing in the upper bluff area and Kreher Park are as follows:

1. Soil washing and ancillary equipment will be set up at Kreher Park because inadequate space is available at the upper bluff area.
2. Demolition of the center section of the NSPW service center for excavation south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
3. Removal of existing asphalt pavement from the alley and courtyard area will also be required.
4. All shallow water table wells screened in the fill soil unit will be abandoned prior to excavation. Piezometers screened in the underlying Copper Falls aquifer will be protected during excavation and backfilling activities and remain in place for future use.
5. Removal will include the excavation of soil containing NAPL, and the removal of buried structures (i.e. former gas holders) at the upper bluff area south of St. Claire Street. This area includes the excavation of unsaturated and saturated zone soils to a depth between 12 and 15 feet for an area approximately 130 feet by 130 feet, yielding between 7,600 and 9,400 cubic yards. Also included for removal will be soil containing NAPL in the ravine on the north side of St. Claire Street. This will include the excavation of saturated zone soil from the bottom five feet of the filled ravine where the clay tile and NAPL were encountered. At the surface, this excavation area will be approximately 30 feet by 75 wide. An estimated 75 to 150 cubic yards of NAPL contaminated soil will be removed from the base of the filled ravine.
6. Removal will also include the excavation of unsaturated and saturated zone soils at the former coal tar dump area. This includes approximately 5 feet of contaminated soil in an area approximately 280 feet by 130 feet, yielding approximately 4,000 cubic yards.
7. Deep excavations, or excavations completed near facility buildings may require shoring to support sidewalls.
8. Groundwater seeping into the excavation will be collected, temporarily placed in holding tanks, and treated by the on site treatment system prior to discharge to the sanitary sewer.
9. Saturated and unsaturated zone material will be treated by soil washing to reduce contaminant mass and toxicity, and returned to the excavation as back fill. Material unsuitable for soil washing will be transported off site for landfill disposal.
10. Site restoration will include the installation of new asphalt pavement as a surface barrier over the excavated area south of St. Claire Street, and new asphalt pavement at the gravel covered courtyard area on the north side of the street. The existing street (inspected for water tightness and sealed or replaced as needed) and new asphalt pavement on the NSPW property will prevent exposure to fill material beneath St. Claire Street and the NSPW storage yard.
11. Site restoration at Kreher Park will include backfilling with clean fill material, and installation of a new RCRA Class C or D cap or asphalt road or parking lot over the Kreher Park area.
12. Long-term operation and maintenance for the site will include groundwater monitoring and periodic inspection and repair of all asphalt caps.

Table2-1 - Summary of Potential Remedial Alternatives for Soil

Soil Remediation	Alternative S1	Alternative S2	Alternative S3A	Alternative S3B	Alternative S4	Alternative S5A	Alternative S5B	Alternative S6
	No Action	**Containment using Engineered Surface Barriers**	**Limited Removal and Off site Disposal**	**Unlimited Removal and Off site Disposal**	**Limited Removal and On site Disposal**	**Limited Removal and On site Thermal Treatment**	**Limited Removal and Off site Incineration**	**Limited Removal and Onsite Soil Washing**
Removal /Treatment Volume (cubic yards)								
Upper Bluff Area	0	32,500	7,675 to 9,650	32,500	7,675 to 9,650	7,675 to 9,650	7,675 to 9,650	7,675 to 9,650
Kreher Park	0	4,000	4,000	223,000	4,000	4,000	4,000	4,000
Removal /Treatment Method								
Upper Bluff Area	None	No treatment prior to capping.	No treatment prior to disposal.	No treatment prior to disposal.	No treatment prior to disposal.	On site thermal treatment staged at Kreher Park.	Off site incineration and disposal.	On site soil washing staged at Kreher Park
Kreher Park	None							
Disposal Required								
Upper Bluff Area	No removal or treatment of contaminated soil.	No removal or treatment of contaminated soil.	Transport all material to existing off site NR 500 landfill for disposal.	Site and construct new nearby off site NR 500 landfill for disposal of all material.	Site and construct new disposal cell at Kreher Park for disposal of all excavated material.*	Transport debris not suitable for treatment to an existing off site NR 500 landfill for disposal.	Transport debris not suitable for treatment to an existing off site NR 500 landfill for disposal.	Transport debris not suitable for treatment to an existing off site NR 500 landfill for disposal.
Kreher Park								
Excavation Dewatering Required								
Upper Bluff Area	No	No	Yes – utilize on site treatment system.	Yes – utilize on site treatment system.**	Yes – utilize on site treatment system.*	Yes – utilize on site treatment system.	Yes – utilize on site treatment system.	Yes – utilize on site treatment system.
Kreher Park								
Backfill								
Upper Bluff Area	None	None	Clean fill from off site source.	Clean fill from Kreher Park.	Clean fill from Kreher Park.	Return treated soil to excavation, and fill to grade with clean fill from an off site source.	Clean fill from off site location.	Return treated soil to excavation, and fill to grade with clean fill from an off site source.
Kreher Park				Clean fill from off site location as needed. .				
Site Restoration								
Upper Bluff Area	None	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.	Asphalt pavement over former ravine.
Kreher Park		Cap over former coal tar dump area.	Cap over former coal tar dump area.	Restore Kreher Park to pre-removal elevations with clean fill. or restoration as	Cap over former coal tar dump area.	Cap over former coal tar dump area.	Cap over former coal tar dump area.	Cap over former coal tar dump area

Soil Remediation	Alternative S1	Alternative S2	Alternative S3A	Alternative S3B	Alternative S4	Alternative S5A	Alternative S5B	Alternative S6
	No Action	**Containment using Engineered Surface Barriers**	**Limited Removal and Off site Disposal**	**Unlimited Removal and Off site Disposal**	**Limited Removal and On site Disposal**	**Limited Removal and On site Thermal Treatment**	**Limited Removal and Off site Incineration**	**Limited Removal and Onsite Soil Washing**
				wetland or shallow lakebed.				
Other Remedial Technologies Used								
Upper Bluff Area	MNA Instit. Cntrls. Surface Barriers Vertical Barriers	MNA Instit. Cntrls Vertical Barriers	MNA Instit. Cntrls Surface Barriers Vertical Barriers	MNA Institutional Cntrls	MNA Instit. Cntrls Surface Barriers Vertical Barriers CDF	MNA Instit. Cntrls Surface Barriers Vertical Barriers	MNA Instit. Cntrls Surface Barriers Vertical Barriers	MNA Instit. Cntrls Surface Barriers Vertical Barriers
Kreher Park				MNR Vertical Barriers				

* Disposal cell could be enlarged for on site disposal of sediment.

** May include use of sediment de-watering treatment equipment if sediment removal is selected for off-shore contamination.

2.4 Evaluation of Potential Remedial Alternatives for Soil

Potential remedial alternatives for soil were evaluated in this section in accordance with the threshold criteria, primary balancing criteria, and modifying criteria described in Section 1.4 above.

2.4.1 Threshold Criteria

Threshold criteria, which relate to statutory requirements that each alternative must satisfy to be eligible for selection, include:

- Overall protection of human health and the environment; and
- Compliance with ARARs.

The "no action" alternative will not satisfy threshold criteria; it will not result in the protection of human health and the environment. The remaining potential remedial alternatives for soil (removal and off site disposal and removal and ex-situ treatment) will result in a reduction in mass, toxicity, or mobility of contaminants, which will result in the overall protection of human health and the environment.

The "no action" alternative will not achieve compliance with ARARs. However, the remaining potential remedial alternatives for soil will achieve compliance with ARARs, which are summarized in Table 1 in Attachment 1. Remedial responses for soil were screened in the Alternative Screening Technical Memorandum, and responses that were retained for screening were further evaluated in this report. Remedial responses that would not protect human health and the environment or achieve compliance with ARARs were not retained for screening.

2.4.2 Balancing Criteria

The primary *balancing criteria*, which are the technical criteria upon which the detailed analysis is primarily based, include:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

A summary of the balancing criteria for each potential remedial alternative for soil follows.

2.4.2.1 Long Term Effectiveness and Permanence

Each remedial alternative is evaluated as to magnitude of long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. Table 2-2 presents an evaluation of the long-term effectiveness and permanence of each alternative.

Table 2-2 - Evaluation of Long-term Effectiveness and Permanence For Potential Soil Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative S1 No Action	• Potential risk to human health or the environment would not be reduced.	• There are no remedial actions or controls associated with this alternative.
Alternative S2 Containment using Engineering Surface Barriers	• Contaminants will remain in soil beneath a surface barrier that will prevent direct contact. • Surface barriers will also reduce infiltration and minimize leaching to groundwater.	• Surface barriers will effectively prevent direct contact with contaminated soil and reduce infiltration. • Reliability is high through maintenance of barriers and institutional controls; these can easily be implemented. • Most effective if used in conjunction with a remedial response for groundwater.
Alternative S3A Limited Removal and Off site Disposal	• Limited removal of source areas containing NAPL and elevated concentrations of VOCs and PAHs will minimize residual soil contamination. • Other contaminants (i.e. metals) and groundwater contamination may remain. • Site restoration will include surface barriers to prevent direct contact with subsurface residual contamination and reduce infiltration to minimize leaching to groundwater.	• Removal of shallow soil from filled ravine and former coal tar dump area with conventional earth moving equipment is highly reliable. • Removal of source areas containing NAPL and elevated concentrations of VOCs and PAH compounds would sufficiently reduce risk to human health and the environment. • Surface barrier maintenance will be required to maximize reliability of remedial response. Institutional controls could be easily implemented to prevent long-term exposure to residual subsurface contamination.
Alternative S3B Unlimited Removal and Off site Disposal	• This remedial response will results in the removal of contaminated and un-contaminated fill material. • Unlimited removal of all fill material will minimize potential for residual contamination. • Construction of an off site landfill would likely be required for large volume of material.	• Removal of shallow soil from filled ravine with conventional earth moving equipment is highly reliable, but would require removal and replacement of buried utilities and section of City street, which may be difficult to implement. • Significant contamination is present at base of fill in Kreher Park, but removal of fill material below lake level will be difficult to implement. • Kreher Park restoration may require placement of clean fill, or restoration of former lakebed as wetland area or shallow lakebed.

Table 2-2 - Evaluation of Long-term Effectiveness and Permanence For Potential Soil Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative S4 Limited Removal and On site Disposal ***Alternative S5A*** Limited Removal and On site Thermal Treatment ***Alternative S5B*** Limited Removal and Off site Incineration	• Limited removal of source areas containing NAPL and elevated concentrations of VOCs and PAHs will minimize residual soil contamination. • Other contaminants (i.e. metals) and groundwater contamination may remain. • Site restoration will include surface barriers over excavated area and over disposal cell to prevent direct contact with subsurface residual contamination and reduce infiltration to minimize leaching to groundwater. • Groundwater monitoring will likely be needed to evaluate on-going risk to human health and the environment	• Removal of shallow soil from filled ravine and former coal tar dump area with conventional earth moving equipment is highly reliable. • Although other contaminants may remain, removal of source areas containing NAPL and elevated concentrations of VOCs and PAH compounds would significantly reduce risk to human health and the environment. • Minimal long-term maintenance and monitoring will be required to evaluate reliability. Institutional controls could be easily implemented to prevent long-term exposure to residual subsurface contamination, treated material placed as backfill, and contaminated material placed in disposal cell.
Alternative S6 Limited Removal and onsite Soil Washing	• Limited removal of source areas containing NAPL and elevated concentrations of VOCs and PAHs will minimize residual soil contamination. • Site restoration for limited removal will include surface barriers to prevent long-term exposure to subsurface residual contamination and reduce infiltration to minimize leaching to groundwater. • Groundwater monitoring will likely be needed to evaluate on-going risk to human health and the environment	• Removal with conventional earth moving equipment is highly reliable, but residual contamination may remain in treated soil. • Long-term monitoring will be required following on site placement of treated soil to evaluate reliability. • Minimal long-term surface barrier maintenance and monitoring will be required to evaluate reliability of remedial response. Institutional controls could be easily implemented to prevent long-term exposure to residual subsurface contamination and treated material placed as backfill.

2.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment

The remedial alternatives are evaluated for permanence and completeness of the remedial action in significantly reducing the toxicity, mobility, or volume of hazardous materials through treatment. Each alternative is evaluated based on the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. Table 2-3 presents a summary of this evaluation.

Table 2-3 - Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment For Potential Soil Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Removed Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative S1 No Action	None	None	None	Not applicable	Not applicable
Alternative S2 Containment using Engineering Surface Barriers	No material treated; surface barrier used to prevent direct contact.	None	No reduction in contaminant mass or toxicity, but will reduce infiltration and minimize mobility of contaminants leaching to groundwater.	Surface barriers could easily be removed.	Contaminated soil will remain in place beneath surface barriers placed over the filled ravine and former coal tar dump areas; the wood waste layer at Kreher Park will remain in place.
Alternative S3A Limited Removal and Off site Disposal	No treatment prior to disposal at off site landfill.	7,675 to 9,650 cubic yards removed from upper bluff area, and 4,000 cubic yards removed from the former coal tar dump area.	Removal of highly contaminated fill where NAPL is present will result in significant reduction of contaminant mass Reduction of toxicity, mobility and volume reduction is expected to be high.	Off site disposal would be irreversible.	Residual contamination may remain in the filled ravine and former coal tar dump area; the wood waste layer at Kreher Park will remain in place.
Alternative S3B Unlimited Removal and Off site Disposal	No treatment prior to disposal at off site landfill.	32,500 cubic yards removed from the upper bluff area and 223,000 cubic yards removed from Kreher Park.	Removal of all fill material containing high and low levels of contamination will result in significant reduction of contaminant mass. Reduction of toxicity, mobility and volume reduction is expected to be very high.	Off site disposal would be irreversible.	All fill soil containing high and low levels of contamination removed. The wood waste layer at Kreher Park will be removed. Little to no residual soil contamination would be expected.

Table 2-3 - Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment For Potential Soil Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Removed Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative S4 Limited Removal and On site Disposal	No treatment prior to disposal at on site disposal cell landfill.	7,675 to 9,650 cubic yards removed from the upper bluff area. Nothing removed from Kreher Park, and 4,000 cubic yards removed from the former coal tar dump area..	Removal of highly contaminated fill will result in significant reduction of contaminant mass Reduction of toxicity, mobility and volume reduction is expected to be high.	Material placed in disposal cell at Kreher Park would remain in place, or transported off site at a later time.	Residual contamination may remain in fill at upper bluff area and at former coal tar dump area; the wood waste layer at Kreher Park will remain in place.
Alternative S5A Limited Removal and On site Thermal Treatment	On site thermal treatment to remove contaminants. Return treated soil to excavation.	7,675 to 9,650 cubic yards removed from upper bluff area, and 4,000 cubic yards removed from the former coal tar dump area.	Removal and thermal treatment of highly contaminated fill where NAPL is present will result in significant reduction of contaminant mass. Reduction of toxicity, mobility and volume is expected to be high.	Thermal treatment would be irreversible; treated soil would remain in place as back fill, or transported off site at a later time.	Residual contamination may remain in untreated fill at the upper bluff and at the former coal tar dump area; the wood waste layer at Kreher Park would remain in place.
Alternative S5B Limited Removal and Off site Incineration	Off site incineration to treat contaminated soil. Clean fill used to back fill excavated areas.			Incineration would be irreversible.	

Table 2-3 - Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment For Potential Soil Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Removed Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative S6 Limited Removal and onsite Soil Washing	Soil washing to remove contaminants. Return treated soil to excavation.	7,675 to 9,650 cubic yards removed from upper bluff area, and 4,000 cubic yards removed from the former coal tar dump area.	Removal of highly contaminated fill will result in significant reduction of contaminant mass. Reduction of toxicity, mobility and volume reduction is expected to be high.	Soil washing would be irreversible; treated soil would remain in place as back fill, or transported off site at a later time.	Residual contamination may remain in untreated fill at the upper bluff and at the former coal tar dump area; the wood waste layer at Kreher Park would remain in place.

2.4.2.3 Short Term Effectiveness

The evaluation of short-term effectiveness is based on the degree of protectiveness of human health achieved during construction and implementation of the remedy. Potential implementation risks to the community and site workers and mitigation measures for addressing those risks are included in this evaluation. In addition, environmental impacts during implementation and the time required to achieve the RAOs must also be considered in the evaluation of this criterion. Table 2-4 summarizes the results of this evaluation.

Table 2-4 - Evaluation of Short Term Effectiveness for Potential Soil Remedial Alternatives

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative S1 No Action	None	No additional impact to the environment	RAOs will not be achieved.
Alternative S2 Containment using Engineering Surface Barriers	Actions to protect community and site workers during remediation can be implemented.	Surface barrier will reduce infiltration and minimize leaching to groundwater, but long-term source for groundwater contamination will remain.	Direct contact exposure route can be eliminated in a short time frame, but contaminants will remain beneath surface barrier for an extended period of time.
Alternative S3A Limited Removal and Off site Disposal		Significant contaminant mass will be removed from highly contaminated areas where NAPL is present. Residual contaminants may remain on site.	Site work can be completed in a short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs.
Alternative S3B Unlimited Removal and Off site Disposal		All fill material including contaminated and uncontaminated material will be removed from fill ravine and at upper bluff and Kreher Park; minimal residual contamination may remain.	Site work can be completed in a short time frame, and verification soil samples collected following removal of all material will be used to determine compliance with RAOs.
Alternative S4 Limited Removal and On site Disposal		Significant contaminant mass will be removed from highly contaminated areas where NAPL is present. Residual contaminants may remain on site.	Site work can be completed in a short time frame, and verification soil samples collected following removal of all material will be used to determine compliance with RAOs. Long term monitoring will be required to ensure disposal cell compliance with RAOs.

Table 2-4 - Evaluation of Short Term Effectiveness for Potential Soil Remedial Alternatives

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative S5A Limited Removal and On site Thermal Treatment	Actions to protect community and site workers during remediation can be implemented.	Significant contaminant mass will be removed from highly contaminated areas where NAPL is present. Residual contaminants may remain on site.	Site work can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs. Long-term monitoring may be needed for areas backfilled with treated soil.
Alternative S5A Limited Removal and Off site Incineration			Site work can be completed in a short time frame, and verification soil samples collected following removal of all material will be used to determine compliance with RAOs.
Alternative S6 Limited Removal and onsite Soil Washing	Actions to protect community and site workers during remediation can be implemented.	Significant contaminant mass will be removed from highly contaminated areas where NAPL is present. Residual contaminants may remain on site.	Site work can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs. Long-term monitoring may be needed for areas backfilled with treated soil.

2.4.2.4 Implementability

Implementability is based on the evaluation of technical feasibility, administrative feasibility, and the availability of services and materials. Technical feasibility considers the following factors:

- difficulties that may be inherent during construction and operation of the remedy;
- the reliability of the remedial processes involved;
- the flexibility to take additional remedial actions, if needed;
- the ability to monitor the effectiveness of the remedy;
- the availability of offsite treatment, storage, and disposal facilities; and,
- the availability of needed equipment and specialists.

Administrative feasibility considers permitting and regulatory approval and coordination with other agencies. Table 2-5 presents a summary of this evaluation.

Table 2-5. Evaluation of Implementability for Potential Soil Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative S1 No Action	Additional remedial actions could be easily implemented.	Not applicable.	No permitting required, but will likely not be able to obtain regulatory approval.	None required.
Alternative S2 Containment using Engineering Surface Barriers	Installation is technically feasible for areas where fill and/or subsurface contamination are present.	Reliable technology for elimination of direct contact exposure route and reduction of infiltration.	Regulatory approval likely if implemented with remedial response for shallow groundwater contamination.	Conventional construction equipment could be used for construction of surface barriers.
Alternative S3A Limited Removal and Off site Disposal	Excavation is feasible technology for remediation of contaminated soil. Likely that removal and off site disposal of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass.	Highly reliable technology; most commonly used remedial technology for contaminated soil at MGP sites.	Regulatory approval likely. Selection of landfill for off site disposal would be required.	Conventional earth moving and excavation de-watering equipment would be used. Groundwater would be treated on site with existing equipment.
Alternative S3B Unlimited Removal and Off site Disposal	Removal of all fill material from filled ravine is feasible, but excavation of saturated fill at Kreher Park below lake level may be difficult. A landfill may need to be sited and constructed for disposal of the large volume of contaminated soil.	Reliable technology; most commonly used for contaminated soil at MGP sites However, removal of all fill material may not be needed to achieve compliance with RAOs.	Regulatory approval likely. Would require siting and construction of landfill for off site disposal, and approval of restoration of Kreher Park to either pre-filling (i.e. wetland, or shallow lake bottom), or pre-removal conditions.	Conventional earth moving and excavation de-watering equipment would be used. Groundwater would be treated on site using equipment used for sediment remediation.

Table 2-5. Evaluation of Implementability for Potential Soil Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative S4 Limited Removal and On site Disposal	Disposal cell construction at Kreher Park is technically feasible. Long-term maintenance and monitoring of disposal cell will likely be completed in combination with containment of Kreher Park using surface and vertical barriers walls (evaluated as a groundwater remedial alternative).	Reliable technology, but not commonly used for contaminated soil at MGP sites due to land-use limitations.	Regulatory approval likely. Would require siting and construction of disposal cell for on site disposal.	Conventional earth moving, thermal treatment and excavation de-watering equipment would be used. Groundwater would be treated on site with existing equipment.
Alternative S5A Limited Removal and On site Thermal Treatment	On site thermal treatment is a feasible technology for remediation of contaminated soil at MGP sites. Likely that removal and off site disposal of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass.	Highly reliable technology; it is commonly used for contaminated soil at MGP sites. Would require separation and off site disposal of debris not suitable for thermal treatment.	Regulatory approval likely. Discharge permits for air and waste water may be needed.	
Alternative S5B Limited Removal and Off site Incineration	Off site incineration is technically feasible, but will be more costly than on site thermal treatment. Likely that removal and off site incineration of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass.	Highly reliable technology; but incineration may not be needed to achieve RAOs. Would require separation and off site disposal of debris not suitable for incineration.	Regulatory approval likely. Selection of facility for off site incineration would be required.	Incineration most commonly performed at off site facilities due to specially equipment and required air permits.

Table 2-5. Evaluation of Implementability for Potential Soil Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative S6 Limited Removal and onsite Soil Washing	Pilot test would be needed to evaluate reliability of soil washing. Likely that removal of all fill soil containing NAPL and high VOC and PAH concentrations will result in a significant reduction of contaminant mass	Pilot test will need to be completed to evaluate reliability of technology; technology not commonly used for contaminated soil at MGP sites.	Regulatory approval likely. Discharge permits for air and waste water may be needed.	Conventional earth moving, soil washing and excavation de-watering equipment would be used. Groundwater would be treated on site with existing equipment.

2.4.2.5 Cost

Preliminary estimated costs for potential soil remedial alternatives include estimated costs for site preparation, excavation, excavation de-watering, transportation and disposal, on site treatment, and site restoration. Annual operation, maintenance, and monitoring (OM&M) costs are not estimated for each alternative. It is assumed the OM&M following soil remediation will be completed concurrent with OM&M following groundwater remediation. Consequently, OM&M costs are included with potential groundwater remedial alternatives costs in Section 3. Additionally it is assumed that all work is contracted and the estimates do not account for possible economies of scale (i.e., completing all activities at the site concurrently). These cost estimates are developed primarily for the purpose of comparing remedial alternatives and not for establishing project budgets. Detailed cost estimates will be presented in the Feasibility Study in accordance with the USEPA guidance document, *A Guide to Developing and Documenting Cost Estimates* (EPA and USACE, 2000). Table 2-6 presents a summary of the cost evaluation.

Table 2-6. Evaluation of Cost for Potential Soil Remedial Alternatives

Alternative	Upper Bluff Area	Kreher Park
Alternative S1 No Action	$0	$0
Alternative S2 Containment Using Engineered Surface Barriers	$184,000	$176,000
Alternative S3A Limited Removal and Off site Disposal	$1,068,000	$485,000
Alternative S3B Unlimited Removal and Off site Disposal (restore Kreher Park as wetland)	$1,525,000	$14,715,000
Alternative S3B Unlimited Removal and Off site Disposal (backfill Kreher Park with clean fill)		$19,504,000
Alternative S4 Limited Removal and On site Disposal	$916,000	$1,298,000*
Alternative S5A Limited Removal and Ex-situ Thermal Treatment	$946,000	$518,000
Alternative S5B Limited Removal and Off site Incineration	$3,412,000	$1,240,000
Alternative S6 Limited Removal and Ex-situ Soil Washing	$1,370,000	$1,201,000

* Includes only construction of one acre disposal cell in Kreher Park.

2.4.3 Modifying Criteria

The third group, the *modifying criteria*, includes:

- State/Support agency acceptance
- Community acceptance.

As previously discussed, these last two criteria are typically formally evaluated following the public comment period, although they can be factored into the identification of the preferred alternative to the extent practicable.

2.5 Comparative Analysis of Potential Remedial Alternatives for Soil

In this section, as required by CERCLA and NCP regulations, the alternatives will undergo a comparative evaluation wherein the advantages and disadvantages of the alternatives will be concurrently assessed with respect to each criterion. The criteria considered as part of this comparative evaluation are defined in Section 2.4. Table 2-7 presents a summary of the comparative analysis.

Table 2-7 – Comparison of Potential Soil Remedial Alternatives

Criteria	Alt. S1	Alt. S2	Alt. S3A	Alt. S3B	Alt. S4	Alt. S5A	Alt. S5B	Alt. S5
	No Action	Containment using Engineered Surface Barriers	Limited Removal and Off site Disposal	Unlimited Removal and Off site Disposal	Limited Removal and On site Disposal	Limited Removal and On site Thermal Treatment	Limited Removal and Off site Incineration	Limited Removal and Ex-situ Soil Washing
Overall Protection of Human Health and the Environment	None	Low	High	High	Moderate	High	High	Moderate to High
Compliance with ARARs and TBCs	None	Low	High	High	Low to Moderate	High	High	Moderate to High
Long-term Effectiveness and Permanence	None	Low	High	High	Low to Moderate	High	High	Moderate to High
Reduction of Toxicity, Mobility and Volume through Treatment	None	Low	High	High	Low to Moderate	High	High	Moderate to High
Short-term Effectiveness	Low	High	High	High	Moderate	High	High	High
Implementability	None	High	High	Low to Moderate	High	High	Low to Moderate	Moderate
Cost	Low	Low	Moderate	Very High	Moderate	High	Very High	High
Agency Acceptance	None	Low	High	High	Low to Moderate	High	High	Low to Moderate
Community Acceptance	None	Low	High	Low to Moderate	Low	Moderate	High	Low to Moderate

2.5.1 Overall Protection of Human Health and the Environment

Alternative S1 (no action) offers no additional protection for human health and the environment because no additional actions would be taken to address soil contamination at the Site. ***Alternative S3B*** (unlimited removal and off site disposal) offers the highest level of protection of human health and the environment in the long-term because all fill and contaminated soil would be removed. ***Alternative S3A*** (limited removal and off site disposal), ***Alternative S5A*** (limited removal and on site thermal treatment), and ***Alternative S5B*** (limited removal and incineration) would also offer high levels of protection because these remedial responses would result in the removal of a significant contaminant mass. ***Alternative S6*** (limited removal and treatment by soil washing) would offer moderate to high level of overall protection of if this technology can be implemented to effectively reduce contaminant concentrations. ***Alternative S2*** (containment using engineered surface barriers) will eliminate the direct contact exposure route, but will provide a low level of overall protection because soil contamination will remain. ***Alternative S4*** (limited removal and on site disposal) will provide a moderate level of human health and the environment because highly contaminated material from the upper bluff area and the former coal tar dump area will be consolidated into a disposal cell at Kreher Park. .

Although unlimited removal for Alternative S3B will provide high level of human health and environmental protection, limited removal for Alternatives S-3A, S-5A, S-5B, and S-6 will also provide adequate protection because these remedial responses will result in the removal of a significant mass of contamination. Although Alternatives S-2 and S-4 will result in the containment of contaminated materials, which will be inaccessible to humans or biota, thereby reducing risk, the overall level of protection are lower because there is no reduction on contaminant mass.

2.5.2 Compliance with ARARs and TBCs

Alternative S1 (no action) will not achieve compliance with ARARs and TBCs. Implementation will require that engineering and construction actions be developed and completed in compliance with federal and state regulations. ***Alternatives S2 and S4*** (surface barriers and limited removal and on site disposal) must be implemented with a groundwater remedial response to achieve compliance. If properly implemented, the remaining remedial responses could achieve compliance with ARARs and TBCs for soil.

2.5.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence considers long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. ***Alternative S1*** (no action) will not provide any long-term benefit; no additional actions will be taken to address soil contamination at the Site. ***Alternative S3B*** (unlimited removal and off site disposal) will provide the highest effectiveness and permanence over the long term because all contaminated material and fill soil would be removed. ***Alternative S3A*** (limited removal and off site disposal), ***Alternative S5A*** (limited removal and ex-situ thermal treatment), and ***Alternative S5B*** (limited removal and incineration will also highly effective and permanent over the long

term because these responses will result in the removal of a significant mass of contamination. ***Alternative S6*** (limited removal and treatment by soil washing) will provide low moderate to high levels of effectiveness and permanence over the long term; effectiveness will depend upon the reduction in contaminant concentrations that can be achieved with this technology. The long-term effectiveness of ***Alternative S4*** (limited removal and on site disposal) is considered low to moderate because contaminants will remain on site in a disposal cell constructed at Kreher Park. The long-term effectiveness of ***Alternative S2*** (containment using engineered surface barriers) is considered low because constituents will remain at the site beneath the surface barriers. However, for Alternatives S-2 and S-4, contaminated material will be contained and inaccessible to humans or biota, thereby reducing risk.

If properly implemented, the long-term effectiveness and permanence for all alternatives can be achieved for all active remedial responses for soil. Surface barriers (Alternative S2) must be implemented in conjunction with a remedial response for groundwater to be more effective.

2.5.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

Reduction of toxicity, mobility, or volume of hazardous materials through treatment considers the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. ***Alternative S1*** (no action) will not result in a reduction in the toxicity, mobility, or volume of contaminated soil. ***Alternative S3B*** (unlimited removal and off site disposal) will result in the highest degree of reduction of toxicity, mobility, and volume of impacted material because all contaminated soil and fill material will be removed. ***Alternative S3A*** (limited removal and off site disposal), ***Alternative S5A*** (limited removal and ex-situ thermal treatment), and ***Alternative S5B*** (limited removal and incineration) will also result in a high degree of reduction of toxicity, mobility, and volume of impacted material because these remedial responses will remove a significant contaminant mass. ***Alternative S-6*** (limited removal and treatment by soil washing) will result in a moderate to high degree of reduction of toxicity, mobility, and volume of contaminated soil, but will depend upon the reduction in contaminant concentrations that can be achieved with this technology. ***Alternative S-4*** (limited removal and on site disposal) will offer a low to moderate reduction in the toxicity, mobility, and volume of contaminated soil at the Site. It will effectively reduce the toxicity and a significant volume of contaminated soil at the upper bluff area and former coal tar dump area, but this material will be placed in a disposal cell at Kreher Park, which will reduce the mobility of these contaminants. ***Alternative S2*** (containment using engineered surface barriers) will not reduce the toxicity or and volume of contaminated soil in unexcavated areas, but it will limit the mobility of contaminants by reducing infiltration, which will minimize contaminant leaching to groundwater.

2.5.5 Short-term Effectiveness

Short-term effectiveness considers potential implementation risks to the community and site workers, environmental impacts, and time required to achieve RAOs. Implementation of **Alternative S1** (no action) will not achieve RAOs or improve environmental impacts in the short-term. Because there is no remediation, there will be no exposure to the community and workers. The remaining alternatives will improve environmental impacts in the short-term, but require significant effort to protect the community and workers during remediation. Implementation of ***Alternative S3B*** (unlimited removal and off site disposal) will result in the most significant on and off site site disturbance and require the highest levels of effort for this protection. ***Alternative S4*** (limited removal and on site disposal) will result in no off site disturbance; site disturbance will be limited to the site, and will require a moderate level of effort for protection. ***Alternative S2*** (containment using engineered surface barriers) will results in minimal on site disturbance, and no off site disturbance. Because the remaining alternatives include limited removal of highly contaminated soil, they will require high levels of effort for worker and community protection. If properly implemented, all alternatives, can achieve short term effectiveness for soil. . Surface barriers (Alternative S2) must be implemented in conjunction with a remedial response for groundwater to be more effective

2.5.6 Implementability

Implementability considers technical feasibility, administrative feasibility, and the availability of services and materials. **Alternative S1** (no action) will require the least amount of effort for implementability. Additionally, because no remedial action will occur, there will be no difficulty in implementing additional remedial actions at a later date. ***Alternative S3B*** (unlimited removal and off site disposal) will result in significant site disturbance, and will be the most difficult to implement. ***Alternative S6*** (limited removal and treatment by soil washing) may require a pilot test to evaluate its implementability. The remaining limited removal alternatives are highly implementable.

2.5.7 Cost

Preliminary cost estimates for potential remedial alternatives for soil include site preparation, excavation, excavation de-watering, transportation and disposal, on site treatment, and site restoration. There are no costs associated with ***Alternative S1*** (no action) because none of these activities will be completed. For the upper bluff area, the ***Alternatives S3B*** (unlimited removal and off site disposal) and ***Alternative S5B*** (limited removal and incineration) yielded the highest costs. ***Alternative S6*** (limited removal and treatment by soil washing) yielded the next highest cost, following by **Alternative 3A** (limited removal and off site disposal), and ***AlternativeS5A*** (unlimited removal and on site thermal treatment). ***Alternatives S4*** (limited removal and on site disposal) yielded lower costs for the upper bluff area compared to the off site disposal and on site treatment alternatives, but would require construction of a disposal cell in Kreher Park; this alternative does not include soil or groundwater remediation in Kreher Park. ***Alternative S2*** (containment using engineered surface barriers) would be the lowest cost remedial response for

soil in the upper bluff area, but would likely need to be completed in conjunction with a groundwater remedial response to be effective.

Alternative S3B (unlimited removal and off site disposal) also yielded the highest cost for Kreher Park. ***Alternative S5B*** (limited removal and incineration) yielded the next highest cost followed by ***Alternative S4*** (limited removal and on site disposal), ***Alternative S6*** (limited removal and treatment by soil washing), ***Alternative S5A*** (limited removal and on site thermal treatment), and ***Alternative S3A*** (limited removal and off site disposal). ***Alternative S2*** (containment using engineered surface barriers) yielded the lowest cost, but would likely need to be completed in conjunction with a groundwater remedial response to be effective.

2.5.8 Agency and Community Acceptance

No action alternative (Alternative 1) for soil will not be acceptable to the community or regulatory agencies. ***Alternative S2*** (containment using engineered surface barriers) could be acceptable to the community and regulatory agencies if implemented with other soil and/or groundwater remedial responses. ***Alternative S3A*** (limited removal and off site disposal) will be the most acceptable remedial response to the Community because it will result in the least impact to current and future site use. Implementation of ***Alternative S5A*** (limited removal and on site thermal treatment) and ***Alternative S6*** (limited removal and treatment by soil washing) will result in temporary limitations to use of the Kreher Park during remediation. Implementation of ***Alternative S4*** (limited removal and on site disposal) will result in temporary limitations to use during remediation and permanent limitation to site use following remediation. Implementation of ***Alternatives S3B*** (unlimited removal and off site disposal) and ***Alternative S5B*** (limited removal and incineration) will also result in temporary limitations to use during remediation, but may acceptable to community and regulatory agencies. .

3.0 Groundwater

This section of the Comparative Analysis of Groundwater Alternatives Technical Memorandum is organized as follows:

Section 3.1: Remedial Action Objective for Groundwater
Section 3.2: Potential Remedial Technologies for Groundwater
Section 3.3: Development of Potential Remedial Alternatives for Groundwater
Section 3.4: Evaluation of Potential Remedial Alternatives for Groundwater
Section 3.5: Comparative Analysis of Potential Remedial Alternatives for Groundwater

3.1 Remedial Action Objectives for Groundwater

The general goal of RAOs is to protect human health and environmental receptors at risk from contaminants at the site. These objectives are subject to the criteria evaluated in the Feasibility Study. As described in the RAO Tech Memo (URS 2007) preliminary RAOs for groundwater are as follows:

- Protect human health by eliminating exposure (direct contact, ingestion, inhalation) to groundwater with COPCs in excess of regulatory or risk-based standards; reduce contaminant levels in groundwater to meet MCLs and State of Wisconsin Drinking Water Standards
- Protect the environment by controlling the off site migration of contaminants in groundwater to surrounding surface water bodies which would result in exceedance of ARARs for COPCs in surrounding surface waters.
- Conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water.

No COPCs were initially identified in the HHRA for groundwater because groundwater is not used as a potable water supply. However, currently there is no restriction on groundwater use in the area of known contamination. Exposure to contaminated groundwater and accompanying NAPLs can potentially occur via the following exposure scenarios:

- Construction worker exposure to shallow groundwater infiltrating trenches at Kreher Park; and
- Trespasser exposure to groundwater infiltrating the lower level of the former WWTP.

NAPL encountered in the Kreher Park fill, ravine fill, NSPW property and Copper Falls aquifer are a source for the dissolved phase plumes identified in groundwater in each unit at the Site. PRGs for NAPL within these units are based on WAC NR 708.13, which states the following:

> *Responsible parties shall conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the*

discharge to the air, lands or waters of the state. When required, free product removal shall be conducted, to the maximum extent practicable, in compliance with all of the following requirements:

(1) *Free product removal shall be conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones using recovery and disposal techniques appropriate to the hydrologic conditions at the site or facility, and that properly reuses or treats discharges of recovery byproducts in compliance with applicable state and federal laws.*
(2) *Free product removal systems shall be designed to abate free product migration.*
(3) *Any flammable products shall be handled in a safe and competent manner to prevent fires or explosions.*

Using the above criteria, alternatives for the removal of NAPL will be further refined in the Feasibility Study.

3.2 Potential Remedial Technologies for Groundwater

This section presents a description of remedial technologies retained for additional evaluation based on the results of the Alternatives Screening Technical Memorandum (ASTM) dated April 9, 2007. The following remedial technologies for groundwater were retained for screening, and are described in detail in Section 2.3.

1. No Action
2. Institutional Controls
3. Monitored Natural Attenuation
4. Containment Using Engineered Surface and Vertical Barriers
5. In-situ Treatment Using Ozone Sparging
6. In-situ Treatment Using Surfactant Injection and Removal using Dual Phase Recovery
7. In-situ Treatment Using Permeable Reactive Barrier Walls
8. In-situ Treatment Using Chemical Oxidation
9. In-situ Treatment Using Electrical Resistance Heating
10. In-situ Treatment Using Dynamic Underground Stripping /Steam Injection
11. Removal using Groundwater Extraction Wells

Institutional controls and monitored natural attenuation were not retained for screening as stand alone remedial responses; both technologies were evaluated as elements of other active remedial alternatives for soil and groundwater. Surface barriers, vertical barriers, SVE, and groundwater extraction were combined with other potential remedial technologies for groundwater as described below.

3.3 Development of Potential Remedial Alternatives for Groundwater

Groundwater remedial technologies retained for screening were used to develop potential remedial alternatives for groundwater. Remedial alternatives for groundwater presented in this report are summarized in Table 3-1. A description of each remedial alternative follows.

3.3.1 Alternative GW1 - No Action

The "no action" alternative for groundwater was retained as required by the NCP as a basis for comparing the other alternatives. The NCP at Title 40 Code of Federal Regulations (40 CFR §300.430(e)(6)) provides that the no-action alternative should be considered at every site. Implementation of no further action consists of leaving contaminated groundwater in place; no engineering, maintenance, or monitoring will be required.

3.3.2 Alternative GW2 -Containment Using Engineered Surface and Vertical Barriers

Containment for groundwater contamination consists of the utilization of natural or man-made barriers to prevent potential exposure to or migration of contaminants with subsurface contamination. Containment alternatives retained for screening and evaluated in this report include engineered surface barriers, vertical barrier walls installed in the aquifer, and extraction wells (barrier wells). Surface barriers eliminate the direct contact exposure pathway and reduce contaminant leaching from the unsaturated zone, by restricting infiltrating water from contacting contaminated soil. Vertical barrier walls and barrier wells prevent the off site migration of contaminants. Engineered surface barriers, vertical barrier walls, and barrier wells are described below.

Engineered Surface Barrier

Engineered surface barriers are considered passive containment alternatives because the contaminated zone is not disturbed, and only minimal maintenance is required following implementation. Surface barriers include the following:

- Asphalt cap;
- Low permeability soil cap (i.e. 2 feet of clay with hydraulic conductivity of less than 10^{-7} cm/sec) cap;
- Multi-layer cap with a minimum two-foot thick clay barrier, drainage layer, soil and vegetated top soil cover; and,
- Multi-layer cap with geomembrane (a minimum two-foot thick clay barrier, geomembrane, drainage layer, soil and vegetated top soil cover.

At the upper bluff area, asphalt caps over the filled ravine as surface barriers will be compatible with existing and future site use. At Kreher Park, asphalt pavement for the marina parking lot and a low permeability cap for the former coal tar dump will be compatible with existing and future site use. Multi-layer caps will be compatible with on site and off site disposal options for

soil and the CDF for sediment. Multi-layer cap will also be compatible with areas area of unexcavated soil, especially in Kreher Park. Single layer asphalt and low permeability caps will satisfy at a minimum 40 CFR Subtitle D requirements, and multi-layer caps will satisfy 40 CFR Subtitle C requirements. As with potential soil remedial alternatives (evaluated in section 2.3), surface barriers will be included as key elements of the potential groundwater and sediment remedial alternatives.

Barrier Wells

Barrier wells are considered active containment alternatives because long-term operation (groundwater extraction), maintenance, and monitoring will be required. Down gradient barrier wells were retained for groundwater at the upper bluff and for the saturated fill unit at Kreher Park. Properly engineered, these wells will prevent contaminants from migrating off site with groundwater. However, down gradient barrier wells were not considered for the Copper Falls aquifer. Regional groundwater flow conditions in the Copper Falls indicate that a stagnation zone beneath the center of Kreher Park has prevented the dissolved phase plume from migrating beyond the shoreline. Additional hydrogeologic and groundwater quality data will be required to ensure that contaminants will not migrate beyond the Kreher Park shoreline.

Well EW-4 was installed at the mouth of the filled ravine to prevent water discharging to the seep area at Kreher Park; it has been in operation since 2002. A final remedy for shallow groundwater in the ravine could include continued operation of EW-4, installation of additional extraction wells, or future operation of EW-4 along with a vertical barrier wall installed down gradient from the extraction well (use of EW-4 will reduce the hydraulic head behind the vertical barrier). An evaluation of the volume of groundwater discharging from the filled ravine and a capture zone analysis for EW-4 will be necessary to evaluate which alternative will be more effective. Continued use of EW-4 as a barrier well for the upper bluff, and barrier wells for shallow groundwater at Kreher Park are evaluated with Alternative GW-9 (removal using groundwater extraction).

Vertical Barrier Walls

Vertical barrier walls are also considered active containment alternatives because contaminated material may be disturbed during construction, and/or long-term maintenance such as groundwater extraction may be required. Engineered vertical barrier walls were retained for further evaluation as potential containment alternatives for shallow contaminated groundwater encountered in the ravine fill at the upper bluff and at Kreher Park. However, vertical barrier walls would not be feasible for the underlying Copper Falls aquifer because this deep aquifer is confined by the Miller Creek formation creating strong upward gradients. Installation of a barrier wall for contaminants in the Copper Falls aquifer will require penetration of the Miller Creek, formation which will likely compromise the long-term integrity of this confining unit.

Vertical barriers walls consist of a slurry wall or sheet piling installed around the perimeter of the contaminated groundwater zone. A slurry wall is a low permeability barrier constructed by placing a low permeability material (slurry) in a trench around the perimeter of the contaminated

groundwater mass. Sheet piling consisting of inter-locking sheets of steel pilings form a continuous wall installed around the perimeter of the contaminated groundwater mass. Both types of vertical barriers can be anchored into the underlying low permeability Miller Creek Formation to create a barrier that will prevent contaminants in the shallow fill units from migrating off site with groundwater.

In additional to vertical barriers, the Feasibility Study will evaluate the use of engineered surface barrier to minimize infiltration versus the installation of a multi layer cap for contained areas. Although a multi-layer cap will result in significant site disturbance and additional implementation cost, long-term operation, maintenance, and monitoring cost will likely be lower[8]. For Kreher Park, this alternative may be used in combination with containment alternatives evaluated for nearshore sediment described in Section 4.0. The location of the vertical barrier wall at Kreher Park is shown on Figure 3-1. Key elements for the conceptual design of a sheet pile vertical barrier wall around the perimeter of Kreher Park follows:

1. Site preparation will include clearing and grubbing of small trees and bushes along the bluff and near the former seep area as needed.
2. Although the former waste-water treatment plant will be located within the contained area, demolition of this dormant facility may be required.
3. A vertical barrier wall will be placed around the perimeter of Kreher Park. This vertical barrier will consist of a sheet pile wall anchored into the underlying Miller Creek Formation.
4. The sheet pile wall along the shoreline will be installed at an approximate depth of 25 feet below existing grade to allow the off-shore removal of sediment to a depth of ten feet. The sheet pile wall on the south, east, and west sides of the Park will be installed at an approximate depth of 16 feet below existing grade.
5. Surface barriers will be installed over the filled ravine to minimize infiltration, and the sheet pile wall on the south side of Kreher Park will terminate on the east and west flanks of the filled ravine to create a "funnel" for shallow groundwater discharge into Kreher Park[9].
6. A groundwater diversion trench will be installed between the remainder of the south wall and the upper bluff area to divert groundwater that currently seeps into the Kreher Park fill unit.

[8] Groundwater recharge at Kreher Park results from seepage from the upper bluff area and infiltration. Although groundwater from the upper bluff area can be diverted, infiltration seeping into the confined area may still increase the hydraulic head within the confined area. Surface barrier placed over the marina parking lot and former coal tar dump area will reduce infiltration, and storm water control features can be constructed to promote run-off. However, long-term groundwater extraction may be needed to reduce the hydraulic head within the contained area.

[9] For the upper bluff area, a vertical barrier wall at the mouth of the filled ravine, which may require groundwater extraction, or this installation of a permeable reactive barrier wall (PRB). These groundwater treatment alternatives will also be evaluated in the Feasibility Study. A PRB is evaluated as Alternative GW-5, and a barrier well for the filled ravine is evaluated as Alternative GW-9 (removal and groundwater extraction) in this report.

7. At Kreher Park, site restoration will include installation of new asphalt pavement over the marina parking lot to minimize infiltration in this area. Additionally, a low permeability soil cap will be placed over the former coal tar dump area, and if applicable, a soil cap over the disposal cell. [10].
8. Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and restrict infiltration.
9. Long-term operation and maintenance of the facility will include the removal of contaminated groundwater. A minimum of 15 pressure relief wells will be installed to periodically remove groundwater and reduce the hydraulic head within the confined area[11].

Long-term operation and maintenance will include groundwater monitoring to evaluate the effectiveness of the vertical barrier walls. Fluid levels will also be monitored to ensure the hydraulic head within the confined area remains below lake level. Institutional controls will likely be implemented as a part of this remedial response.

3.3.3 Alternative GW3 - In-situ Treatment Using Ozone Sparging

Ozone sparging is an in-situ chemical oxidation technology that can be used to oxidize and degrade contaminants in groundwater. Because ozone is a gas, it can be injected into the saturated zone as a gas via sparging. Sparging consists of injecting air or oxygen rich ozone into an aquifer as a gas through small diameter sparge wells. Commercially, ozone is generated by a high voltage discharge through air or oxygen in an ozone generator. Generally, yields are on the order of 1 to 3-percent ozone by volume in air and 2 to 6-percent ozone by volume in oxygen. In water, ozone decomposes to form free radicals. These free radicals are strong oxidizers and react with contaminants in water to form carbon dioxide and water. As an additional benefit, ozone treatment increases the dissolved oxygen level in the water when any unreacted free radicals combine to form water and oxygen; the dissolved oxygen content in groundwater promotes biodegradation of contaminants.

Ozone sparging is typically used for dissolved phase contamination, but is typically not used in areas where NAPL is present. If used for NAPL contamination, groundwater extraction will likely be needed because ozone/air injection may displace NAPL and/or cause a chemical reaction increasing the mobility of NAPL. This mobilized material is then recovered via extraction wells. Air/ozone sparging was retained for further evaluation as a potential in-situ treatment alternative for contaminated groundwater encountered in the underlying Copper Falls aquifer. Although this technology can also be used for contaminated shallow groundwater in the ravine fill and at Kreher Park, buried structures (the former gas holders) and man made debris (wood waste, bricks, cinders, etc.) may prevent proper installation of sparge wells to allow

[10] A multi-layer cap over the remainder of Kreher Park would also reduce infiltration, and will be evaluated in the Feasibility Study.

[11] The Feasibility Study will also include an evaluation of on- and off site treatment and disposal of extracted groundwater, which will be determined by the anticipated volume of groundwater to be extracted.

optimum delivery. Additionally, injecting into fill soil, which exhibits a wide range of physical characteristics (permeability in particular), may limit the effectiveness of this in-situ technology. The layout of an ozone sparge system for underlying the Copper Falls Aquifer is shown on Figure 3-2. Key elements for the conceptual design of an ozone sparging system for shallow groundwater at the upper bluff area and at Kreher Park, and for the Copper Falls Aquifer follows:

1. All sparge wells will be installed in soil borings advanced with a hollow stem auger by a rotary drill rig.
2. Sparge wells will be installed on approximate 50-foot diameter centers, and one control panel will inject ozone into a cluster of 12 sparge wells. A pilot test will be necessary to obtain information for designing of the sparge well system.
3. One control panel will be needed for shallow groundwater in the filled ravine.
4. Eight control panels will be needed for shallow groundwater at Kreher Park.
5. Six control panels will be needed for groundwater in the underlying Copper Falls aquifer.
6. All air lines between the sparge wells and control panels will be buried in shallow trenches.
7. For the Copper Falls aquifer, the existing groundwater extraction system will likely be operated concurrent with the ozone sparge system to recover NAPL.

The ozone sparge system may need to be operated for several years, and long-term groundwater monitoring will be required to evaluate the effectiveness of the sparging and subsequent natural attenuation. Institutional controls will also be utilized for this option.

3.3.4 Alternative GW4 - In-situ Treatment using Surfactant Injection and Dual Phase Recovery

Physical/chemical treatment includes the use of surfactants to enhance the removal of NAPL. Surfactant injection is an in-situ injection technology. Surfactants are “surface active agents” that reduce the interfacial tension between oil (NAPL) and water by adsorbing at the liquid-liquid interface, which can result in an increase in the mobility of NAPL. Injection can also displace oil trapped within the aquifer media. Groundwater remediation using surfactant is a two phase approach involving injection of surfactant and recovery of fluids. Surfactant is injected to displace or mobilize NAPL, which is then recovered slowly by groundwater extraction or rapidly by vacuum enhancement. Vacuum enhancement is also referred to as dual phase or multiphase extraction because an induced vacuum is used to remove air, water, and NAPL simultaneously.

For the Copper Fall Aquifer, dual phase recovery was retained for screening. Although this technology can also be applied to contaminated groundwater in the ravine fill and at Kreher Park, site conditions may prevent implementation and limit effectiveness. Buried structures (the former gas holders) and man made debris (wood waste, bricks, cinders, etc.) may prevent proper installation of injection/extraction wells. Additionally, fill soil, which exhibits a wide range of physical characteristics (permeability in particular), may limit the effectiveness of this in-situ technology. The layout of injection/extraction wells for the underlying Copper Falls Aquifer is

shown on Figure 3-3. Key elements for the conceptual design of surfactant injection and dual phase recovery system the Copper Falls Aquifer follows:

1. A minimum of 30 small diameter injection/extraction wells will be installed in borings advanced below the Miller Creek / Copper Falls interface where NAPL has been identified. (Existing piezometers in this area will also be utilized).
2. Each well will be constructed with 2-inch diameter SCH 80 PVC well casing and screen. A sand pack will be placed around a well screen five feet in length.
3. Surfactant will be injected into wells where NAPL has been encountered to lower the interfacial tension that restricts the movement of non-mobile NAPL in the aquifer.
4. After allowing the surfactant to penetrate the formation for 24 to 48 hours, NAPL and groundwater is then removed by an induced vacuum and treated on site. Fluids will be removed from the injection/extraction wells by vacuum enhancement. To remove a significant mass of mobile NAPL, it is assumed that fluids will be removed monthly for one year before the next application is injected.
5. Multiple applications will be needed to remove NAPL to the extent practicable; for this evaluation it is assumed that a minimum of five applications of surfactant will be needed. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.
6. A pilot test using existing piezometers MW-2AR, MW-4A, MW-10B, MW-13A, MW-15A, MW-19A, MW-21A, and MW-22A screened at the Miller Creek / Copper Falls interface should be completed prior to full scale remediation to determine if a mobile vacuum truck or fixed based system is needed for dual phase recovery. The pilot test will also be used to evaluate, the mobile mass of NAPL that can be removed, the number of applications needed, and the most efficient frequency of fluid removal between injections.

Surfactant injection and dual phase recovery can likely be completed within one year, but the existing groundwater remediation system may need to be operated for several more years. Long-term groundwater monitoring will be required to evaluate natural attenuation and institutional controls will be implemented as part of this option.

3.3.5 Alternative GW5 - In-situ Treatment using Permeable Reactive Barrier Walls

Physical/chemical treatment also includes the use permeable reactive barrier (PRB) walls to treat contaminated groundwater migrating from source areas. PRB walls are limited to subsurface conditions where contaminants are bound within a continuous aquitard at a depth within the vertical limits of trenching equipment. PRB walls are installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall. There are two types of barriers, 1) permeable reactive barriers and 2) in-place bioreactors. These barriers allow the passage of water while restricting, via reaction with barrier materials, the movement of contaminants. Contaminants are either degraded, adsorbed, or retained in a by the barrier material. Vertical barriers will prevent seepage into Kreher Park from the lake and upper bluff areas. However, groundwater may still be recharged by infiltration. Shallow groundwater will be allowed to discharge from Kreher Park through the PRB wall. PRB walls are passive

system designed for long-term operation to control treat contaminants migrating from source areas with ground water.

PRB walls were not retained for the underlying Copper Falls Aquifer as construction of the PRB would require penetration of the overlying Miller Creek Formation. The Miller Creek forms a confining unit for the Copper Falls Aquifer, which has strong upward gradients at the Site, and construction will compromise the integrity of the confining unit. However, a PRB could be used as a remedial alternative for shallow groundwater. Instead of installing PRB walls in source areas, they are typically installed at down gradient locations to treat contaminated groundwater before is migrates off site. PRB walls are more expensive than vertical barrier walls. PRB walls are typically constructed as "gate" and "funnel" systems; gates are vertical barriers used to direct groundwater flow to the PRB wall which functions as a funnel and treats groundwater before it leaves the site. A sheet pile or slurry wall (vertical barrier) will be installed around the east, north, and south sides of Kreher Park to form the gate, and a down gradient PRB will be installed along the west side as the funnel. The layout of the PRB wall, vertical barrier wall, and engineered surface barrier is shown on Figure 3-4. Key elements for the conceptual design of a PRB wall for shallow groundwater at the site follow:

1. Site preparation will include clearing and grubbing of small trees and bushes along the bluff and near the former seep area as needed.
2. Although the former waste-water treatment plant will be located within the contained area, demolition of this dormant facility may still be required as part of the overall remediation to accommodate future site use.
3. A vertical barrier wall will be placed on the north, east, and south sides of Kreher Park. This vertical barrier will consist of a sheet pile wall anchored into the underlying Miller Creek Formation.
4. The sheet pile wall along the shoreline will be installed at an approximate depth of 25 feet below existing grade to allow the off-shore removal of sediment to a depth of ten feet. The sheet pile wall on the south, east, and west sides of the Kreher Park will be installed at an approximate depth of 16 feet below existing grade.
5. A trench will be excavated on the west side of the Kreher Park for the PRB wall. The wall will be constructed with a porous layer of granular activated carbon to remove dissolved phase organic compounds prior to discharge.
6. Surface barriers will be installed over the filled ravine to minimize infiltration, and the sheet pile wall on the south side of Kreher Park will terminate on the east and west flanks of the filled ravine to create a "funnel" for shallow groundwater discharge into Kreher Park[12].
7. A groundwater diversion trench will be installed between the remainder of the south wall and the upper bluff area to divert groundwater seepage into the Kreher Park fill unit.

[12] For the upper bluff area, a PRB wall at the mouth of the filled ravine will also be evaluated in the Feasibility Study.

8. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the disposal cell and former coal tar dump area to minimize potential exposure to subsurface contamination and minimize infiltration[13].
9 Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and restrict infiltration.

Long-term operation and maintenance of the facility will include groundwater monitoring to evaluate the effectiveness of the PRB. Reactive material used to construct the PRB may need to be replaced if NAPL migrates from the source area and permeates the PRB. Fluid levels will also be monitored to ensure the hydraulic head within the confined area remains below lake level. Institutional controls will likely be implemented as part of this remedial option.

3.3.6 Alternative GW6 – Treatment using Chemical Oxidation

Chemical oxidation introduces strong oxidizing chemicals such as permanganate and peroxide into the subsurface to degrade VOCs and PAH compounds to CO_2 and H_2O end products. Permanganate or peroxide could be injected as liquid reagents through boreholes, wells, or mixed with a backhoe in shallow trenches. Chemical oxidation has an added benefit of enhancing biodegradation by increasing oxygen concentrations in the subsurface. Chemical oxidation could be performed on saturated and unsaturated zone soils by injecting chemicals into the subsurface via borings or wells.

In-situ chemical oxidation could be used for unsaturated and saturated zone contamination at the upper bluff. However, existing conditions at the upper bluff area (the NSPW facility building and buried gas holders) and at Kreher Park (wood waste layer) may limit implementability. Mixing reagent in shallow trenches would be the most effective treatment method at Kreher Park because contamination is present at shallow depths at the former coal tar dump area, and would be easily accessible. Because in-situ chemical oxidation reactions can result in the generation of off-gases, primarily CO_2, passive venting or an active SVE system may be required to capture off-gases. The presence of NAPL may require multiple applications to lower contaminant concentrations to acceptable levels. Potential injection locations for in-situ chemical oxidation at the upper bluff area are shown on Figure 3-5A. Key elements for the conceptual design for in-situ chemical oxidation for shallow soil and groundwater at the site follow:

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access contaminated soil beneath the building at the upper bluff area.
2. Replacement of existing asphalt pavement south of St. Claire Street and new pavement north of St. Claire Street will be required.
3. Between 200 and 300 injection borings will be advanced in the filled ravine using a direct push drill rig[14].

[13] A multi-layer cap would also reduce infiltration, and will be evaluated in the Feasibility Study.

[14] Direct use was used to advance injection boring for the USEPA SITE pilot test completed at the Site in early 2007.

4. For this evaluation it is assumed that approximately 1,500 gallons of reagent will be injected into each boring.
5. A minimum of 10 passive vent wells will be installed in the filled ravine.
6. Site preparation will include clearing and grubbing small trees and bushes along the bluff and near the former seep area as needed at Kreher Park
7. Chemical oxidation at Kreher Park will be completed above the wood waste layer in the former coal tar dump area by mixing reagent in a shallow excavation.
8. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the former coal tar dump area to minimize potential exposure to subsurface contamination and minimize infiltration.
9. Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and restrict infiltration.
10. Multiple applications may be needed to reduce contaminant levels to the extent practicable.

Implementation for the underlying Copper Falls would be more extensive; it may require groundwater extraction rather than soil vapor extraction. The USEPA's SITE program recently completed a demonstration pilot test to fully evaluate the implementability of this alternative at the Site. Additional data will be available in the near future following compilation of pilot test data. Chemical oxidation may also increase the mobility of NAPL recovered by extraction wells resulting in the removal of significant contaminant mass in a short time frame. Preliminary results from the recent SITE program pilot test indicate that injection into areas with NAPL contaminants resulted in an initial vigorous reaction followed by an increase in the mobility and recovery of NAPL. Additional data is currently being collected and will be available in the near future to evaluate NAPL recovery and improvements to groundwater quality. Potential injection locations for in-situ chemical oxidation for the underlying Copper Falls aquifer are shown on Figure 3-5B. Key elements for the conceptual design for in-situ chemical oxidation for the Copper Falls aquifer follow:

1. Between 250 and 500 injection borings will be advanced in the Copper Falls aquifer using a direct push drill rig.
2. For this evaluation it is assumed that approximately 1,500 gallons of reagent will be injected into each boring.
3. Existing extraction wells EW-1, EW-2, and EW-3 will continue to operate during and after reagent injection.
4. A minimum of 7 additional extraction wells will be installed in the Copper Falls aquifer in borings advanced with hollow stem auger using a rotary drill rig.
5. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.
6. Multiple applications may be needed to reduce contaminant levels to the extent practicable.

Although chemical oxidation applications can be completed within a short period of time, the groundwater extraction system may be operated for several years. Long-term groundwater

monitoring to evaluate natural attenuation and institutional controls will be included with this remedial response.

3.3.7 Alternative GW7 - In-situ Treatment using Electrical Resistance Heating

Electrical resistance heating (ERH) technology uses electricity applied into the ground through electrodes to heat the formation. This mobilizes contaminants by heating contaminants and groundwater to boiling point, the steam and contaminants are then recovered with a SVE, groundwater extraction, or dual phase system. The ERH electrodes can be installed either vertically to about 100 feet or horizontally beneath buildings. ERH heats the contaminants up to 100 ^{0}C, which raises the vapor pressure of volatile and semi-volatile organic compounds in the soil. For soil and shallow groundwater, this enhances the recovery of volatilized contaminants by SVE. At these high temperatures (100 ^{0}C), ERH can also be used to dry soil, which can create fractures that increase soil permeability resulting in improved recovery of contaminants by SVE. At high temperatures, saturated zone soils can also be heated to high temperatures to create steam that strips contaminants from soil. Treatment of effluent vapors and dissolved phase groundwater contamination will be required before discharge of air and/or water.

Implementation of this technology for shallow soil and groundwater contamination could be completed simultaneously; SVE and groundwater extraction will likely be required. Existing site buildings and buried structures at the upper bluff and the wood waste layer at Kreher Park will likely limit implementation of this alternative for soil and shallow groundwater. If a containment alternative is implemented for Kreher Park, treatment of shallow soil and groundwater will not be required. If removal of buried structures is required, ERH may not be as feasible for soil and shallow groundwater as are removal and ex-situ treatment alternatives described in Section 2.0. Building demolition and removal of the buried structures at the upper bluff area would enhance the implementability of ERH for the underlying Copper Falls aquifer. For shallow soil and groundwater at the upper bluff area and at Kreher Park, and for the underlying Copper Falls aquifer, ERH could be utilized with groundwater extraction to remove NAPL. Rather than heat soils to create steam, the saturated zone is heated to between 30oC and 40oC to decrease the viscosity and increase the mobility of NAPL, which is then removed via extraction wells or by a dual phase recovery system. Current Environmental Solutions (CES) reported over 5,000 gallons of product was recovered after the first three months of operation at a former MGP site in Illinois (*Enhanced Free Product Recovery Using Low Temerature In-Situ Heating - An Option For MGP Sites*, CES 2006).

Potential locations for ERH electrodes, SVE, and extraction well for shallow soil and groundwater at the upper bluff area are shown on Figure 3-6A. Key elements for the conceptual design for ERH for shallow soil and groundwater at the site follow:

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access contaminated soil beneath the building in the upper bluff area.
2. Replacement of existing asphalt pavement south of St. Claire Street and new pavement north of St. Claire Street will be required.

3. Installation of a minimum of 200 electrodes in the filled ravine and 150 electrodes in the former coal tar dump area to heat the subsurface.
4. A minimum of 10 passive vent wells will be installed in each area
5. A minimum of 4 additional extraction wells will be installed in each area.
6. Effluent vapors and dissolved phase groundwater contamination will be required before discharge of air and/or water. Vapor-phase carbon adsorption will be used to treat vapors prior to discharge to the atmosphere. Water will be treated by the on site treatment system prior to discharge to the sanitary sewer; this will require upgrades to the existing treatment system.
7. Site preparation will include clearing and grubbing of small trees and bushes along the bluff and near the former seep area as needed at Kreher Park.
8. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the disposal cell and former coal tar dump area to minimize potential exposure to subsurface contamination and minimize infiltration.
9. Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and restrict infiltration.

Potential injection locations for ERH electrodes and SVE wells for deep groundwater contamination in the Copper Falls Aquifer are shown on Figure 3-6B. Key elements for the conceptual design for ERH for shallow the Copper Falls aquifer follow.

1. Demolition of the center section of the NSPW service center will be required to access the underlying Copper Falls Aquifer.
2. Removal of the buried gas holders will improve the implementability of ERH for the underlying Copper Falls Aquifer.
3. Installation of a minimum of 200 electrodes in the underlying Copper Falls Aquifer to heat the subsurface.
4. A minimum of 12 additional extraction wells will be installed in each area.
5. Effluent vapors and dissolved phase groundwater contamination will be required before discharge of air and/or water. Vapor-phase carbon adsorption will be used to treat vapors prior to discharge to the atmosphere. Water will be treated by the on site treatment system prior to discharge to the sanitary sewer; this will require upgrades to the existing treatment system.

Although ERH can be completed within a short period of time, the groundwater extraction system may be operated for several years. Long-term groundwater monitoring to evaluate natural attenuation and institutional controls will be included with this remedial response.

3.3.8 Alternative GW8 - In-situ Treatment using Steam Injection / Dynamic Underground Stripping / Contained Recovery of Oily Wastes (CROW) Process

Steam injection physically separates volatile and semi-volatile organic constituents from soil by thermal or mechanical energies. A passive or active SVE and/or groundwater extraction system will be needed to recover volatilized contaminants. Implementation for soil and shallow

groundwater remediation can be completed simultaneously. Potential steam injection and recovery wells for shallow soil and groundwater at the upper bluff are shown on Figure 3-7A. (A similar array would be utilized for contained recovery of oily wastes.)

Key elements for the conceptual design for steam injection for shallow groundwater follow.

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access contaminated soil beneath the building in the upper bluff area.
2. Replacement of existing asphalt pavement south of St. Claire Street and new pavement north of St. Claire Street will be required.
3. Installation of a boiler for generation of steam for injection.
4. A minimum of four steam recovery wells will be installed at each area (the filled ravine and the former coal tar dump area).
5. A minimum of seven recovery wells will be installed in the filled ravine, and five recovery wells will be installed at Kreher Park.
6. Effluent vapors and dissolved phase groundwater contamination will be required before discharge of air and/or water. Vapor phase carbon will be used to treat vapors prior to discharge to the atmosphere. Water will be treated by the on site treatment system prior to discharge to the sanitary sewer; this will require upgrades to the existing treatment system.
7. Site preparation will include clearing and grubbing of small trees and bushes along the bluff and near the former seep area as needed at Kreher Park as needed.
8. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the disposal cell and former coal tar dump area to minimize potential exposure to subsurface contamination and minimize infiltration.
9. Regrading and a storm-water basin will be constructed within the confined area to manage storm-water and reduce infiltration.

Implementation for the underlying Copper Falls aquifer will require groundwater extraction and treatment of contaminated fluids mobilized by heating via a hybrid steam injection process called Dynamic Underground Stripping (DUS). DUS is a combination of technologies. DUS consists of the following integrated technologies: steam injection; electrical heating; underground imaging; and collection and treatment of effluent vapors, NAPL, and contaminated groundwater. These technologies are utilized as follows:

- Steam injection at the periphery of the contaminated area heating permeable zone soils, which then vaporizes volatile compounds bound to the soil causing contaminant migration to centrally located vapor/groundwater extraction wells;
- Electrical heating of less permeable clays and fine-grained sediments vaporizing contaminants causing migration into the steam zone;
- Underground imaging, primarily Electrical Resistance Tomography (ERT) and temperature monitoring, which delineates the heated area and tracks the steam fronts daily to monitor cleanup, and
- Treating effluent vapors, NAPL, and impacted groundwater as needed before discharge.

Hydrous Pyrolysis/Oxidation (HPO) is a process sometimes completed after contaminants are removed during the DUS phase. HPO consists of steam and air injection, which creates a heated, oxygenated zone in the subsurface. After the injection is terminated the steam condenses causing contaminated groundwater to migrate to the heated zone where it mixes with the condensed steam and oxygen. Although this may destroy some microorganisms impeding natural biodegradation, HPO enhances biodegradation of residual contaminants by stimulating other microorganisms (called thermophiles) that thrive at high temperatures. A pilot test will be needed to evaluate the effectiveness of HPO after DUS.

Potential steam injection and recovery wells for deep groundwater contamination in the Copper Falls aquifer are shown on Figure 3-7B. Key elements for the conceptual design for DUS for the Copper Falls Aquifer follow.

1. Demolition of the center section of the NSPW service center south of St. Claire Street will be required to access the underlying Copper Falls Aquifer at the upper bluff area.
2. A minimum of 12 steam injection wells will be installed in the Copper Falls Aquifer at the upper bluff area.
3. A minimum of 9 recovery wells will be installed in the Copper Falls Aquifer at the upper bluff area.
4. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.

Although steam injection or DUS can be completed within a short period of time, the groundwater extraction system may be operated for several years. Long-term groundwater monitoring will be required to evaluate natural attenuation and institutional controls as final remedial responses.

Another in situ technology using thermal injection is the Contained Recovery of Oily Wastes (CROW) process. Rather than steam, injection wells utilizing hot water displace NAPL toward recovery wells, which then convey the mixture to separators along with an on site treatment system. This innovative technology has been successfully used at tar sites as full-scale remedial applications. Limitations to the technology include groundwater injection and recharge, groundwater chemistry, site accessibility, and utility access.

For purposes of this comparison, the conceptual design layouts discussed above for steam injection will be similar. A pilot test will likely be necessary prior to a full application at the Ashland Site. Information developed for the 2006-2007 SITE ISCO demonstration (injection rates, aquifer chemistry where applicable) will be utilized in the full analyses of this option in the Feasibility Study.

3.3.9 Alternative GW9 – NAPL Removal using Groundwater Extraction Wells

Groundwater extraction uses water as a carrier to remove both NAPL and dissolved phase contamination. Groundwater extraction can be implemented for shallow groundwater

contamination encountered at the upper bluff area and Kreher Park as well as the underlying Copper Falls Aquifer. The existing groundwater extraction interim system currently extracts groundwater from one well installed at the mouth of the filled ravine, and groundwater and NAPL from three low flow wells installed in the underlying Copper Falls Aquifer. Enhanced removal at the upper bluff area will include installation of additional low flow extraction wells in the Copper Falls aquifer to increase NAPL removal rates, and continued operation of existing wells EW-1, EW-2, and EW-3. This will also include continued operation of EW-4. However, an evaluation of the volume of groundwater discharged from the filled ravine along with a capture zone analysis for this well will also be required to evaluate utilization of EW-4 for shallow groundwater containment (i.e. barrier wells, or to reduce hydraulic head behind a vertical barrier wall). Potential extraction well locations for the Copper Falls aquifer are shown on Figure 3-8A. Key elements for enhanced groundwater and NAPL extraction in the upper bluff area follow.

1. A minimum of 12 extraction wells will be installed in the Copper Falls Aquifer.
2. Installation of lateral piping between each extraction well and the existing treatment building.
3. Replacement of existing asphalt pavement south of St. Claire Street and new pavement north of St. Claire Street will be installed to reduce infiltration into the ravine fill.
4. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require upgrades to the existing treatment system.

Horizontal rather than vertical extraction wells will be used at Kreher Park because shallow groundwater is encountered in a widespread thin fill unit, and fill material has variable permeability in this area. A potential horizontal well configuration for shallow groundwater extraction contamination at Kreher Park is shown on Figure 3-8B. Key elements for the conceptual design for shallow groundwater extraction at Kreher Park follow.

1. Horizontal wells consisting of perforated pipe will be installed in trenches penetrating the saturated fill unit[15].
2. One trench will transcend the length of the Kreher Park. Lateral trenches will be installed to dissect the former coal tar dump area and the former open sewer area.
3. Recovered fluids will be treated on site prior to discharge to the sanitary sewer. This will require installation of a treatment system at Kreher Park
4. Site restoration will include installation of new asphalt pavement over the marina parking lot and a low permeability soil cap over the former coal tar dump area to prevent potential exposure to subsurface contamination and minimize infiltration.

The groundwater extraction system in the upper bluff area and Kreher Park may be operated for an extended period of time. Long-term groundwater monitoring will be required to evaluate natural attenuation and institutional controls will also be implemented as part of this option.

[15] The Feasibility Study will include an evaluation of groundwater extraction with and without vertical barrier walls.

Table 3-1.Summary of Potential Groundwater Remedial Alternatives

Alternative	Upper Bluff Area	Kreher Park	Copper Falls Aquifer	Other Groundwater Remedial Technologies Used
Alternative GW1 No Action	• No removal or treatment of groundwater required.	• No removal or treatment of groundwater required.	• No removal or treatment of groundwater required.	• Not applicable
Alternative GW2 Containment Using Engineered Surface and Vertical Barriers	• Install barrier well or barrier wall at mouth of filled ravine to prevent off site migration of contaminants with groundwater. • Install asphalt pavement as surface barrier over filled ravine.	• Install barrier wall around perimeter of Kreher Park fill to prevent off site migration of contaminants with groundwater. • Install asphalt pavement over marina parking lot, and low permeability soil cap in the former coal tar dump area.	• Not evaluated because installation of a vertical barrier wall may jeopardize the integrity of the overlying confining unit.	• Monitored natural attenuation • Institutional controls • Groundwater extraction
Alternative GW3 In-situ Treatment using Ozone Sparging	• Install sparge wells in the filled ravine south of St. Claire Street.	• Install sparge wells in entire Kreher Park.	• Install of sparge wells in the impacted portion of Copper Falls Aquifer. • Continue to operate existing groundwater remediation system to collect NAPL.	• Monitored natural attenuation • Institutional controls • Groundwater extraction
Alternative GW4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	• Not evaluated because existing conditions (buried gas holders) may impede effectiveness.	• Not evaluated because existing conditions (wood waste layer) may impede effectiveness.	• Install a minimum of 30 injection/extraction wells, inject surfactant, and remove fluid monthly for a minimum of one year.	• Monitored natural attenuation • Institutional controls • Groundwater extraction
Alternative GW5 In-situ Treatment using Permeable Reactive Barrier Walls	• Groundwater from ravine would continue to discharge to Kreher Park where PRB wall will be installed.	• Install PRB wall constructed of GAC on west side of Kreher Park. • Install vertical barrier wall on north, south, and west sides.	• Not evaluated because installation of a PRB wall may jeopardize the integrity of the overlying confining unit.	• Monitored natural attenuation • Institutional controls • Containment using surface and vertical barrier walls
Alternative GW6 In-situ Treatment using Chemical Oxidation	• Inject reagent through borings advanced into filled ravine south of St. Claire Street. • Install a passive SVE system to vent off-gases. • Modify existing treatment system, and treat recovered fluid on site.	• Mix reagent in shallow trench excavated at former coal tar dump area. Would be limited to contamination above the wood waste layer.	• Inject reagent through borings advanced into the underlying Copper Falls Aquifer. • Install additional groundwater extraction wells to collect NAPL. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Soil vapor extraction • Groundwater extraction • Containment using surface and vertical barrier walls

Table 3-1.Summary of Potential Groundwater Remedial Alternatives

Alternative	Upper Bluff Area	Kreher Park	Copper Falls Aquifer	Other Groundwater Remedial Technologies Used
Alternative GW7 In-situ Treatment using Electrical Resistance Heating	• Install array of electrodes in filled ravine to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and SVE wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install array of electrodes above wood waste layer at the former coal tar dump area to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and SVE wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install array of electrodes in the underlying Copper Falls Aquifer to enhance the migration of NAPL. • Install additional groundwater extraction wells and SVE wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Soil vapor extraction • Groundwater extraction • Dual Phase Recovery • Treat air stream from SVE prior to discharge. • Treatment of SVE condensate prior to discharge. • Containment using surface and vertical barrier walls
Alternative GW8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)	• Install steam injection wells in filled ravine to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and SVE wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install steam injection wells above wood waste layer at former coal tar dump area to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and SVE wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Install steam injection wells in the underlying Copper Falls Aquifer to heat subsurface and enhance the migration of NAPL. • Install additional groundwater extraction wells and SVE wells to recover fluids and vapors. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Soil vapor extraction • Groundwater extraction • Treat air stream from SVE prior to discharge. • Treatment of SVE condensate prior to discharge. • Dual Phase Recovery • Containment using surface and vertical barrier walls
Alternative GW9 Removal using Groundwater Extraction	• Continue to operate EW-4 as down gradient barrier well for shallow groundwater contamination in filled ravine. • Continue to operate existing treatment system.	• Install horizontal wells in saturated fill unit. • Construct building at Kreher Park for groundwater treatment equipment. • Treat contaminated groundwater on site	• Install extraction wells in the filled ravine to recover contaminated groundwater and NAPL. • Continue to operate EW-1, EW-2, and EW-3. • Modify existing treatment system, and treat recovered fluid on site.	• Monitored natural attenuation • Institutional controls • Containment using surface and vertical barrier walls • Ozone sparging • Surfactant Injection • Chemical oxidation • Electrical resistance heating • Dynamic underground stripping

3.4 Evaluation of Potential Remedial Alternatives for Groundwater

Potential remedial alternatives for groundwater were evaluated in this section in accordance with the threshold criteria, primary balancing criteria, and modifying criteria described in Section 1.2 above.

3.4.1 Threshold Criteria

Threshold criteria, which relate to statutory requirements that each alternative must satisfy to be eligible for selection, include:

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).

The "no action" alternative will not satisfy threshold criteria; it will not result in the protection of human health and the environment. Containment technologies (surface and vertical barriers) will prevent exposure to contaminants and prevent the off site migration of contaminants with groundwater. The remaining potential remedial alternatives for groundwater will result in a reduction in mass, toxicity, and mobility of contaminants, which will result in the overall protection of human health and the environment.

The "no action" alternative will not achieve compliance with ARARs. However, the remaining potential remedial alternatives for groundwater will achieve compliance with ARARs as summarized in Table 2 in Attachment 1.

3.4.2 Balancing Criteria

The primary *balancing criteria*, which are the technical criteria upon which the detailed analysis is primarily based, include:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

3.4.2.1 Long Term Effectiveness and Permanence

Each remedial alternative is evaluated as to magnitude of long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. Table 3-2 presents an evaluation of the long-term effectiveness and permanence of each alternative.

Table 3-2. Evaluation of Long-term Effectiveness and Permanence for Potential Groundwater Remedial Alternatives

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative GW1 No Action	• Potential risk to human health or the environment, if any, would not be reduced.	• There are no remedial actions or controls associated with this alternative.
Alternative GW2 Containment Using Engineered Surface and Vertical Barriers	• Containment of shallow groundwater will reduce long-term potential risk to human health and the environment at the Site. • The risk levels for the underlying Copper Falls aquifer will not be reduced. • Natural attenuation monitoring for shallow groundwater may be needed to evaluate on-going risk to human health and the environment.	• Would be effective for shallow groundwater, but not the Copper Falls aquifer. • Long-term operation, maintenance, and monitoring will be required to ensure containment is effective. • Institutional controls could be implemented to prevent long-term exposure to residual subsurface contamination.
Alternative GW3 In-situ Treatment using Ozone Sparging	• Removal of significant volume of NAPL will reduce long-term potential risk to human health and the environment at the Site. • Site restoration will include surface barriers to prevent long-term exposure to shallow groundwater contamination. • Natural attenuation monitoring for shallow groundwater and deep groundwater in the underlying Copper Falls aquifer may be needed to evaluate on-going risk to human health and the environment.	• Would be effective for Copper Falls aquifer, and could also be used for shallow groundwater contamination • In-situ treatment could be completed in relatively short time frame, but long-term operation, maintenance, and monitoring will be required to ensure containment is effective. • Institutional controls could be implemented to prevent long-term exposure to residual subsurface contamination.
Alternative GW4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery		
Alternative GW5 In-situ Treatment using Permeable Reactive Barrier Walls		
Alternative GW6 In-situ Treatment using Chemical Oxidation		
Alternative GW7 In-situ Treatment using Electrical Resistance Heating		
Alternative GW8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)		
Alternative GW9 Removal using Groundwater Extraction		• Long-term operation, maintenance, and monitoring will be required to ensure containment is effective. • Institutional controls could be implemented to prevent long-term exposure to residual subsurface contamination.

3.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment

The remedial alternatives are evaluated for permanence and completeness of the remedial action in significantly reducing the toxicity, mobility, or volume of hazardous materials through treatment. Each alternative is evaluated based on the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. Table 3-3 presents a summary of this evaluation.

Table 3-3. Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Groundwater Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative GW1 No Action	None	None	None	Not applicable	Not applicable
Alternative GW2 Containment Using Engineered Surface and Vertical Barriers	No treatment prior to containment of shallow groundwater encountered in shallow fill unit at Kreher Park. Not feasible for Copper Falls aquifer.	No treatment but the fill unit in Kreher Park, which is approximately 11.5 acres in size, and is an average of 12 feet thick, will be contained. No treatment for Copper Falls Aquifer.	No reduction in contaminant mass, but containment will prevent off site exposure for shallow groundwater. No reduction for Copper Falls Aquifer.	Contained fill at Kreher Park will remain on site. Will not influence implementation of any remedial alternative for Copper Falls.	All fill material, including the wood waste layer and contaminated soil in the former coal tar dump area would remain on site within the contained area. Does not address contamination in Copper Falls Aquifer.
Alternative GW3 In-situ Treatment using Ozone Sparging	Inject ozone to oxidize and destroy contaminants. Can also be used to displace NAPL that could be recovered by groundwater extraction.	Can be used to oxidize and destroy contaminants for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls Aquifer.	Can reduce dissolved phase contamination concentrations by 50 to 75%. Can also enhance NAPL recovery.	Ozone sparge is a chemical oxidation reaction, and is irreversible.	Ozone sparge is a chemical oxidation process that destroys contaminant to CO_2 and H_2O end product by chemical oxidation.
Alternative GW4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	Injection of a surfactant to enhance NAPL removal by vacuum enhanced recovery.	Surfactant injection is intended to enhance removal of NAPL.	Significant removal of NAPL can be expected, but multiple applications may be needed.	Removal of NAPL is irreversible. Surfactant is removed concurrent with NAPL; no lasting impacts from surfactant injection.	Not intended for dissolved phase contamination, but removal of NAPL will remove source for dissolved phase contamination.
Alternative GW5 In-situ Treatment using Permeable Reactive Barrier Walls	Install a PRB wall to treat dissolved phase contaminants in shallow aquifer by adsorption onto GAC material used to construct PRB as groundwater passes through it. Not feasible for Copper Falls aquifer.	Contaminants from contained area in Kreher Park are treated as they pass through the wall. No treatment for Copper Falls aquifer.	Significant reduction of dissolved phase contaminants passing through PRB wall from confined area in Kreher Park can be expected. No reduction for Copper Falls aquifer	Removal of contaminants from groundwater will be irreversible, but contained fill at Kreher Park will remain on site. Will not influence implementation of any remedial alternative for Copper Falls.	All fill material, including the wood waste layer and contaminated soil in the former coal tar dump area would remain on site within the contained area. Does not address contamination in Copper Falls aquifer.

Table 3-4. Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Groundwater Remedial Alternatives

Alternative	Treatment Process Used and Materials Treated	Volume of Material Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative GW6 In-situ Treatment using Chemical Oxidation	Inject liquid reagent to oxidize and destroy contaminants. Can also be used to increase mobility and displace NAPL that could be recovered by groundwater extraction.	Can be used for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Significant reduction in dissolved phase contamination, and increase in the mobility of NAPL can be expected.	Chemical oxidation is an irreversible reaction, but it can result in a permanent change to the aqueous geochemistry of the aquifer.	Chemical oxidation destroys contaminant to CO_2 and H_2O end product by chemical oxidation.
Alternative GW7 In-situ Treatment using Electrical Resistance Heating (ERH)	Install electrodes in contaminated zone to heat aquifer to decrease viscosity and increase solubility and mobility of NAPL that is recovered by groundwater extraction or soil vapor extraction.	Can be used for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Significant removal of mobile and immobile NAPL and dissolved phase contaminants can be expected.	ERH is a thermal treatment process; no lasting impacts from thermal treatment.	Removal of NAPL will remove source for dissolved phase contamination.
Alternative GW8 In-situ Treatment using Dynamic Underground Stripping (DUS) / Steam Injection	Inject steam into contaminated zone to heat aquifer and increase solubility and mobility of NAPL that is recovered by groundwater or soil vapor extraction.	Can be used for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Significant removal of mobile and immobile NAPL and dissolved phase contaminants can be expected.	DUS / steam injection is a thermal treatment process; no lasting impacts from thermal treatment.	Removal of NAPL will remove source for dissolved phase contamination.
Alternative GW9 Removal using Groundwater Extraction	Utilizes groundwater as a carrier to remove NAPL and dissolved phase contaminants.	Can be used for shallow groundwater plume in upper bluff area and Kreher Park, and for underlying Copper Falls aquifer.	Significant removal of mobile NAPL and dissolved phase contaminants can be expected over an extended period of time.	Treatment of extracted groundwater will be irreversible.	Will removed mobile NAPL, but immobile NAPL may remove as source for dissolved phase contamination.

3.4.2.3 Short Term Effectiveness

The evaluation of short-term effectiveness is based on the degree of protectiveness of human health achieved during construction and implementation of the remedy. Potential implementation risks to the community and site workers and mitigation measures for addressing those risks are included in this evaluation. In addition, environmental impacts during implementation and the time required to achieve the RAOs must also be considered in the evaluation of this criterion. Table 3-4 summarizes the results of this evaluation.

Table 3-4. Evaluation of Short Term Effectiveness for Potential Groundwater Remedial Alternatives

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative GW1 No Action	None	No additional impact to the environment	RAOs will not be achieved.
Alternative GW2 Containment Using Engineered Surface and Vertical Barriers	Actions to protect community and site workers during remediation can be implemented.	All fill material will remain in Kreher Park along with fill material at upper bluff area, but containment will prevent contaminant migration from contained area. No impact to Copper Falls aquifer.	Containment construction can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs. Long-term operation, maintenance, and monitoring will be needed for Kreher Park.
Alternative GW3 In-situ Treatment using Ozone Sparging		Will reduce dissolved phase contaminant concentrations and enhance NAPL removal in shallow and deep plumes.	In-situ treatment can be completed in short time frame. Post remediation monitoring for residual contamination remaining on site may be needed to ensure compliance with RAOs
Alternative GW4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery		Will enhance NAPL removal.	
Alternative GW5 In-situ Treatment using Permeable Reactive Barrier Walls		All fill material will remain in Kreher Park along with fill material at upper bluff area, but PRB will prevent contaminant migration from contained area. NAPL will impact performance of the PRB. No impact to Copper Falls aquifer	
Alternative GW6 In-situ Treatment using Chemical Oxidation		Will reduce dissolved phase contaminant concentrations and enhance NAPL removal in shallow and deep plumes.	
Alternative GW7 In-situ Treatment using Electrical Resistance Heating			
Alternative GW8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)			

Table 3-5. Evaluation of Short Term Effectiveness for Potential Groundwater Remedial Alternatives

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative GW9 Removal using Groundwater Extraction	Actions to protect community and site workers during remediation can be implemented.	Will remove dissolved phase and NAPL contaminants and prevent off site migration of contaminants with groundwater.	Long-term operation, maintenance, and monitoring of groundwater extraction system will be required Monitoring will be used to ensure compliance with RAOs

3.4.2.4 Implementability

Implementability is based on the evaluation of technical feasibility, administrative feasibility, and the availability of services and materials. Technical feasibility considers the following factors:

- difficulties that may be inherent during construction and operation of the remedy;
- the reliability of the remedial processes involved;
- the flexibility to take additional remedial actions, if needed;
- the ability to monitor the effectiveness of the remedy;
- the availability of offsite treatment, storage, and disposal facilities; and,
- the availability of needed equipment and specialists.

Administrative feasibility considers permitting and regulatory approval and coordination with other agencies. Table 3-5 presents a summary of this evaluation.

Table 3-5. Evaluation of Implementability for Potential Groundwater Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative GW1 No Action	Additional remedial actions could be easily implemented. No other relevant technical issues.	Not applicable.	No permitting required, but will likely not be able to obtain regulatory approval.	None required.
Alternative GW2 Containment Using Engineered Surface and Vertical Barriers	Well suited for Kreher Park Miller Creek formation is shallow; not suited for confined Copper Falls aquifer. Wood waste layer may result in minor installation problems. Unlikely that additional remedial action for shallow groundwater will be required.	Containment is a reliable Containment technology will prevent exposure and contaminant migrations via shallow groundwater,	Regulatory agency and community approval likely. .	Conventional construction Specialized and conventional equipment and materials required are commercially available.
Alternative GW3 In-situ Treatment using Ozone Sparging	Installation of sparge wells may be difficult in shallow groundwater areas due to buried structures and wood waste layer. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology for dissolved phase contamination. Can also be used to enhance NAPL recovery.	Minimal permitting requirements. Regulatory approval likely. .	Convention drilling and trenching equipment will be used. Would require specialized equipment that is commercially available.
Alternative GW4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	Buried structures and wood waste may prevent installation of sparge points. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology for enhanced NAPL recovery.	Will require permit for injection. Regulatory approval likely. .	Convention drilling equipment and vacuum truck will be used. Will use commercially available surfactant.
Alternative GW5 In-situ Treatment using Permeable Reactive Barrier Walls	Well suited for Kreher Park Miller Creek formation is shallow; not suited for confined Copper Falls aquifer. Wood waste layer may result in minor installation problems. Unlikely that additional remedial action for shallow groundwater will be required.	Reliable passive system, but will require long-term monitoring to evaluate effectiveness.	Regulatory agency and community approval will be required for construction. Regulatory approval likely. .	Conventional construction equipment would be used. Material used to construct the PRB wall is commercially available.
Alternative GW6 In-situ Treatment using Chemical Oxidation	Injection into areas with buried structures and wood waste may be difficult in shallow groundwater. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology for dissolved phase contamination, and can be used to enhance NAPL recovery.	Will require permit for injection. Regulatory approval likely.	Conventional drilling equipment used for injection Would use commercially available surfactant.

Table 3-6. Evaluation of Implementability for Potential Groundwater Remedial Alternatives

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative GW7 In-situ Treatment using Electrical Resistance Heating	Installation of wells or electrodes may be difficult in shallow groundwater areas due to buried structures and wood waste layer. Groundwater extraction would be needed if used to enhance NAPL recovery.	Reliable technology to enhance NAPL recovery.	Minimal permitting requirements. Regulatory approval likely. .	Highly specialized equipment available through vendors specializing in application of remedial technology
Alternative GW8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)			Will require permit for injection. Regulatory approval likely.	
Alternative GW9 Removal using Groundwater Extraction	Installation of wells may be difficult in shallow groundwater areas due to buried structures and wood waste layer. Can be easily used in combination with containment and several in-situ treatment technologies.	Reliable technology, but must be operated for an extended period of time.	Minimal permitting requirements. Regulatory approval likely. .	Conventional drilling and trenching equipment will be used. Treatment equipment is commercially available.

3.4.2.5 Cost

Preliminary estimated costs for potential groundwater remedial alternatives include estimated costs for site preparation implementation, and site restoration. Detailed cost estimates will be presented in the Feasibility Study in accordance with USEPA guidance document, A Guide to Developing and Documenting Cost Estimates (EPA and USACE, 2000). Annual operation, maintenance, and monitoring (OM&M) costs are estimated for each alternative. Long-term monitoring costs for each alternative will be further evaluated in the Feasibility Study. Additionally it is assumed that all work is contracted and the estimates do not account for possible economies of scale (i.e., completing all activities at the site concurrently). These cost estimates are developed primarily for the purpose of comparing remedial alternatives and not for establishing project budgets. A summary of potential groundwater remedial alternatives for groundwater is included in Table 3-6.

Table 3-6. Evaluation of Cost For Potential Groundwater Remedial Alternatives

	Shallow Groundwater			Deep Groundwater	
Alternative	**Upper Bluff Area**	**Kreher Park**	**Annual OM & M**	**Copper Falls aquifer**	**Annual OM & M**
Alternative GW1 No Action	$0	$0	$0	$0	$0
Alternative GW2 Containment Using Engineered Surface and Vertical Barriers	$140,000	$7,055,000	$127,000	--	--
Alternative GW3 In-situ Treatment using Ozone Sparging	$146,000	$984,000	$28,600	$785,500	$98,000
Alternative GW4 In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery	--	--	--	$709,500	$138,000
Alternative GW5 In-situ Treatment using Permeable Reactive Barrier Walls	$140,000	$9,220,000	$25,000	--	--
Alternative GW6 In-situ Treatment using Chemical Oxidation	$1,904,000	$480,000	$25,000	$3,566,000	$96,000
Alternative GW7 In-situ Treatment using Electrical Resistance Heating	$2,023,000	$937,000	$250,000	$3,560,000	$350,000
Alternative GW8 In-situ Treatment using Dynamic Underground Stripping (Steam Injection)	$1,590,000	$1,241,000	$25,000	$3,560,000	$35,000
Alternative GW9 Removal using Groundwater Extraction	--	$573,000	$98,000	$641,000	$103,000

3.4.3 Modifying Criteria

The third group, the *modifying criteria*, includes:

- State/Support agency acceptance
- Community acceptance.

As previously discussed, these last two criteria are typically formally evaluated following the public comment period, although they can be factored into the identification of the preferred alternative to the extent practicable.

3.5 Comparative Analysis of Potential Remedial Alternatives for Groundwater

In this section, as required by CERCLA and NCP regulations, the alternatives will undergo a comparative evaluation wherein the advantages and disadvantages of the alternatives will be concurrently assessed with respect to each criterion. The criteria considered as part of this comparative evaluation are defined in Section 2.4. Table 3-7 presents a summary of the comparative analysis.

Table 3-7 – Comparison of Potential Groundwater Remedial Alternatives

Criteria	Alt. GW-1	Alt. GW2	Alt. GW3	Alt. GW4	Alt. GW5	Alt. GW6	Alt. GW7	Alt. GW8	Alt. GW9
	No Action	Containment using Surface and Vertical Barriers	In-situ Treatment using Ozone Sparging	In-situ Treatment using Surfactant Injection	In-situ Treatment using Permeable Reactive Barrier Walls	In-situ Treatment using Chemical Oxidation	In-situ Treatment using Electrical Resistance Heating	In-situ Treatment using Dynamic Underground Stripping/Steam Injection	Removal using Groundwater Extraction Wells
Overall Protection of Human Health and the Environment	None	Moderate	Moderate	High	Moderate	High	High	High	Moderate
Compliance with ARARs and TBCs	None	High	High	High	High	High	High	High	High
Long-term Effectiveness and Permanence	None	Low	High	High	Low	High	High	High	Moderate
Reduction of Toxicity, Mobility and Volume through Treatment	None	Moderate	Low	Moderate	Moderate	High	High	High	Moderate
Short-term Effectiveness	None	Very High	High	High	High	High	High	High	High
Implementability	None	Very High	High	High	Very High	High	High	High	High
Cost	None	Very High	Low	Low	Very High	High	Very High	High	Low
Agency Acceptance	None	High	High	High	High	High	High	High	High
Community Acceptance	None	Moderate	High	High	High	High	High	High	High

3.5.1 Overall Protection of Human Health and the Environment

Alternative GW1 (no action) offers no additional human health and the environment because no additional actions would be taken to address groundwater contamination at the Site. ***Alternatives GW2*** and ***GW5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) offer an overall moderate level of protection because contaminants will be left on site. These materials will be contained and inaccessible to humans or biota, thereby reducing risk, but offer no protection for the underlying Copper Falls aquifer. ***Alternative GW9*** (removal using groundwater extraction wells) can be used for shallow and deep groundwater, but offers a moderate level of protection of human health and the environment in the long-term because operation will require an extended period to achieve RAOs. The remaining alternatives offer high levels of protection because each technology will result in the removal of a significant contaminant mass, NAPL in particular, from the subsurface.

3.5.2 Compliance with ARARs and TBCs

Alternative GW1 (no action) will not achieve compliance with ARARs and TBCs. Compliance with ARARs and TBCs could be achieved for the remaining remedial alternatives for groundwater. Implementation will require that engineering and construction actions be developed and completed in compliance with federal and state regulations.

3.5.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence considers long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring soil contamination. ***Alternative GW1*** (no action) will not provide any long-term benefit; no additional actions will be taken to address groundwater contamination at the Site. ***Alternatives GW2*** and ***GW5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) offer low levels of effectiveness and permanence over the long term of protection. Although risk will be reduced by containment of contaminated material, contaminants will be left on site. Additionally, both are limited to shallow groundwater; neither is feasible alternative for the underlying Copper Falls aquifer. ***Alternative GW9*** (removal using groundwater extraction wells) will provide a moderate level of effectiveness and permanence over the long term; operation will be required for an extended period to achieve RAOs. The remaining alternatives have high levels of effectiveness and permanence over the long term because each technology will result in the removal of a significant contaminant mass, NAPL in particular, from the subsurface.

3.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Reduction of toxicity, mobility, or volume of hazardous materials through treatment considers the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. ***Alternative GW1*** (no action) will not result in a

reduction in the toxicity, mobility, or volume of contaminated soil. ***Alternatives GW2*** and ***GW5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) will not result in the toxicity or volume of contaminant mass. However, both will reduce contaminant mobility for shallow groundwater, but not for the Copper Falls. ***Alternative GW9*** (removal using groundwater extraction wells) will result in a reduction in the toxicity, mobility, and volume of contaminant mass, but operation will be required for an extended period to achieve RAOs. Implementation of the remaining in-situ treatment alternatives will result in the highest degree of reduction of toxicity, mobility, and volume of impacted groundwater. However, amount of volume reduction will vary for each of the remaining in-situ treatment.

3.5.5 Short-term Effectiveness

Short-term effectiveness considers potential implementation risks to the community and site workers, environmental impacts, and time required to achieve RAOs. Implementation of ***Alternative GW1*** (no action) will not achieve RAOs or improve environmental impacts in the short-term, but it will allow maximum protection to the community and workers during remediation. The short-term effectiveness for the remaining alternatives is considered high. Each alternative can achieve RAOs and will reduce environmental impacts in the short-term by removing contaminant mass or preventing the off site migration of contaminants. Containment, in-situ, and removal technologies evaluated in this report will require minimal effort to protect the community and workers during remediation.

3.5.6 Implementability

Implementability considers technical feasibility, administrative feasibility, and the availability of services and materials. ***Alternative GW1*** (no action) will require the least amount of effort for implementability. Additionally, because no remedial action will occur, there would be no difficulty in implementing additional remedial actions at a later date. ***Alternatives GW2*** and ***GW5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) have a very high degree of implementability. The remaining alternatives have a high degree of implementability. However, buried structures in the upper bluff area and the wood waste layer in Kreher Park may limit the effectiveness of in-situ treatment for shallow and deep groundwater in these areas. Removal of the buried structures concurrent with remedial alternatives evaluated for soil in Section 2.0 may ease implementation of the in-situ treatment and removal alternatives for the Copper Falls. If removal and disposal (on- or off site) or on site treatment is selected as a remedial response for soil, or if containment is selected for shallow groundwater, in-situ treatment and or removal will not be necessary for soil and shallow groundwater contamination, but one or more of the in-situ or removal technologies evaluated in this report will be required for the Copper Falls aquifer.

3.5.7 Cost

Preliminary cost estimates for potential remedial alternatives for groundwater include site preparation, implementation of the remedial response, and site restoration. There are no costs associated with ***Alternative GW1*** (no action) because none of these activities will be completed.

For shallow groundwater, ***Alternatives GW2*** and ***GW5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) have high installation. Annual OM&M cost for ***GW2*** are high due to long term groundwater recovery and disposal costs, but low for ***GW5***, which relies on - situ treatment. Cost for implementation of the in-situ treatment ***Alternatives GW6*** (chemical oxidation), ***GW7*** (ERH), and ***GW8*** (steam injection) area also high with low annual OM&M costs[16]. ***Alternatives GW3*** (ozone sparging) has low implementation and annual OM&M costs. Implementation costs for ***Alternatives GW9*** are the lowest, but have high annual OM&M cost for continued operation, which may be required for an extended period of time.

For the Copper Falls Aquifer, in-situ treatment ***Alternatives GW6*** (chemical oxidation), ***GW7*** (ERH), and ***GW8*** (steam injection) implementation costs area high. ***GW6*** has high OM&M cost, and ***GW7*** and ***GW8*** have low OM&M annual costs. In-situ treatment ***Alternatives GW3*** (ozone sparging), and ***GW4*** (surfactant injection) implementation costs area low, but have high annual OM&M costs. As with shallow groundwater, implementation costs for ***Alternatives GW9*** are the lowest, but have high annual OM&M cost for continued operation, which may be required for an extended period of time.

3.5.8 Agency and Community Acceptance

With the exception of no action, all remedial alternatives for groundwater evaluated in this report should be acceptable to the regulatory agency and community. ***Alternatives GW2*** and ***GW5*** (containment using surface and vertical barriers and in-situ treatment using PRB walls) will likely be the least desirable to the community because contaminant may limit future Site use; building will likely be restricted at Kreher Park to prevent disturbance of the contained area. ***Alternative GW9*** (removal using groundwater extraction wells) can be used to achieve RAOs, it may be the least desirable to the Agency because it will take the longest to complete.

[16] These in-situ remedial alternatives are limited to the coal tar dump area. Significantly higher costs would be expected if implemented for all of Kreher Park.

4.0 Sediment

As described in the RI and the Alternatives Tech Memo, NAPL is present in sediments in the offshore zone along the Kreher Park shoreline. The greatest mass of NAPL-impacted material extends between the marina and an area north of the former WWTP from 100 to 300 feet from the shore.

A wood waste layer varying from sawdust-sized particles to timber overlies much of the impacted sediment at depths from a few inches to more than ten feet. Approximately 95 percent of the impacted sediments are covered by this wood waste layer. The greatest wood waste thickness is found at the area east of the WWTP, where the former Schroeder Lumber sawmill operated. An estimated 25,000 cubic yards of this material is present in this layer. The greatest contaminant mass is found immediately below the wood waste layer at the sediment surface.

Based upon estimates developed in the Alternatives Tech Memo, the areal extent of contaminated sediment was first calculated for total PAH concentrations exceeding 10 ppm dry weight (dwt)[17]. Approximately 16 acres of the Site contains total PAH concentrations in excess of 10 ppm. The volume of sediment in the 16 acres was then calculated for contamination up to maximum depths of 4 and 10 feet. Total PAHs exceeding 10 ppm include an estimated 77,822 cubic yards of sediment between 0 and 4 feet, and an estimated total of 133,906 cubic yards of sediment up to a maximum depth of 10 feet. All volume estimates include wood waste overlying, and mixed with, the contaminated sediment.

The Alternatives Screening Tech Memo identified the following remedial alternatives as retained for further evaluation:

Alternative SED-1: No Action
Alternative SED-2: Containment with a CDF
Alternative SED-3: Containment with subaqueous capping
Alternative SED-4: Removal

Each of these alternatives includes potentially multiple ex-situ treatment and disposal processes which will be further discussed in this section.

This section, presenting a Comparative Analysis of Sediment Alternatives, is organized as follows:

Section 4.1: Remedial Action Objectives for Sediment
Section 4.2: Potential Remedial Alternatives for Sediment

[17] For purposes of estimating sediment volumes the 9.5 ug PAH/g dwt was rounded to 10 ppm and it was assumed that the concentration was on a dry weight basis.

Section 4.3: Development of Remedial Alternatives for Sediment
Section 4.4: Detailed Analyses of Remedial Alternatives
Section 4.5 Comparative Analyses of Remedial Alternatives

4.1 Remediation Action Objectives for Sediment

As described in the RAO Technical Memorandum (Appendix A to the Remedial Investigation; URS 2007), in general, the goals of remedial action for sediment are to prevent human ingestion or direct contact with sediments having contaminants of potential concern (COPCs) which pose an unacceptable health risk. Similarly, for ecological receptors, the general goal is to prevent direct contact with or ingestion of sediments or of prey having levels of COPCs that would pose an unacceptable risk to populations of ecological receptors or individuals of protected species. Remedial action objectives for sediment[18] include:

- Protect human health by eliminating exposure (direct contact, ingestion, inhalation, fish ingestion) to sediment with COPCs in excess of regulatory or risk-based standards;
- Conduct free product removal whenever it is necessary to halt or contain the discharge of a hazardous substance or to minimize the harmful effects of the discharge to the air, land or water; and,
- Protect populations of ecological receptors or individuals of protected species by eliminating exposure (direct contact with incidental ingestion of sediments or of prey) to sediment with levels of COPCs that would pose an unacceptable risk.

With the exception of iron, the cumulative risks estimated for the human health recreational receptor exposures to sediments were below EPA's target risk levels.

For ecological receptors, USEPA set the sediment PRG at 2295 µg PAHs/g Organic Carbon (OC) or 9.5 ug PAH/g dwt at 0.415% OC based upon their "best professional judgment". In addition, USEPA directed that, "if the final depth of sediments will be less than 6 feet, the PRG for any active remedial intervention will be adjusted downward as based upon ultraviolet light (UV) extinction coefficients measured in Site waters. In addition, sediments in greater than 6 feet of water having a concentration equal or less than 2,295 ug PAH/g OC (9.5 ug PAH/g dwt at 0.415% OC) and sediments in 6 feet or less of water having a concentration greater than a UV-adjusted PRG will be monitored to assure that there are no unacceptable impacts to benthic community and that the levels of PAHs in surface sediments decrease over time to 1340 ug PAH/g OC (5.6 ug PAH/g dwt at 0.415% OC)."

4.2 Potential Remedial Alternatives for Sediment

Remedial technologies retained for screening were used to develop potential remedial alternatives for sediment. Remedial alternatives for groundwater presented in this report are summarized in Table 4-1.

[18] These RAOs were provided by USEPA in comments to the RAO Technical Memorandum.

Table4-1 Screening and Assembly of Remedial Technologies for Sediment

GRA	Technology	Process Option	Screening and Alternative Assembly Effectiveness	Screening Decision
No Action	None	N/A	Required	Retained as Alternative SED-1.
Institutional Controls	Physical, Engineering or Legislative Restrictions	Access Restrictions	Potential protection for limited areas; used in combination with other alternatives	Retained as a potential component of other alternatives.
Monitored Natural Recovery	Physical degradation Biological/ chemical degradation	Desorption, diffusion, dilution, volatilization Dechlorination (aerobic and anaerobic)	Slow processes but for limited areas may be effective in combination with other natural recovery mechanisms	Retained only as a potential component of other alternatives.
	Physical processes	Burial	Evidence of net deposition is limited; however contribution of clean sediment to areas of the Site and subsequent bioturbation would lead to reduced PAH levels in surface sediments. Also, placement of engineering structures could lead to increased deposition	
		Resuspension and transport	Slow process but for limited areas may be effective in combination with other natural recovery mechanisms	
Containment	Subaqueous capping	Sand cap Composite cap Armored cap	A cap utilizing aspects of these three types of caps could be effective in combination with removal of approximately the top four feet of sediment in the nearshore.	Retained as a component of Alternative SED-3.
Containment (cont.)	Confined disposal facility	Sheet pile enclosure with impervious cap and groundwater management	Effective in reducing mobility of all Site contaminants and eliminates potential exposure pathways to humans and ecological receptors. May have administrative implementability issues. Would require substantial mitigation.	Retained as Alternative SED-2. Process options may be used singly or in combination.
		Combination of sheet pile and slurry wall enclosure with impervious cap and groundwater management		

GRA	Technology	Process Option	Screening and Alternative Assembly Effectiveness	Screening Decision
Removal	Dredging	Mechanical	Dredging is standard practice and generally effective; however site conditions may limit effectiveness. Mechanical dredging is expected to be more effective for debris removal or for dredging in areas where there is debris; however it will also result in the maximum loss of VOCs and SVOCs to the atmosphere through volatilization.	Retained as a component of Alternatives SED-2, SED-3, and SED-4.
		Hydraulic	Dredging is standard practice and generally effective; however site conditions may limit effectiveness. Hydraulic dredging will be ineffective in areas where there is a substantial amount of debris; however it is more effective for limiting volatilization and dispersal of NAPL.	
		Excavator	Excavation of sediment is standard practice and generally effective; however site conditions may limit effectiveness. Excavation is expected to have the same potential limitations that mechanical dredging would have.	
	Excavation in the dry	Excavator	Can be effective but at very high cost for entire Site. May have applications at this Site for supplementing other removal technologies in the nearshore areas, perhaps for debris removal.	
Ex-situ Treatment	Physical	Screening	Effective for wood debris as part of other alternative.	Retained as a component of Alternatives SED-2, SED-3, and SED-4.
		Crushing		
		Floatation		
		Hydraulic Separation		
	Thermal	High and Low Temperature Thermal Desorption	Effective at destroying organics. Effectiveness limited by supporting technologies and wood debris content	Retained as a component of Alternatives SED-3, and SED-4.
		Incineration	Effective at destroying organics. Effectiveness limited by supporting technologies	
Disposal	On site disposal	Nearshore CDF	Effective in reducing mobility and toxicity of all Site contaminants and eliminating potential exposure pathways to humans and ecological receptors.	Retained as Alternative SED-2.
		Beneficial use or fill	Effective provided residuals are "clean"	Retained as a component of Alternatives SED-3 and SED-4.
	Off site disposal	NR 500WAC Landfill	Effective and administratively implementable	Retained as potential components of

GRA	Technology	Process Option	Screening and Alternative Assembly Effectiveness	Screening Decision
		Upland confined fill	Effective provided it can be permitted	Alternatives SED-3 and SED-4.
		Upland beneficial use or fill	Effective provided residuals are "clean"	

As shown in the above table, more than one process option may be available for a given technology. Examples include thermal treatment, on site disposal, and off site disposal. In these cases, there is not a sufficiently significant difference in the technologies to warrant selection of one process option over another at this time. However, a distinction would be made during the Remedial Design phase based on availability and costs. Therefore, both processes may be included in subsequent discussions.

4.2.1 No Action

There are no process options associated with a "no action" alternative; however, no action was retained as required by the NCP as a basis for comparing the other alternatives. No action requires no planning, maintenance, or monitoring. It is not the same as "institutional controls" or "monitored natural recovery," each of which require some maintenance and monitoring. A "no action" alternative, however, does not meet the RAOs for the Site.

4.2.2 Containment

There were two containment processes retained: subaqueous capping, which is a component of Alternative SED-3, and a CDF, which is the primary component of Alternative SED-2.

4.2.2.1 Subaqueous Capping

One subaqueous capping option has been retained for further evaluation. This is a nearshore cap that would be placed after dredging sediment to a depth such that placement of the cap will not interfere navigation. For this evaluation it has been assumed, the top four feet of sediment in areas exceeding the proposed sediment cleanup level of 2,295 ug PAH/g OC (9.5 ug PAH/g dwt at 0.415% OC) will be removed to provide sufficient depth for emplacement of an armored cap and not decrease the lake bottom depth in the area. Cap material considered in this application would be natural sand, organo-clays and/or carbon or other amendments to adsorb contaminants and rock armoring to resist erosion. Geomembranes will also be considered in the design of a cap.

4.2.2.2 CDF Process

This remedial alternative consists of a CDF that would cover sediments that are impacted by substantial levels of wood debris as well as by substantially elevated levels of SVOCs and VOCs, including NAPL. In addition, the CDF would cover areas on upland portions of the Site that are impacted by wood material mixed with coal tar wastes. Sediments outside this CDF

footprint that exceed the sediment cleanup level of 2,295 ug PAH/g OC (9.5 ug PAH/g dwt at 0.415% OC) would be dredged or excavated and placed in the CDF where they would be permanently stored. This alternative would also include a cap and drainage system to eliminate or minimize infiltration from precipitation and eliminate groundwater infiltration. It can be designed as a comprehensive alternative that would address contaminated sediments, soils and groundwater. Since this alternative would involve filling of the nearshore area to levels above the lake level, it will require compensatory mitigation for wetland loss.

The proposed CDF would consist of the following components:

Sheet Pile Enclosure

A 3,700-foot-long sheet pile wall would be constructed enclosing roughly 17 acres (approximately six acres in the lake and 11 acres in Kreher Park). The sheet piling on land would be driven into unimpacted silty clays below the water table to serve as a cut-off wall impeding the flow of groundwater through the contaminated sediments that are enclosed. The sheet piling in the lake would also be driven through the water and impacted sediment/debris layer into unimpacted silty clays of the Miller Creek formation. The sheet piling in the lake would be structurally supported and protected from wave and ice action by an armored dike. The extent of this armored dike will be determined in Remedial Design. The sheet piling would be sealed to achieve an average permeability of $1x10^{-7}$ cm/sec, using one of several commercially available sealing methods and products. The sealing process involves directly filling the voids in the joints using a polymer or bentonite material. This material is most often applied prior to driving the pile and the pile can be installed through water. Other processes available involve driving the pile and adding the sealant afterwards, either into the joint or into an enclosure formed by a two-inch angle iron welded to the outside of the sheet pile at the joint. Additional means of eliminating flux of contaminants for the CDF will be considered if treatability studies indicate they may be necessary.

Dredging

A mechanical dredge will be used that will either load directly to a barge or place sediment in a hopper with a screen/basket and grizzly[19] connected to a high-solids slurry pump. When the method of loading directly into a barge is used, the sediment would then be unloaded into the CDF with a crane. If a high-solids slurry pump method is used, a pipeline is used to hydraulically transfer sediments to the CDF and discharge them under the water into the CDF. A discharge nozzle such as a tremie may be used to control the discharge velocity and minimize suspended solids entrainment within the CDF. Other dredging procedures and controls would be as described in Section 4.2.3.

[19] Most treatment trains include coarse separation using grizzly screens as an initial treatment step. Grizzlies are the simplest and coarsest devices for removing small debris. Grizzly screens are made up of inclined parallel iron or steel bars spaced between one and 12 inches apart. The material to be screened is loaded either directly by bucket or front-end loader, or may be fed by conveyer. Objects larger than the spacing of the bars are separated into a separate stream that may be treated or disposed of independently. Grizzly screens are very rugged and require little maintenance.

Water Treatment

Treatment would be provided to treat the water from dredging during filling of the CDF. Water treatment could include polymer addition to improve settlement of suspended solids followed by sand filtration and carbon adsorption to allow discharge to the City POTW or to the lake at levels that conform to water quality guidelines.

Capping and Geomembrane Cover

After disposal of dredged sediments in the CDF, a cap that would meet the requirements of a RCRA Class C or D landfill will be installed to cover impacted sediments and minimize infiltration from precipitation. This cover will be installed over the entire 17-acre area after the existing city wastewater treatment plant is demolished and removed. Contaminated sediments in the CDF will require time for consolidation and possible dewatering prior to installation of this layer. A two-foot thick sand cap will be placed over the CDF with a final topsoil layer for a vegetative or evapotranspiration cap. Limited use of stabilization of some sediments also may be a consideration such that the stabilized material would act as a pseudo-liner. A hydraulic control plan in the upland area may use alternative cap materials to minimize infiltration such as asphalt for a parking lot or clay layer.

Groundwater Control

Up gradient groundwater will be diverted around the CDF through use of drainage tiles and/or the use existing hydraulic control system for the filled ravine (EW-4 or other extraction wells). This includes discharges to storm drainage systems that would be a part of the hydraulic control plan for the upland and sediment capping area. This may also include vegetation plantings and landscaping to enhance evapotranspiration and drainage from the bluff.

4.2.3 Removal

While removal of contaminated sediment with dredges or excavators has been successfully implemented at a number of contaminated sediment sites, Site characteristics at Ashland provide several unique challenges. These challenges arise from the presence of large quantities of wood debris, including logs to depths of eight or more feet, and the presence of both dissolved phase VOCs and SVOCs and NAPL in sediments. These factors taken together result in a substantial potential for release of volatile contaminants to the air as well as for potential release of dissolved and NAPL to surface water. While this potential can often be addressed through use of hydraulic dredges which minimize the probability of escape and dispersion of these LNAPL and volatiles, the presence of large quantities of wood debris may preclude the effective use of hydraulic dredges in substantial portions of the Site. For this reason it is likely that debris removal primarily would need to be accomplished by mechanical dredges or excavators. With use of mechanical dredges or excavators, volatilization is expected to be significantly greater than what would occur if only hydraulic dredging was utilized.

If volatiles are released to the air, they may disperse beyond the immediate vicinity of dredging operations and onshore treatment operations, depending upon ambient weather conditions. With the proximity of a relatively large population in Ashland, this presents the real possibility of unacceptable exposure unless it is possible to design engineering controls. A preliminary evaluation based upon conservative assumptions of volatilization indicates that naphthalene and benzene released during dredging and sediment treatment activities would potential impact residential areas at levels exceeding air quality standards. Details regarding this assessment can be found in Attachment 2.

The removal alternative would therefore likely feature multiple removal technologies, such as use of mechanical dredging and/or excavation to remove debris, and hydraulic dredging once a sufficient amount of debris is removed.[20] To minimize volatilization of VOCs and SVOCs and limit dispersion of NAPL, the dredging operation would likely employ modular pontoon barges or scows that are configured in such a manner that turbidity "skirts" can be placed around them. Debris removal and dredging will take place in the "hole" made by the arrangement of pontoons or strategic placement of scows with open/out bottom 'doors.' Various types of equipment, including lattice-boom modified clamshell cranes, hydraulic cutterhead suction or extended articulating-boom excavators with modified thumb-bucket(s), would operate from these floating platforms depending upon their effectiveness. In areas where the presence of debris does not interfere with hydraulic dredging, hydraulic pumps installed directly on the excavators could be used. The scows or pontoon barges would be moved around using either a small tug or cables/swing-gear connected to the shore or off site anchor points. Anchor spuds could also be used.

Debris close to shore might also be removed by extended-boom excavators operating directly from shore or submerged/flooded-grounded (removable) piers made from modularized pontoons/barges.

Once dredged or excavated, debris and the sediment/debris mixture would be passed through grizzlies to separate out large wood into hoppers or scows with sediment locks. Water could be added to the sediment and moved hydraulically to tertiary treatment, settlement, dewatering and specialized treatment areas, possibly using a closed-circuit (return water) pipeline system. The wood debris would be handled separately.

Engineering controls for minimizing release of dissolved or free-phase contaminants to water beyond the Site would likely consist of redundant turbidity barriers and booms. Temporary sheet piling will also be considered if redundant turbidity barriers and booms are not effective. In addition, dredging operations can be suspended during conditions that render redundant turbidity barriers and booms ineffective.

[20] Various hydraulic equipment, such as cutterhead suction dredges, can deal with a certain amount of wood debris provided it can be cut/resized and pumped. A cutterhead suction dredge can crush the wood debris into smaller pieces and hydraulically move it with the sediment to separation and treatment facilities but would increase the amount of contaminated material(s) to be treated.

Controls for minimization of volatile releases would have to be investigated further since covering over working dredges and adjacent water is difficult and would add complexity to maintaining more efficient dredge production rates. It is likely that remedial construction workers would have to use Class C personal protective equipment (PPE).

Because of the limitations on dredging in the winter, it is anticipated that 12 hour shifts, working 24 hours per day, seven days per week, would be used with an anticipated 'pay' production rate of 500-1,000 'in-place' cy per 24 hours, including debris handling. If this is achieved, then the dredging under any alternative should be able to be completed in one construction season (May through October).

Since dredging is a component of all remedial alternatives for sediment, a pilot-scale project is recommended to evaluate and optimize effectiveness and determine whether engineering controls can be used to minimize volatilization and dispersal of NAPL. A pilot could be conducted separately or on the "front end" of the dredging project. Because of time limitations, not all removal alternatives can be completed in one construction season if a pilot is conducted on the front end of the project. In removal alternatives that require dredging of more than about 60,00 cy, the pilot would have to be conducted separately the year prior to dredging.

Sediment removal is a component of Alternatives SED-2, SED-3 and SED-4, although different dredging processes may be used for certain elements of sediment removal. This will be described in more detail in Section 4.3.

4.2.4 Dewatering, Treatment, and Disposal Process Options

4.2.4.1 Dewatering Process Options

Sediment removed from the lake would be transported to settling ponds specifically constructed for dewatering purposes within the confines of Kreher Park. These ponds would be used for separating the liquid from the sediment, and decanting the water for treatment, effectively separating the sediment from the water. Sediment would be removed from the settling ponds and mechanically dewatered prior to being treated on site or shipped off site for disposal. The ponds would be constructed of clean locally-derived soil compacted in place.

Settling ponds are usually divided into three basins: primary, secondary, and return basins. The primary and secondary basins are used to allow solids to settle out of the sediment slurry. By the time the water reaches the return basin, most of the sediment that was suspended in the water has settled out. Following additional treatment to meet all regulatory standards, the water is then allowed to flow back into the lake. The sediment would take between 1 and 5 days to completely settle out.

Through use of flocculants or other additives, it would be possible to increase the settling rate of suspended sediment, thereby decreasing the time required to clarify the water prior to discharge. This would also lengthen the service life of any system, such as granular activated carbon, used to remove VOC and PAH from the water.

Prior to treatment or disposal at a landfill, sediment must be dewatered. USEPA has suggested three methods of dewatering (USEPA 1994):

1. "Passive" dewatering, where sediment is allowed to dry under ambient conditions. This could include settling basins where solids are allowed to settle by gravity, possibly aided by use of flocculants. VOCs or PAHs in the sediment could potentially be released to air, causing unacceptable risk, unless the sediment were dried in an enclosure with appropriate vapor controls.

2. "Mechanical" dewatering, where the sediment is processed through equipment that removes water by squeezing, centrifugation, filtering, or other similar means. Use of these methods will remove water rapidly, potentially reducing the exposure of the surrounding areas to vapors, given proper handling techniques. Water that is removed using these types of processes will contain VOCs, SVOCs, and NAPL and therefore will require treatment prior to discharge. .

3. "Active" dewatering; where sediment is heated to vaporize water. Using this method, it is anticipated that the level of vapors released will be higher than other methods; however, steps could be taken to minimize the exposure of the surrounding areas to these vapors.

Dewatering would be required for the alternatives that include treatment or off site disposal. Dewatering would not be required for the no-action alternative or and only passive dewatering would be required within a CDF.

Passive Dewatering

Settling ponds could be used for separating sediment from the water, and decanting the water for treatment. The ponds would be constructed of clean locally-derived low permeability soil compacted in place with a liner. Following settlement, sediment would be removed from the settling ponds and mechanically dewatered. Prior to transport to an off site location, sediment may require stabilization through addition of fly ash or cement dust to reduce the water content to acceptable levels.

Settling ponds are usually comprised of three basins: primary, secondary, and return basins. The primary and secondary basins are used to allow solids to settle out of the sediment slurry. By the time the water reaches the return basin, most of the sediment that was suspended in the water has settled out. Clarified water would be discharged to the sanitary sewer system, or treated through an oil/water separator, sand and carbon filters, following which and verifying that it meets water quality standards, the water would be allowed to flow back into the lake. The sediment would take between 1 and 5 days to completely settle out of the water.

Through use of flocculants or other additives, it would be possible to increase the settling rate of suspended sediment, thereby decreasing the time required to clarify the water prior to discharge.

This would also lengthen the service life of any system, such as granular activated carbon, used to remove VOC and SVOCs from the water.

The CDF alternative would utilize the containment area as a passive settling basin during sediment placement in the CDF. Clear water would be pumped from the opposite side of the CDF as it is filled with sediment to maintain an approximately constant water level. This water would be run through an oil/water separator, settling chamber and filter (sand, bag, or cartridge) to remove fine particulate. The water would then be treated in a bed of activated carbon granules (GAC) to remove dissolved COPCs. If the sediment is pumped into the CDF, a treme' to discharge sediment to reduce the resuspension of sediment in the overlying water. This will reduce particulate and dissolved concentrations of COPCs and lower emissions and treatment requirements. The discharge from the CDF would be returned to Lake Superior or to the City of Ashland sanitary sewer system. Hydraulic dredging would generate the highest flow with approximately six to ten percent solids slurry and would be pumped to the CDF. Mechanical dredging would consider dewatering in the barge and then placed mechanically into the CDF or pumped from a dredge equipped with a high solids slurry pump and screen for debris removal. The intake water would be pumped from the CDF to the slurry pump on the dredge and be re-circulated to the CDF with the sediment. This method of hydraulic placement would reduce the water volume for treatment and minimize air emissions compared to hydraulic dredging.

For alternatives where the dredge material will be treated and disposed off site a settling pond will be located in Kreher Park. The dewatering pond would be about 4 acres and allow for settling and staging of the sediments for additional treatment options. The sediment would require filtering such as the plate and frame filter press system to meet the off site landfill requirements to remove free liquids or for the thermal treatment contingency alternative to reduce moisture for processing. A solids content of 45-75% solids would be needed for thermal treatment. The clear water overflow from the pond and re-circulated water from mechanical dewatering would be treated using settling and filtering before treatment with GAC and then discharged similar to the system described in the CDF alternative.

The solids from mechanical dredging may be dewatered in a barge and then placed in the ponds for additional dewatering and staging for mechanical dewatering. Solids content under a mechanical dredging scenario would likely be similar to in-situ levels of 25 to 60 % depending on the sand and wood debris content. All of the water treatment equipment would be the same but would be a much smaller flow and system than with using a hydraulic dredge.

Additional dewatering treatment on land could include a hydrocyclone to first separate the sand fraction of the sediment. If there is sufficiently large enough sand content and it can be demonstrated that the sand would meet concentrations of COPCs for reuse, this would reduce the amount of sediment for final dewatering and subsequent treatment and disposal.

4.2.4.2 Treatment Process Options

In the event the dewatered sediment can not be disposed after dewatering and/or stabilizing, on site treatment using mobile Low Temperature Thermal Desorption (LTTD) or High Temperature

Thermal Desorption (HTTD) may be used to thermally extract the organic COPCs from the sediments and then incinerate the fumes in a secondary combustion chamber to achieve 99.99% destruction removal efficiency (DRE). The equipment would be located next to the dewatering facilities and would have a mechanical feed from the dewatered sediments stockpile. The lower the moisture potentially the greater throughput of the system. The first stage would be an indirectly heated rotating kiln to evaporate the water and volatilize the COPCs. This would discharge treated sediment to a hopper and the fumes and water vapor would be diverted into a secondary combustion chamber for incineration. The temperature would be raised in the chamber to a level needed to achieve the DRE.

An on site mobile incinerator would operate in a similar fashion as HTTD except the kiln would be direct-fired[21] and would cause some COPCs to be destroyed before the vapors reach the secondary combustion chamber. In addition the gas flow rates are higher since the fuel and air combustion gases are included in the gases sent from the kiln to the secondary combustion chamber.

For all thermal processes, an ash stockpile area would be needed and the ash would be trucked off site for fill or land disposal.

For land disposal alternatives without thermal treatment, stabilization treatment likely will be required to meet landfill requirements. The process would include a material holding tank and mixing tank to add sufficient cement and/or fly ash to meet the "no free liquids" standard. After mixing the sediment would be stockpiled for loading onto trucks for off site land filling. It is estimated that stabilization would increase sediment weight by about 10-percent[22]..

4.2.4.3 Disposal Process Options

Disposal is relocation and placement of removed materials into a site, structure or facility. Impacted and/or treated/stabilized sediment removed from the site may be disposed of at a number of off site commercial/industrial disposal facilities that meet the requirements of chapter NR 500 WAC and the EPA's "off site rule" (40 CFR 300.440). Out-of-state disposal facilities are also available. Off site disposal is being considered for both contaminated and treated/stabilized sediments.

A landfill is an engineered facility that provides long-term isolation and disposal of wastes. These facilities are designed to prevent the release of contaminants to groundwater, control runoff to surface water and limit dispersion of contaminants into the air. Through statute and case law, it has been determined that dredged sediment is classified as solid waste in Wisconsin

[21] Medium and high temperature thermal desorption may also be direct-fired, but at a lower temperature than incineration.

22 This is on a weight basis and 10% is typical unless there is difficulty in the dewatering process. Testing will be needed to determine the stabilization formula required and will affect the increase in sediment weight. Disposal costs are normally on a weight basis.

(Lynch 1997, 1998). Wisconsin Statute Chapter 289 and NR 500 through NR 520 WAC address handling of solid waste and therefore handling of dredged sediment. Any in-state landfill approved for disposal of contaminated sediment must meet Wisconsin requirements for design, operation and maintenance of a Subtitle D landfill. WDNR has authority to issue exemptions from regulation under Wis. Stats chapter 289. Exemptions which cover dredged material exist in NR 500.08 WAC (beneficial reuse) and in Wis. Stats chapter 289.43 (8) and related sections of NR 500 WAC known as "Low Hazard Exemption". These exemptions may be applicable for treated or untreated sediment containing low or non-detectable levels of contaminants. Prior to disposal, all sediment will be required to be dewatered to an acceptable moisture content and meet applicable landfill acceptance criteria, including those regarding structural characteristics. As such, at a minimum, sediment will likely be mixed with appropriate materials to improve the strength of the sediment (e.g. kiln dust, fly ash etc.).

Landfill volume acceptance limitations for contaminated materials used for daily cover or for disposal, contained in NR 500 and NR 700 WAC, may require that disposal be approved by the WDNR or that multiple disposal facilities be utilized. Use of out-of-state landfills will be considered if volume acceptance limits within Wisconsin dictate. Out-of-state facilities will need to meet the individual state's requirements as well as 40 CFR 300.440.

Following the dewatering process, sediment would be transported to one or more disposal facilities by truck, rail, or barge. Five existing landfills have been identified within a 125 mile radius of the site. One of these facilities is a municipal landfill and may only accept treated sediment for daily cover. The remainder of the facilities are commercial landfills. An additional Wisconsin landfill was identified that can be accessed by rail service and is approximately 250 miles from the site. Estimated capacity for these landfills was obtained from WDNR and is current as of 2005. The combined remaining capacity according to the WDNR data is 17,500,000 cubic yards. A sixth landfill within 125 miles of the site is located in Michigan and according to the Michigan Department of Environmental Quality, its remaining capacity in 1999 was 2,700,000 cubic yards. Additional landfills capacity may be available in adjacent states (Minnesota, Illinois).

Alternatively, NSPW may initiate siting of a ch. NR 500 landfill in the Ashland area for solid materials removed from the Lakefront Site. This disposal option is dependent on the material volume (unlimited removal indicates in place volumes of 32,500 cy from the upper bluff, 223,000 cy from Kreher Park, and nearly 134,000 cy of sediment). The detailed analysis of this option will be included in the FS.

Wood Waste

There is the potential for generating a substantial quantity of wood waste if sediments are removed. The wood waste ranges in size from sawdust and chips to timber. Potentially, the larger debris could be burned as fuel at the NSP Bayfield Power Plant located in Ashland. Some additional maintenance at the plant would be required to accommodate the wood debris but this is considered a viable option at this time.

Ancillary Solid Wastes

Waste such as personal protective equipment (PPE), construction debris and other types of solid wastes generated during the conduct of remedial activities can be disposed of at a local municipal landfill. This management method will be used in all remedial alternatives. The quantity generated will depend on the remedial alternative. Personal protective equipment (PPE) will be evaluated and handled in accordance with USEPA guidance document to handle investigation derived waste (USEPA 1992).

4.2.5 Monitoring

The magnitude and nature of monitoring will depend upon the alternative selected. Monitoring can include verification monitoring to verify remediation objectives are met, operation and maintenance monitoring of disposal sites, or long-term monitoring to verify achievement of RAOs. As part of the Feasibility Study and Remedial Action Plan, the following monitoring programs will be developed:

- Baseline Monitoring
- Implementation Monitoring
- Verification Monitoring
- Operations and Maintenance Monitoring
- Long-term Monitoring

Specifics of these monitoring programs will be developed once an alternative has been selected. A summary of monitoring programs anticipated for various alternatives is presented along with the discussion of each specific alternative in Section.4.5.

4.3 Development of Remedial Alternatives for Sediment

This section describes the development of alternatives based on the evaluation of process options described above, and sets forth costs associated with each alternative.

As part of the three removal and containment alternatives (Alternatives SED-2, SED-3, and SED-4) monitored natural recovery (MNR) would be used to prevent access to areas where some risk could remain during remedial action, and to evaluate the impact of remedial actions with respect to reduction of risk through natural processes.

Monitored natural recovery relies upon naturally occurring processes to contain, reduce, or eliminate the toxicity or bioavailability of sediment contaminants. These processes may include burial of contaminants by continued sedimentation or degradation of contaminants by biological, chemical or other natural processes. As implied by its name, monitored natural recovery also includes acquisition of information on the effectiveness of these natural processes over time to verify that risk due to sediment contaminants is decreased.

In comments to the RAO Technical Memorandum, USEPA directed that "sediments exceeding 5.6 µg PAH/g dwt will be monitored to assure that there are no unacceptable impacts to the benthic community and that the levels of PAHs in the surface sediments to which the benthic [sic] is exposed decreases over time to [5.6 µg PAH/g dwt]". Furthermore, USEPA directed that, "the Remedial Action Plan will include specific performance objectives for monitoring Site sediments in the concentration range from 5.6 µg PAH/g dwt to 9.5 µg PAH/g dwt" and that "the Remedial Action Plan will include contingencies that will be implemented if the performance objectives for Natural Recovery of these sediments to levels lower than [5.6 µg PAH/g dwt] does not occur."

Thus, monitoring of natural recovery will be a component of all sediment alternatives.

The cost estimates presented in the following sections are preliminary since results of the treatability studies are not yet available. However, relative cost estimates for the three sediment alternatives should allow comparison since they were developed from the same information.

4.3.1 Alternative SED-1: No Action

The no-action alternative was retained as a baseline against which other technologies are compared. The no-action alternative assumes no cleanup or long-term monitoring, and is not expected to meet the RAOs. No action requires no planning, maintenance, or monitoring. Under this alternative, it is anticipated that natural mechanisms, such as dispersion, biodegradation, etc., would eventually reduce concentrations of VOC and PAH and NAPL; however, no monitoring would be performed to determine if these mechanisms are indeed taking place, nor would any method of evaluating potential risk to human health and the environment be enacted.

4.3.2 Alternative SED-2: Sediment Containment within a Confined Disposal Facility

Alternative SED-2 would consist of sediment removal and disposal, and containment within a CDF combined with IC and MNR. This alternative is illustrated in Figure 4-1and consists of the following components:

1) Determine the area of sediment containing significant wood debris and NAPL material to be covered by and contained within a CDF;
2) Construct CDF around pre-determined area;
3) Remove sediment containing concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC located outside the CDF footprint and place within CDF area; and
4) Monitor sediment areas outside of CDF where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed.

Contaminated sediment and soil from portions of the Site that are not included in the footprint of the CDF would be removed by dredging or excavation and placed within the CDF. Once the CDF is constructed, long-term monitoring of sediment where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed would be performed. The objective of the long-term monitoring will be to evaluate the effectiveness of the CDF relative to preventing

migration of contaminants to areas where exposure could occur, and to monitor the affect of natural recovery of areas outside of the CDF.

Since this alternative will involve filling of the nearshore area to elevations above the lake level, it would result in permanent loss of shallow water lake bed. As a result compensatory mitigation for wetland loss would be required.

Equipment that will be used for implementation of this alternative includes:

- Dredging equipment – for removing sediment from the lakebed
  - Hydraulic
  - Mechanical
- Excavation equipment – for construction of portions of the CDF and dewatering basins
  - Traditional
  - Long-stick
- Transportation equipment – for moving sediment from the dredge to the CDF
  - Barge
  - Piping
- Monitoring equipment – to evaluate effectiveness of remedy
  - Groundwater monitoring wells
  - Piezometers for water level measurements
  - Sediment sampling devices
  - Surface water sampling devices

4.3.2.1 Concept and Rationale for the CDF

Concept

A CDF alternative would meet the sediment RAOs at substantially less cost than anticipated for the other alternatives. This remedial alternative is designed to avoid the potential risks due to volatilization of VOCs during debris removal and dredging and excavation of sediment and soil. The CDF would be designed to cover most the areas of the offshore sediment that are impacted by NAPL and substantial volumes of wood debris. Sediment with unacceptably elevated levels of SVOCs and VOCs, including NAPL, as well as areas on upland portions of the Site that are impacted by wood material mixed with coal tar wastes, would remain in place and be incorporated into the CDF.

The design of the CDF would be compatible with the recreational nature of the nearshore area and incorporate features that will enhance both recreational use of the area as well as wildlife usage. Figures 4-2 and 4-3 illustrate this concept.

The CDF would be constructed over approximately six acres of lake bed and 13 acres of upland. The elevation at the lake boundary will be approximately 609' NGVD in order to prevent wave

overtopping. The top of the CDF would be fairly level, although there would be a provision for drainage and "blending" with upland topography.

As conceived, there would be open areas designed as grassland habitat and managed for wildlife, and other areas designed and managed for recreational use by the public, i.e., boaters, fishers, birdwatchers, etc.

There would also be the option for the City of Ashland to incorporate elements of an expanded marina similar to those envisioned in the Ashland Waterfront Development Plan.

Rationale and Precedent

A comprehensive discussion on the use of CDFs for disposal of contaminated sediments and precedent for CDFs in the Great Lakes by Dr. Mike Palermo is provided in Attachment 3. CDFs are one of the most commonly considered alternatives for contaminated sediments from navigation projects and are also an option commonly considered and more recently used for disposal of contaminated sediments dredged for purposes of sediment remediation (USACE 2003, USEPA 2005).

Design of CDFs has evolved over the years based on research and field experience. CDFs have combined design features and processes common to wastewater treatment, landfills, dams, and breakwaters. The designs for existing CDFs in the Great Lakes focused primarily on retention of sediment solids and physical stability of the dikes in the high-wave and ice-prone environment of the Great Lakes. In-water CDFs in the Great Lakes, (e.g., Duluth-Superior Harbor - Erie Pier) have dikes that resemble a breakwater made of stone, gravel and other materials. Large armour stones are typically placed on the outside face of the dike to protect against the erosive effects of waves. The inner core of the dike is often constructed with sand and gravel, sometimes in discrete layers. The dike, which is permeable, encircles the disposal area where the dredged material is placed. The sediment particles and contaminants bound to the particles settle out in the disposal area and excess water passes back through the dike. As the facility becomes filled, the dikes become less permeable, and water must be removed by overflow weirs, filters in the dikes, or pumping. Upland CDFs are designed with earthen dikes that resemble a levee or berm. The dikes are most often constructed with soil excavated from the disposal site, and the sides seeded to prevent erosion (Miller 1998).

Development of a comprehensive technical basis for CDF design aspects related to management of contaminated sediments began in the mid-1970s with the USACE research programs initially authorized by the River and Harbor Act of 1970 (P.L.91-611). These efforts included evaluation of sedimentation and consolidation processes in CDFs; weir design; CDF effluent and leachate control; equipment and techniques for dewatering and reclamation; and beneficial reuse of material in CDFs. The first guidelines for designing, constructing, and managing (CDFs) to maximize service life and minimize adverse environmental impacts were developed (Palermo, Montgomery, and Poindexter 1978), and these guidelines were subsequently updated and expanded in the USACE Engineer Manual *Confined Disposal of Dredged Material* (USACE 1987).

USACE and USEPA subsequently developed a Technical Framework for dredged material management (USACE 2004) that included full consideration of CDF contaminant transport pathways and controls, and developed a supporting sediment testing manual that provided detailed testing and evaluation procedures for CDF contaminant pathways (USACE 2003). An expanded Engineer Manual *Dredging and Dredged Material Management* (USACE in publication) has also been developed that will include guidance on design of contaminant control measures for CDFs. Collectively, these developments have resulting in a comprehensive technical basis for design of CDFs used for placement of contaminated sediments resulting from both navigation and sediment remediation projects.

Field experience and the availability of technically-based design procedures for CDF contaminant pathway evaluations and controls has led to increased consideration and use of CDFs for a number of sediment remediation projects – over 40 have been constructed on the Great Lakes alone (USACE 2003). As a result, USEPA recognized CDFs as an option for disposal of contaminated sediments at CERCLA sites in its Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA 2005):

"CDFs are engineered structures enclosed by dikes and specifically designed to contain sediment. CDFs have been widely used for navigational dredging projects and some combined navigational/environmental dredging projects but are less common for environmental dredging sites, due in part to siting considerations. However, they have been used to meet the needs of specific sites, as have other innovative in-water fill disposal options, for example, the filling of a previously used navigational waterway or slip to create new container terminal space (e.g., Hylebos Waterway cleanup and Sitcum Waterway cleanup in Tacoma, Washington). In some cases, new nearshore habitat has also been created as mitigation for the fill."

4.3.2.2 Mobilization/Demobilization, Site Preparation and Miscellaneous Activities

Mobilization will include transportation and erection of all dredge and crane equipment This will include any piping set up and barges mobilized to the site. The cost also includes site preparation which includes moving or abandonment of any existing utilities and provision of electrical power, adding a site security fence in the work areas and any pre-trenching that may be needed. Demobilization will include the teardown and removal of all of the equipment. Miscellaneous activities include preparing a Health and Safety Plan (HASP), health and safety personnel monitoring and construction oversight.

4.3.2.3 Construction of CDF

CDF construction would include driving the sheet pile wall to separate the areas inside not to be dredged and the outside area planned for dredging area as well as on land as described in Section 4.2.2.2. A barge mounted pile driver will be used for the in water locations. The design is intended to contain all of the sediment and groundwater in a water tight enclosure. On the lake side of the wall a protective stone dike will be constructed. The extent of this armored dike will be determined in Remedial Design. Other items included in the construction are placement and

disposal of the hydrocarbon booms along the inside perimeter of the water area to collect the NAPL that may be released during dredging and placement activities.

4.3.2.4 Sediment Removal

Sediment removal under this alternative is less complex because a design objective for the CDF is that it will cover most of the areas that contain large wood debris and NAPL. This will avoid the need for the substantial majority of debris removal and with it the potential for release of VOCs. Removal of sediment outside of the footprint of the CDF under this alternative likely will be accomplished with a hydraulic dredge. Although this will result in a need to treat substantially more dredge water, hydraulic dredging will minimize volatilization and resuspension. Some modern hydraulic dredges should be able to achieve 20% solids content (v/v) with careful control when dredging in areas that are relatively debris-free.

Under this alternative, volatilization associated with dredging and dredge material dewatering may be an issue, but it expected to be less than for Alternatives SED-3 and SED-4.

Areas outside of the footprint of the CDF with concentrations of tPAHs greater than 9.5 ug PAH/g dwt at 0.415% OC will be dredged and pumped directly to the CDF. Under this scenario approximately 74,000 CY would be dredged from areas outside of the CDF and disposed of in the CDF.

Performance Objectives for Dredging Residuals and Dredging-Related Resuspension

Dredging performance objectives will specify goals for residual concentrations of contaminants in surface sediments in areas that have been dredged. Typical performance objectives for dredging residual would be based upon the comparison of surface-weighted average concentrations (SWAC) to the sediment PRG. These performance objectives would specify whether re-dredging is necessary and in some cases when a thin layer cap would be applied to meet performance objectives.

Dredging performance objectives would also be developed for allowable rates of sediment resuspension during dredging, based upon water quality standards that are protective of ecological receptors and used for operational control of dredging. Typically, resuspension objectives are two or three-tiered and specify how dredging operations need to be modified if the action levels are exceeded.

Volatilization and Odor Control

If volatiles are released, they may disperse beyond the immediate vicinity of dredging operations and onshore treatment operations, depending upon ambient weather conditions (See Attachment 2). With the proximity of a relatively large population in Ashland, this presents the real possibility of unacceptable exposure unless it is possible to design engineering controls.

Controls for minimization of volatile releases are available for onshore operations; however, volatilization control for operations on the water would have to be investigated further during a pilot scale project, since tenting over working dredges on the water is difficult and would add complexity to maintaining efficient dredge production rates.

It is likely that remedial construction workers would have to use Class C PPE.

Silt Curtains and Hydrocarbon Booms

Engineering controls for minimizing release and dispersal of dissolved or free phase contaminants to water beyond the Site are well developed and would likely consist of redundant turbidity barriers and booms. Temporary sheet piling will also be considered if redundant turbidity barriers and booms are not effective. This aspect of a dredging remedy can also be evaluated and optimized though a pilot scale project.

4.3.2.5 Sediment Dewatering

Prior to dewatering, the dredge material will be processed to separate wood from sediment. This can be achieved through processes that separate sediment by screening, gravity settling, and floatation. Screening would likely take place on the dredge if the material is mechanically dredged and hydraulically transported to the CDF. No other dewatering will be needed except for dredge dewatering of the debris stockpile in the barge before placing debris in the dumpster for disposal.

4.3.2.6 Water Treatment

Water treatment potentially would include addition of polymers and alum to help settle fine particles in the CDF. Water would be pumped off at a rate equal to the sediment placement into the CDF. The system would include pumping the clear water near the surface of the CDF to a sand filter or other cartridge filters, an oil/water separator and through an activated carbon bed. The treated water meeting the substantial requirements of an NPDES permit would be discharged to Lake Superior or to the WWTP. The cost for water treatment also includes operating a skimmer in the CDF to control any floating NAPL.

As an alternative to direct placement of sediments in the CDF after mechanical dredging, hydraulic transportation from the mechanical dredged sediments may be considered. This would include a screen on a hopper at the dredge that would discharge to a high solids slurry pump. Here make-up water that is pumped from CDF after settling would be and mixed with the sediments to 15%-20% solids level and hydraulically conveyed in a hose through a discharge nozzle into the CDF. This nozzle could be a treme' type design to minimize velocity at the discharge and also minimize suspension of fines in the CDF water. The treme' would allow more controlled placement and help reduce water settlement treatment in the CDF due to lower fines in the water caused during sediment placement. An estimated flow of about 40 million gallons will be re-circulated to the dredge using only settlement and polymer treatment in the CDF prior to pumping back to the dredge. Approximately 14.9 million gallons will get fully treated and

discharged to the lake or sewer system. This discharge volume is about the same volume for both placement methods.

4.3.2.7 CDF Closure

Closure of the CDF after all dredging is complete will include construction of a CDF cap. This includes placing a two-foot sand cap on the dredged sediments to begin the consolidation process. The cap will be placed in one foot lifts to allow even loading. After sufficient consolidation to obtain strength, additional sand will be placed in areas that are lower due to differential settlement. A geotextile drainage layer will be added, followed by a two foot compacted clay layer underlying a 40 mil HDPE liner. Drainage wells or wicks will be used to continue water removal during additional consolidation from the drainage layer below the HDPE liner. Another geotextile drainage layer will be added above the HDPE liner to collect the storm water seepage. A two-foot compacted layer additional foot of fill (sand) will then be placed on top of the HDPE liner with an overlying layer 0.5 ft top soil that will be seeded for grass.

On the land side of this cap in Kreher Park to the Marina Drive, the cap will be designed to meet the requirements of a RCRA Class C or D landfill and will be vegetated or paved on top. As discussed in Section 4.2.2.2 up gradient groundwater will be passively diverted around the CDF through use of drainage tiles, etc. This includes discharges to storm drainage systems that would be a part of the hydraulic control plan for the upland and sediment capping area. This may also include vegetation plantings and landscaping to enhance evapotranspiration and drainage from the bluff hillside.

4.3.2.8 Wetland Mitigation

Interaction with WDNR would be needed to identify appropriate mitigation/restoration projects to compensate for permanent loss of shallow water lake bed. Appropriate projects might include wetlands/river restoration, granting access across NSPW property adjacent to rivers or conveyance of land that has relevant environmental value. For purposes of this Technical Memorandum we will include an estimated cost of $1.5 million.

4.3.2.9 Monitoring

The magnitude and nature of monitoring will depend upon the alternative selected. Monitoring can include the following:

- baseline monitoring;
- implementation monitoring;
- verification monitoring;
- operation and maintenance monitoring; and
- long-term monitoring to verify achievement of RAOs.

As part of the Feasibility Study and Remedial Action Plan, the following monitoring programs would be developed.

Baseline Monitoring

Once RAOs are established and prior to implementation of the remedy, the database of information from all Site studies will be reviewed to ascertain whether an adequate statistical database is available to provide the basis for determining whether performance criteria are achieved. Based upon this review additional baseline sampling may be necessary.

Implementation Monitoring

Monitoring during implementation of the remedy will be conducted to ensure that remediation is being conducted in accordance with the Remedial Action Plan and that all project design specifications including performance of the contractor and environmental controls are met.

Verification Monitoring

Of particular importance to removal alternatives, verification monitoring determines whether performance criteria established for environmental media cleanup levels are met.

Operations and Maintenance Monitoring

Operations and maintenance monitoring will be required for any on site structures, e.g., CDFs, or continuing operations, e.g., hydraulic control, that are part of the Site remedy. This will verify continuing source control as well as ensure structures and/or control operations continue to perform as designed.

Long-term Monitoring

Long-term monitoring is primarily focused on verifying the continuing achievement of RAOs. It is of particular importance if any RAO is to be met through natural attenuation or natural recovery mechanisms. Generally, long-term monitoring is performed to ensure that the Remedial Action taken at the site continues to achieve RAOs. Contingency plans will be implemented in instances where expected results of remediation, RAOs, are not met.

4.3.2.10 Cost

The cost for this alternative is estimated at approximately $30,500,000. Various cost elements are summarized in Table 4-2.

Table 4-2 - Cost Summary – Alternative SED-2: CDF.

Task	Estimated Cost*
Mob/Demob & Miscellaneous	$2,298,000
Construct CDF	11,195,000
Dredge	9,696,000
Complete CDF	4,970,000
Compensatory Mitigation	1,500,000
Long Term Monitoring	800,000
Total Estimated Cost	**$30,459,000**

* Cost includes oversight and administration, engineering and contingency.

4.3.3 Alternative SED-3: Subaqueous Capping

Alternative SED-3 would consist of sediment and debris removal, subaqueous capping, dewatering, consolidation, and off site disposal with or without on site treatment, combined with MNR. The shallow nature of nearshore portions of the Site requires that some dredging be completed prior to capping so that the cap remains subaqueous and doesn't interfere with navigation or recreational boating. In addition, because of the location, the cap would have to be armored to resist erosion.

Costs estimates have been prepared for options under this alternative:

Alternative SED-3A: Mechanical Dredging, No Decontamination of Sediment
Alternative SED-3B: Mechanical Dredging, Thermal Decontamination of Sediment
Alternative SED-3C: Hydraulic Dredging, No Decontamination of Sediment
Alternative SED-3D: Hydraulic Dredging, Thermal Decontamination of Sediment

This alternative is illustrated in Figure 4-4 and consists of the following components:

1) Determine the area of sediment containing significant wood debris and free-phase material with concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC;
2) Remove sediment in these areas to a depth of approximately four feet using one or more of the following means from barge-based or land-based platforms:
    a. hydraulic dredging;
    b. mechanical dredging; or
    c. excavation.
3) In areas where PAH levels do not exceed 9.5 ug PAH/g dwt at 0.415% OC at depths greater than approximately six feet, all sediment exceeding 9.5 ug PAH/g dwt at 0.415% OC will be removed.
4) Dewater dredged sediment on site using a settling pond and mechanical separation followed by on site treatment of sediment and liquid or off site disposal of sediment;
    a. If sediment is treated using LTTD, HTTD, or incineration it would be sent for off site disposal at a solid waste or other landfill after treatment;
    b. If sediment is not treated on site but only stabilized, it would be sent to a NR500 landfill for off site disposal;
    c. Water would be treated using flocculation, clarification, sand filtering, and carbon filtering and discharged to the Ashland WWTP. Alternatively it could be discharged directly to Lake Superior if it met DNR surface water criteria;
5) Construct subaqueous armored cap over dredged area; and
6) Monitor sediment areas outside of cap where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed.

Subaqueous capping would make use of a variety of materials, including some that would be reactive with site contaminants to contain or treat contaminants in situ. A properly designed cap would significantly decrease contaminant mobility and isolate the contaminants from the overlying water column and prevent exposure to ecological receptors or humans by covering the sediment.

Equipment that will be used for implementation of this alternative includes:

- Dredging equipment – for removing sediment from the lakebed
    - Hydraulic
    - Mechanical
- Excavation equipment – for construction of dewatering basins
    - Traditional
- Transportation equipment – for moving sediment from the dredge to the dewatering basins
    - Barge
    - Piping
- Dewatering equipment – for removing water from sediment prior to treatment or disposal
    - Settling ponds
    - Mechanical dewatering equipment
- Treatment equipment

  - LTTD
  - HTTD
  - Incinerator
  - Water treatment system
    - Flocculation
    - Clarification
    - Sand filtration
    - Carbon filtration
    - Oil/water separator
  - Solidification
- Disposal equipment
  - Piping to lake or WWTP for treated water
  - Transport to disposal location
    - Rail
    - Truck
    - Barge
- Monitoring equipment – to evaluate effectiveness of remedy
  - Groundwater monitoring wells
  - Piezometers for water level measurements
  - Sediment sampling equipment
  - Surface water sampling equipment

4.3.3.1 Concept and Rationale for Subaqueous Capping

Concept

The subaqueous capping alternative was selected for consideration because implementation of this alternative would meet the RAOs through capping of sediment that poses risk to human health and the environment. The cap would be designed to prevent access to impacted sediment with concentrations greater than 9.5 ug PAH/g dwt at 0.415% OC, as well as minimize migration of VOCs and SVOCs from within the sediment to surface water and unimpacted areas.

As previously stated, up to four feet of debris and sediment would be removed from the cap area to maintain the navigability of the submerged area to allow continued use as a recreational area and promote recruitment of aquatic organisms. Figure 4-5 illustrates the implementation of a cap over sediment.

The subaqueous cap would be constructed over approximately six acres of lake bed. Following construction, there would be no restrictions on usage of the capped area.

Rationale and Precedent

Subaqueous capping reduces risk associated with impacted sediment by eliminating the possibility of contact with sediment through removal and containment. In order to allow continued use of the area for water recreation, sufficient thickness of sediment would be

removed to allow the cap to be placed without changing the elevation of the lake bottom in the area being capped.

Subaqueous caps have been constructed at numerous locations across the U.S.

4.3.3.2 Mobilization/Demobilization, Site Preparation, Site Restoration and Miscellaneous Activities

Mobilization/demobilization includes all the equipment needed for dredging, capping, and water treatment. This is estimated to be 5% of the remedial costs. Also included are pre and post bathymetric surveys and turbidity curtains across the bay to contain the dredging area. The miscellaneous activities include the preparing the HASP, health and safety personnel monitoring and construction oversight. Site restoration includes placing six inches of clean sediment on areas outside that are dredged outside the capped area.

4.3.3.3 Sediment Removal

Under this alternative, sediment overlying areas with large quantities of wood debris and areas containing NAPL would be dredged to a depth of approximately four feet. All sediments above the PRG in areas where levels of PAHs greater than 9.5 ug PAH/g dwt at 0.415% OC are not found deeper than six feet. This would allow placement of a subaqueous cap without interfering with navigation.

Sediment removal under this alternative would be conducted with excavators, mechanical dredges and hydraulic dredges. As discussed in Section 4.2.3, excavators and/or mechanical dredges would be used to remove debris from the targeted areas. In some places near shore, caissons could be constructed to enable dewatering, which would allow use of shore-based excavators to remove sediment. The efficacy of this latter approach will be determined during a pilot scale project.

After removal of debris, hydraulic dredges would be employed to dredge sediments above the PRG as described above. The dredge slurry will be pumped to an on-shore dewatering and treatment facility. Engineering controls likely will need to be implemented to minimize volatilization of VOCs during dredging. As previously discussed this can best be evaluated during a pilot scale project.

Performance objectives for dredge residuals and resuspension and control of volatilization and odour would be as discussed for Alternative SED-2 (Section 4.3.2.4).

4.3.3.4 Sediment Dewatering

Dewatering includes screening operations to remove large wood debris and operation of the plate and frame filter presses for dewatering prior to final sediment treatment. Also included is about a 4 acre pond system and stockpile area built at Kreher Park area with a lined earthen dike. Costs are included in the sediment treatment category discussed later. Volumes of dredged

sediment slurries are estimated to be 13,000,000 gallons for mechanical dredging and 80,000,000 gallons for hydraulic dredging. No VOC controls have been included in costs at this time. However, based upon the results of the treatability studies they may be needed due to the naphthalene and benzene emissions. This will be discussed later in the FS when all of the treatability testing and modeling results are available.

4.3.3.5 Water Treatment

Water treatment includes sand filtration, oil/water separators, carbon filtration and related testing for O&M and discharge. Discharge will be to the Lake Superior or City of Ashland sewer system. Quantities range from about 5,200,000 gallons under mechanical dredging options to 69,300,000 gallons for hydraulic dredging. Costs for this are included in the sediment treatment category discussed later. Most of the systems are closed and should have minimal impact on air emissions or have cost controls.

4.3.3.6 Sediment Treatment

Sediment treatment includes either stabilization for direct landfill disposal, or as a contingency, thermal treatment to destroy the organics before land filling. Both processes have the potential to create some emissions in handling the dewatered sediment feed to the systems. This potential is likely much lower emissions than the dewatering operations unless there is an upset in the operations. The sediment treatment volumes are the same for all mechanical and hydraulic dredging options since they would all achieve the same dewatered feed volume of approximately 38,000 cy. The volume and weight after treatment is higher for stabilization since the process would add 10% more weight. Weight is estimated at 58,000. On the other hand thermal treatment which would reduce the water weight and not add material. This process would generate approximately 34,000 tons for disposal. HTTD was assumed to be the most cost effective thermal method and is the basis for the cost estimates. However additional design testing would be needed to evaluate this choice.

Sediment treatment includes the process of either stabilization for direct landfill disposal or thermal treatment to destroy the organics before land filling. Both processes have the potential to create some emissions in handling the dewatered sediment feed to the systems. There are likely much lower emissions associated with sediment treatment than with the dewatering operations unless there is an upset in the operations. The sediment treatment volumes are the same for all mechanical and hydraulic dredging options since they would all achieve the same dewatered feed volume of 37,258 cy. The volume and weight after treatment is higher for stabilization since it would add 10% more weight. There would result in approximately 57,539 tons for disposal compared to thermal treatment which would result in approximately 33,999 tons for disposal. HTTD is assumed to be the most cost effective thermal method and is the basis for the cost estimates. However additional design testing would be needed to evaluate this choice.

Sediment handling costs that include sediment dewatering, water treatment and sediment treatment are shown in Table 4-3. The major differences in cost are due to water treatment costs for hydraulic dredging and difference in stabilization versus thermal treatment costs.

4.3.3.7 Sediment Disposal

The disposal process will include the loading of sediment following drying and treatment/stabilization at the Site, and transportation to a commercial/industrial landfill. Several scenarios were evaluated for this option, assuming a sediment quantity of 78,000 cy based upon the sediment PRG. For purposes of cost estimation it is assumed one cubic yard of sediment will weigh 1.5 tons.

Truck transport to Seven Mile Creek landfill, Eau Claire, WI.

Under this scenario, sediment will be loaded into trucks and transported 125 miles to this facility for disposal. This alternative is the basis for disposal options cost estimates.

Barge and truck transport to K & W landfill, Ontonagon, MI

Under this scenario, sediment will be loaded on to barges in Ashland and transported via Lake Superior to Ontonagon, MI. Upon arrival in Michigan the sediment would be off-loaded to trucks for transport the remaining distance (20 miles) to the landfill. A typical barge has a capacity of approximately 1,500 tons, roughly the capacity of 100 trucks. Cost estimates include costs for improvements to the dock areas in Ashland and Ontonagon to facilitate loading and unloading of the sediment.

Rail transport to Cranberry Creek landfill, Wisconsin Rapids, WI

The third scenario evaluated assumes the sediment is loaded onto rail cars and transported to the Cranberry Creek landfill, Wisconsin Rapids, WI. Since the rail spur at the site is no longer connected to the main line, sediment would need to be loaded into trucks and transported elsewhere in Ashland and loaded on to rail cars. Rail service is available within the industrial park within Ashland, and estimated distance of five miles from the site. Sediment would then be transported via rail to the landfill in Wisconsin Rapids. Rail car capacity for estimation purposes is 100_tons. A train comprised of 50 cars would be able to transport 5,000 tons, roughly equal to 250_truck loads. Cost estimates include costs for improvements to the rail loading facility to facilitate transfer from the trucks directly to the rail cars.

Other Disposal Alternatives

As previously discussed, NSPW also may initiate siting of a ch. NR 500 landfill in the Ashland area for solid materials removed from the Lakefront Site. This disposal option is dependent on the material volume. The detailed analysis of this option will be included in the FS.

Wood Waste

There is the potential for generating a substantial quantity of wood waste if sediments are removed. The wood waste ranges in size from sawdust and chips to timber. Potentially, the larger debris could be burned as fuel at the NSP Bayfield Power Plant located in Ashland. Some additional maintenance at the plant would be required to accommodate the wood debris but this is considered a viable option at this time and will evaluated further in the FS.

Ancillary Solid Wastes

Waste such as personal protective equipment (PPE), construction debris and other types of solid wastes generated during the conduct of remedial activities can be disposed of at a local municipal landfill. This management method will be used in all remedial alternatives. The quantity generated will depend on the remedial alternative. Personal protective equipment (PPE) will be evaluated and handled in accordance with USEPA guidance document to handle investigation derived waste (USEPA 1992).

4.3.3.8 Subaqueous Capping

A subaqueous cap will be designed for placement over the area that has been dredged to four feet but still has sediments exceeding the sediment PRG. Dredging to four feet will provide sufficient depth for placement of an armored cap while not decreasing the lake bottom depth. Cap material considered in this application would be natural sand, organo-clays and/or carbon or other amendments to adsorb contaminants, and rock armoring to resist erosion.

The cap will consist of first installing a two layer organic clay liner over the area to be capped As an alternative a geotexile with activated carbon or bentonite sandwiched between a needle point punched mat may be installed. This will require first placing a 6-9 inch sand layer for protection from debris and levelling the surface. A three foot sand cover next would be placed over the area to be capped using a spreader barge, clam shell dredge or excavator on a barge. The sand cover would be added in 6-12” lifts to allow for consolidation of the underlying sediments to account for differential settlement. The sand cap would then provide containment and allow the sediments to gain strength and stability with the consolidation from the cap load. In areas where the water is less than six feet deep armoring using stone rip rap would be added for wave protection. A post capping bathymetric survey would be conducted to assure proper coverage and as a baseline for future measurements.

4.3.3.9 Monitoring

Monitoring options for this alternative would be the same as those listed in Section 4.2.2.9, with the exception that the monitoring plan would be geared toward monitoring the effectiveness of a subaqueous cap rather than a CDF.

4.3.3.10 Cost

The total cost for this alternative ranges from approximately $38, 321,000 to $59,223,000 depending upon whether the sediment is mechanically or hydraulically dredged and whether thermal treatment is needed. Cost elements are summarized in Table 4-3

Table 4-3 -Cost Summary – Alternative SED-3: Dredge/Cap.

Task	Estimated Cost*			
	SED-3A	SED-3B	SED-3C	SED-3D
	Mechanical Dredge - No Treatment	Mechanical Dredge - Thermal Treatment	Hydraulic Dredge - No Treatment	Hydraulic Dredge - Thermal Treatment
Mob/Demob & Miscellaneous	$3,630,000	$4,359,000	$3,899,000	$4,625,000
Dredge	5,015,000	5,015,000	4,956,000	4,956,000
Cap	11,281,000	11,281,000	11,281,000	11,281,000
Sediment Handling[1]	11,514,000	27,674,000	16,964,000	33,059,000
Transport and Disposal	5,681,000	4,102,000	5,681,000	4,102,000
Long Term Monitoring	1,200,000	1,200,000	1,200,000	1,200,000
Total Estimated Cost	**$38,321,000**	**$53,631,000**	**$43,981,000**	**$59,223,000**

* Cost includes oversight and administration, engineering and contingency.

1: Sediment handling includes screening, dewatering, treatment and/or stabilizing if necessary.

4.3.4 Alternative SED- 4: Removal

Alternative SED-4 would consist of removal, dewatering, consolidation, and off site disposal with or without on site treatment, combined with MNR. Under this alternative, the greatest amount of sediment would be removed, treated and disposed of. This alternative, illustrated in Figure 4-6, consists of the following components:

1) Determine sediment with concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC;
2) Remove these sediments using one or more of the following means from barge-based or land-based platforms:
    a. hydraulic dredging;
    b. mechanical dredging; or
    c. excavation.
3) Dewater dredged sediment on site using a settling pond and mechanical separation;
4) Water would be treated using an oil/water separator, flocculation, clarification, sand filtering, and carbon filtering and discharged to the Ashland WWTP. Alternatively it could be discharged directly to Lake Superior provided it met WI surface water criteria;
5) Dewatered sediment would be stabilized and disposed off site in a NR500 landfill or treated on site using LTTD, HTTD, or incineration prior to off site disposal at a solid waste or other landfill; and
6) Monitor sediment areas outside of cap where concentrations of PAH greater than 5.6 µg PAH/g dwt at 0.415% OC have been observed.

Removal is technically feasible for the Site, although several issues would have to be addressed in the design of a dredging alternative, including potential release of free-phase product and dispersal and volatilization of VOCs during dredging activities, as well as management of dredging residuals and handling of a substantial amount of wood debris. Some aspects of the Site are more disposed to the use of mechanical dredges or excavators (e.g., debris removal), while other aspects favor hydraulic dredges, (e.g., capture of free phase and minimization of volatilization).

Costs estimates have been prepared for options under this alternative:

Alternative SED-4A: Mechanical Dredging, No Decontamination of Sediment
Alternative SED-4B: Mechanical Dredging, Thermal Decontamination of Sediment
Alternative SED-4C: Hydraulic Dredging, No Decontamination of Sediment
Alternative SED-4D: Hydraulic Dredging, Thermal Decontamination of Sediment

Equipment that will be used for implementation of this alternative includes:

- Dredging equipment – for removing sediment from the lakebed
    - Hydraulic
    - Mechanical
- Excavation equipment – for construction of dewatering basins
    - Traditional
- Transportation equipment – for moving sediment from the dredge to the dewatering basins
    - Barge
    - Piping
- Dewatering equipment – for removing water from sediment prior to treatment or disposal
    - Settling ponds
    - Mechanical dewatering equipment
- Treatment equipment
    - LTTD
    - HTTD
    - Incinerator
    - Water treatment system
        - Flocculation
        - Clarification
        - Sand filtration
        - Carbon filtration
    - Solidification
- Disposal equipment
    - Piping to lake for treated water
    - Transport to disposal location
        - Rail

    - Truck
    - Barge
- Monitoring equipment – to evaluate effectiveness of remedy
    - Groundwater monitoring wells
    - Piezometers for water level measurements
    - Sediment sampling devices
    - Surface water sampling devices

4.3.4.1 Concept and Rationale for Removal

Removal by dredging is generally the presumptive remedy for contaminated sediment if cost factors and/or risk factors don't result in other alternatives being favored. Removal of contaminated sediment with dredges or excavators has been successfully implemented at a number of contaminated sediment sites. However, as discussed in Section 4.2.3 Site characteristics at Ashland provide several unique challenges.

4.3.4.2 Mobilization/Demobilization, Site Preparation, Site Restoration and Miscellaneous Activities

The mobilization/demobilization includes all the equipment needed for dredging, capping, and water treatment. This is estimated to be 5% of the remedial costs. Also included are pre and post bathymetric surveys and silt curtains across the bay to contain the dredging area. The miscellaneous activities include preparation of the HASP, health and safety personnel monitoring and construction oversight. Site restoration includes placing six inches of clean sediment in areas that are dredged.

4.3.4.3 Sediment Removal

Under this alternative, sediments greater than 9.5 ug PAH/g dwt at 0.415% OC would be removed regardless of depth. In some areas, sediments as deep as ten feet would be removed. Sediment removal under this alternative would be conducted with excavators, mechanical dredges and hydraulic dredges. As discussed in Section 4.2.3, excavators and/or mechanical dredges would be used to remove debris from the targeted areas. In some places near shore, caissons could be constructed to enable dewatering near-shore areas, which would allow use of shore-based excavators to remove sediment. The efficacy of this latter approach will be determined during a pilot scale project.

Under this alternative, engineering controls would likely need to be implemented to minimize volatilization of VOCs during dredging. As previously discussed this can best be evaluated during a pilot scale project. During dredging operations, turbidity curtains and floating hydrocarbon booms would be deployed to minimize dispersal of suspended sediments or floating free phase.

Because this alternative would result in substantial changes to the bathymetry of the nearshore waters at the Site, approximately 30,000 of clean fill will have to be placed in the nearshore

areas that were dredged deeper than approximately two feet to partially restore pre-dredge contours.

Performance objectives for dredge residuals and resuspension and control of volatilization and odour would be as discussed for Alternative SED-2 (Section 4.3.2.4).

4.3.4.4 Sediment Dewatering

Dewatering is similar to Alternative SED-3 and includes screening to remove large wood debris and operation of plate and frame filter presses for dewatering prior to final sediment treatment. Also included is about a four acre pond system and stockpile area built on the Kreher Park area built with a lined earthen dike. Costs for that are included in the sediment treatment category discussed later. Volumes of dredged sediment slurries are estimated at 21,900,000 gallons for mechanical dredging and 131,700,000 gallons for hydraulic dredging. No VOC controls have been included in costs at this time. However, they may be needed due to naphthalene and benzene emissions. Since the dredging and dewatering are greater volumes than in Alternative SED-3, the emissions will also be last longer. This will be discussed later in the FS when all of the treatability testing and modeling results are available.

4.3.4.5 Water Treatment

Water treatment is also similar to Alternative SED-3 and includes sand filtration, oil/water separators, carbon filtration and related testing for O&M and discharge. Discharge meeting the requirements of an NPDES permit will be to Lake Superior or the City of Ashland WWTP. Estimated treatment quantities range 8,900,000 gallons for mechanical dredging to 118,800,000 gallons for hydraulic dredging. Costs are included in the sediment treatment category discussed later. Most of the systems are closed and should have minimal impact on air emissions or have cost control.

4.3.4.6 Sediment Treatment

Sediment treatment is the same as Alternative SED-3, however the volumes are larger. Sediment treatment includes either stabilization for direct landfill disposal or as a contingency, thermal treatment to destroy the organics before land filling. Both processes have the potential to create some emissions in handling the dewatered sediment feed to the systems. This is likely much lower emissions than the dewatering operations unless there is an upset in the operations. The sediment treatment volumes are the same for all mechanical and hydraulic dredging options since they would all achieve the same dewatered feed volume of approximately 64,000 cy. The volume and weight after treatment is higher for stabilization (99,000 tons) since it would add 10% more weight. Thermal treatment would reduce the water weight and with no added material would result in approximately 58,500 tons for disposal. HTTD is again assumed to be the most cost effective thermal method and is the basis for cost estimates for thermal treatment at this time. However additional design testing would be needed to evaluate this choice.

Sediment handling costs include sediment dewatering, water treatment and sediment treatment as shown in Table 4.4. Major cost differences are due to water treatment costs for hydraulic dredging and difference in stabilization versus thermal treatment costs.

4.3.4.7 Sediment Disposal

The disposal process under this alternative are the same as for Alternative SED-3 (Section 4.3.3.7). There is just more sediment to dispose.

4.3.4.8 Monitoring

Monitoring options for this alternative would be the same as those listed in Section 4.3.2.9, with the exception that the monitoring plan would be geared toward monitoring the potential exposure to residual materials.

4.3.4.9 Cost

The total cost for this alternative ranges from approximately $42,152,000 to $82,496,000 depending upon whether the sediment is mechanically or hydraulically dredged and whether thermal treatment is needed. Cost elements are summarized in.

Table 4-4 - Cost Summary – Alternative 4: Dredge All.

Task	Estimated Cost*			
	SED-4A	**SED-4B**	**SED-4C**	**SED-4D**
	Mechanical Dredge - No Treatment	**Mechanical Dredge - Thermal Treatment**	**Hydraulic Dredge - No Treatment**	**Hydraulic Dredge - Thermal Treatment**
Mob/Demob & Miscellaneous	$4,775,000	$6,028,000	$5,451,000	$6,696,000
Dredge	8,426,000	8,426,000	8,426,000	8,426,000
Sediment Handling[1]	18,605,000	46,390,000	32,053,000	59,746,000
Transport and Disposal	9,776,000	7,058,000	9,849,000	7,058,000
Long Term Monitoring	570,000	570,000	570,000	570,000
Total Estimated Cost	**$42,152,000**	**$68,472,000**	**$56,349,000**	**$82,496,000**

* Cost includes oversight and administration, engineering and contingency.
1: Sediment handling includes screening, dewatering, treatment and/or stabilizing if necessary

4.4 Detailed Analysis of Remedial Alternatives

In the above section, alternatives for sediment were developed in accordance with CERCLA and NCP requirements as well as additional guidance documents available from the USEPA. In this section these alternatives are assessed against criteria specified in the NCP and USEPA guidance, as follows:

- Threshold Criteria
  - Overall compliance with human health and the environment
  - Compliance with ARARs

- Balancing Criteria
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility and volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost

- Modifying Criteria (assessed after the public comment period)
  - State and Agency Acceptance
  - Community acceptance

4.4.1 Threshold Criteria

Of the nine CERCLA-defined FS evaluation criteria, two criteria are threshold criteria and must be met by each remedial alternative to be considered applicable and appropriate for the remedy. These include:

- overall protection of human health and the environment; and
- compliance with ARARs.

4.4.1.1 Overall Protection of Human Health and the Environment

Protection of human health and the environment is based on an evaluation of the remedial alternative's ability to be protective of human health and the environment. The evaluation focuses on how a specific alternative achieves adequate protection, and how site risks are eliminated, reduced, or controlled. Unacceptable short-term or cross-media impacts are also evaluated, if present.

This evaluation criterion provides a final check to assess whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Evaluation of the overall protectiveness of an alternative should focus on whether a specific alternative achieves adequate protection and should describe how site risks posed through each pathway being addressed by the FS are eliminated, reduced, or controlled through treatment, engineering, or institutional controls. This evaluation also allows for consideration of whether an alternative poses any unacceptable short-term or cross-media impacts.

4.4.1.2 Compliance with ARARs and TBCs

Each remedial alternative is evaluated against ARARs to determine compliance. If there are ARARs that are not met by an alternative, either the alternative can not be selected or there may be a basis for justifying a waiver of the ARAR under CERCLA. The justification for a waiver should be discussed under this criterion.

A complete listing and discussion of ARARs and TBCs was presented in the ASTM. This evaluation criterion is used to determine whether each alternative will meet Federal and State ARARs (as defined in CERCLA Section 121) that have been identified in previous stages of the RI/FS process. The detailed analysis should summarize which requirements are applicable or relevant and appropriate to an alternative and describe how the alternative meets these requirements. When an ARAR is not met, the basis for justifying one of the six waivers allowed under CERCLA should be discussed.

ARARs specific to Retained Alternatives

Alternative SED-1 – No Action
There are no ARARs that pertain to the no-action alternative, since no action is taken.

Alternative SED-2 –CDF, Removal and MNR
Under Alternative SED-2, steps would be taken to minimize or eliminate potential exposure to impacted sediment by removing sediment where concentrations of PAH exceed the sediment PRG. ARARs and TBCs that would relate to this alternative include landfill siting requirements (Wisconsin Statutes Chapter 289), design requirements for construction of a CDF in water (NR 322), and permission from the State to build the CDF on state property. In addition, WDNR has indicated that this alternative would need approval from both the Governor and State Legislature

Construction of a CDF would include the placement of fill material and some type of structure to contain the fill on the bed of Lake Superior. There are several available procedural mechanisms which might be used to authorize such fill and structure placement.

Section 30.12 permit: State of Wisconsin Statute Section 30.12 addresses the deposit of “any material” or placement of “any structure” upon the bed of any navigable waterway. Section 30.12 provides that approval may be given by WDNR via issuance of either a general or individual permit. Section 30.12 also recognizes that special authorization may be granted by the Wisconsin Legislature. In correspondence dated March 30, 2007, WDNR staff have advised their interpretation of Section 30.12 limits the agency’s ability to issue permits that authorize

deposits to "small amounts of incidental fill when associated with other structures." The language of Section 30.12 does not contain such a limitation on WDNR's authority and the Company does not agree that the agency's authority is so limited. To the extent that authorization under Section 30.12 might be deemed necessary but not available to an aquatic CDF, this statutory requirement may be pre-empted as a process ARAR via CERCLA section 121 (e)(1) or on the basis that it improperly "restricts the range of options available to the EPA." See, United States v. Denver, City and County Of, 100 F.3d 1509, 1512 (10th Cir. 1996).

Legislative lake bed grant: We are aware of at least two aquatic CDFs that have been authorized in Wisconsin Great Lakes waters via legislative lake bed grant. Pursuant to its authority under Article IX, Section 1 of the Wisconsin Constitution, the Wisconsin Legislature may grant authority to utilize a portion of lake bed for purposes considered to be consistent with the public trust in those navigable waters. Such legislative lake bed grants have been made to authorize the CDF in the waters of Lake Michigan's Green Bay. Wisconsin Statute Section 13.097 provides that WDNR is to report to the Legislature the agency's view of whether the lake bed grant is consistent with protecting and enhancing a public trust purpose. A legislative lake bed grant can be made only to a municipality; thus, if this mechanism is used either the City or County of Ashland would likely be designated as the lake bed grantee. Because a legislative lake bed grant is a form of legislative action, signature by the Governor would also be required.

Board of Commissioners of Public Lands Lease: State of Wisconsin Statute Section 24.39 authorizes the Board of Commissioners of Public Lands (BCPL) to enter into long-term (50-year), renewable leases of submerged lake bed for various purposes, including "improvements to water navigation, construction of harbor facilities, and recreation." State of Wisconsin Statute Section 30.11(5) directs WDNR to advise BCPL of its view as to the consistency of the proposed lease and associated use with the public interest. The BCPL can enter into leases with either municipal or private parties; however, the lessee must be the riparian property owner. If this mechanism is used, the City of Ashland as riparian owner would likely be the lessee and such a lease may well be consistent with the City's harbor development plans. BCPL leases do not require legislative or gubernatorial approval.

In light of the number of mechanisms that might be utilized to authorize an aquatic CDF, it would be premature to eliminate this option or to deem it less viable than other options currently under consideration. Design specifications for the CDF would need to satisfy the substantive statutory, public interest and public trust requirements; however, it is possible that all of these mechanisms may be considered process ARARs and thus subject to the CERCLA § 121(e)(1) permitting exemption as the CDF would constitute an "on site" remedy as defined in 40 CFR § 300.400(e)(1).

Additional action may be required to meet air and surface water quality during dredging and dewatering operations. Furthermore, wetlands mitigation may be necessary as part of this alternative. Upon proper implementation of this alternative, ARARs would be met.
Attachment 1 summarizes the ARARs and TBCs that affect implementation of Alternative SED-2.

In addition to the ARARs and TBCs described above the design of sediment removal process and CDF will have from U.S. Army Corps of Engineers concurrence.

Alternative SED-3 – Removal, Treatment, Disposal, Capping, and MNR

Under Alternative SED-3, steps would be taken to minimize or eliminate potential exposure to impacted sediment by removing sediment to a depth of four feet where concentrations of PAH exceed the sediment PRG. Sediment removed would be dewatered and treated on site using thermal treatment, or dewatered and sent off site for disposal in a landfill. Sediment located outside of the capped area with concentrations of PAH greater than 9.5 ug PAH/g dwt at 0.415% OC would be monitored. Alternative SED-3 would be similar to Alternative SED-2 with respect to ARARs. As with Alternative SED-2 WDNR has indicated that this alternative would need approval from both the Governor and State Legislature.

A subaqueous cap probably would also be considered a structure and fill on the bed of Lake Superior and would be subject to the same ARARs as Alternative SED-2. As with Alternative SED-2 there are several available procedural mechanisms which might be used to authorize such fill and structure placement. These are discussed in the previous section. In this regard, we are aware that USEPA and WDNR have proposed a ROD change for the Fox River NPL Site that includes capping of sediment in navigable waters. It is possible the mechanism upon which this decision is based can be used for the Ashland Site.

In addition, consideration of requirements for high-temperature thermal desorption units may be required (NR 400 through 499) if it is determined that the sediment needs to be decontaminated. Dewatering would be subject to WPDES requirements (NR 200 and NR 220 through 297). Upon proper implementation of this alternative, ARARs would be met.

Attachment 1 summarizes the ARARs and TBCs that affect implementation of Alternative SED-3.

In addition to the ARARs and TBCs described above the design of sediment removal process will have U.S. Army Corps of Engineers concurrence.

Alternative SED-4 – Removal, Treatment, Disposal and MNR

Under Alternative SED-4, steps would be taken to minimize or eliminate potential exposure to impacted sediment by removing sediment where concentrations of PAH exceed the sediment PRG Sediment removed would be dewatered and treated on site using thermal treatment, or dewatered and sent off site for disposal in a landfill. Treated sediment would be sent off site for beneficial reuse. Alternative SED-4 would be similar to Alternative SED-3 with respect to ARARs.

Attachment 1 summarizes the ARARs and TBCs that affect implementation of Alternative SED-4.

In addition to the ARARs and TBCs described above the design of sediment removal process will have U.S. Army Corps of Engineers concurrence.

4.4.2 Balancing Criteria

Five of the remaining criteria are referred to as balancing criteria by which the alternatives are compared and upon which the analysis is based. These include:

- long-term effectiveness and permanence:
- reduction of toxicity, mobility, or volume;
- short-term effectiveness;
- implementability; and
- cost

4.4.2.1 Long Term Effectiveness and Permanence

Each remedial alternative is evaluated as to magnitude of long-term residual risks, adequacy of controls, and reliability of long-term management controls in restoring impacted site media. Table 4-5 presents an evaluation of the long-term effectiveness and permanence of each alternative.

Table 4-5 - Evaluation of Long-term Effectiveness and Permanence for Potential Remedial Alternatives for Sediment

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative SED-1: No Action	Potential risk to human health or the environment, if any, would not be reduced.	There are no remedial actions or controls associated with this alternative.
Alternative SED- 2: CDF, Removal, and MNR	Risk to human health and the environment would be reduced through covering impacted material above the sediment PRG or placement of impacted sediment above the sediment PRG into the CDF area, and covering the CDF by placing clean material over the impacted sediment to prevent human contact and impact to biota. Monitoring would evaluate the effectiveness of the CDF in containing contaminated sediments and the effect of natural recovery processes that could result in reduction of COPC concentrations outside of the CDF footprint.	Alternative SED-2 would involve technologies that have been used previously, and whose adequacy and reliability have been tested. Control measures would be required when dredging and placing sediment into the CDF area to prevent or minimize transport of sediment outside of the area of concern. Similarly, impacts to air quality could occur, and may need to be addressed to prevent exposure to workers and downwind receptors. Placing clean material over the CDF would prevent exposure to sediment, and minimize on-going release of volatiles to water and air. Long-term monitoring would be required to evaluate the effectiveness of the CDF in preventing exposure to contaminants and containment of contaminated sediments.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	Risk to human health and the environment would be reduced through removal of impacted sediment to allow sufficient draft to construct a cover, and constructing a cap over the remaining impacted sediment to prevent human contact and impact to biota. Removed sediment would be treated on site and/or disposed off site, thereby eliminating any potential risk associated with the sediment. Monitoring would evaluate on-going risk to human health and the environment from failure of the cap as well as the effect of natural recovery processes that could result in reduction of COPC concentrations beyond the cap area.	Alternative SED-3 would involve use of technologies that are proven reliable and accepted, including dredging, sediment capping, and treatment of sediment through incineration or thermal destruction, and off site disposal. Control measures would be required to ensure that exposure is limited during sediment removal, dewatering, treatment, and transport activities. These control measures could include placement of silt curtains and sorbent booms, and if necessary temporary sheet piling, during dredging operations, vapor recovery during dewatering and treatment operations, and special handling of waste, if necessary, during transport for disposal. If properly implemented, there would be little risk associated with implementation of this alternative although nearby residents may experience increased exposure to VOCs during dredging and on-shore sediment treatment operations. Monitoring would be required to evaluate the long-term effectiveness of these measures in preventing unacceptable exposure and risk.

Alternative	Magnitude and Type of Residual Risk	Adequacy and Reliability of Controls
Alternative SED-4: Removal, Treatment and/or Disposal and MNR	Risk to human health and the environment would be reduced through removal of impacted sediment, thereby preventing human contact and impact to biota. Since sediment removed would be treated on site and disposed off site, any potential risk associated with the sediment would be effectively eliminated. Monitoring would evaluate on-going risk to human health and the environment from impacted sediment that remains in place.	Alternative SED-4 would involve use of technologies that are proven reliable and accepted, including dredging, treatment of impacted sediment through incineration or thermal destruction, and off site disposal. Control measures would be required to ensure that exposure is limited during sediment removal, dewatering, treatment, and transport activities. These control measures could include placement of silt curtains and sorbent booms and if necessary temporary sheet piling, during dredging operations, vapor recovery during dewatering and treatment operations, and special handling of waste, if necessary, during transport for disposal. If properly implemented, there would be little risk associated with implementation of this alternative although nearby residents may experience increased exposure to VOCs during dredging and on-shore sediment treatment operations... Monitoring would be required to evaluate the long-term effectiveness of these measures in preventing unacceptable exposure and risk.

4.4.2.2 Reduction of Toxicity, Mobility or Volume through Treatment

The remedial alternatives are evaluated for permanence and completeness of the remedial action in significantly reducing the toxicity, mobility, or volume of hazardous materials through treatment. Each alternative is evaluated based on the treatment processes used, the volume or amount and degree to which it destroys or treats hazardous materials; the expected reduction in toxicity, mobility, or volume provided by the alternative; the extent to which the treatment is irreversible; and the types and quantities of residuals that will remain following treatment. Table 4-6 presents a summary of this evaluation.

Table4-6 Evaluation of Reduction of Toxicity, Mobility, or Volume through Treatment for Potential Remedial Alternatives for Sediment

Alternative	Treatment Process Used and Materials Treated	Volume of Material Destroyed or Treated	Degree of Expected Reductions	Degree to Which Treatment is Irreversible	Type and Quantity of Residuals Remaining
Alternative SED-1: No Action	No treatment process used.	None.	None.	Not applicable.	No treatment, therefore all residuals remain.
Alternative SED-2: CDF, Removal, and MNR	Auxiliary treatment for water will be necessary prior to discharge.	None treated, although over 74,000 cy of material would be placed and contained within CDF. Approximately another 60,000 cy would be covered by CDF. There would be no reduction in volume.	None, although exposure to contaminants is eliminated by containment within CDF.	Treatment via construction of a CDF would be nearly completely reversible.	No treatment, therefore all residuals remain; however, these residuals do not pose a risk to humans or biota as direct contact is effectively eliminated and the contaminated sediments are contained in a CDF.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	Impacted sediment that is removed would be treated by thermal desorption or incineration, or shipped off site for disposal.	Approximately 78,000 cubic yards of material would be removed, treated and disposed.	Destruction efficiency of thermal treatment is anticipated to be 99% or more; material that remains in place would be effectively contained thereby eliminating risk to human heath and biota; material shipped off site for disposal would be effectively contained, thereby eliminating exposure.	Thermal destruction is permanent and irreversible; theoretically, untreated sediment that is sent for off site disposal could present potential risk; however, this scenario is unlikely.	Approximately 50,000 cubic yards of impacted material would remain in place; however, this material would be capped, thereby effectively eliminating risk to human health and biota.
Alternative SED-4: Removal, Treatment and/or Disposal and MNR	Impacted sediment that is removed would be treated by thermal desorption or incineration, or shipped off site for disposal.	Approximately 134,000 cubic yards of material would be removed, treated and disposed.	Destruction efficiency of thermal treatment is anticipated to be 99% or more.	Thermal destruction is permanent and irreversible.	Under this alternative, impacted sediment with PAH concentrations greater than the sediment PRG would be removed, thereby effectively eliminating risk to human health and biota.

4.4.2.3 Short Term Effectiveness

The evaluation of short-term effectiveness is based on the degree of protectiveness of human health achieved during construction and implementation of the remedy. Potential implementation risks to the community and site workers and mitigation measures for addressing those risks are included in this evaluation. In addition, environmental impacts during implementation and the time required to achieve the RAOs must also be considered in the evaluation of this criterion.

Table 4-7 summarizes the results of this evaluation.

Table 4-7 - Evaluation of Short Term Effectiveness for Potential Remedial Alternatives for Sediment

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
Alternative SED-1: No Action	Since no remediation is occurring, no protection of community and workers is necessary.	Since no remediation is occurring, there would be no additional impact to the environment over current impacts.	RAOs would not be achieved in the foreseeable future, and are unlikely to be met within 30 years.
Alternative SED-2: CDF, Removal, and MNR	Worker and community protection would be required and controls would need to be implemented during dredging, placement and dewatering of sediment and construction of the CDF.	Dredging and dewatering activities could release volatiles from sediment into surface water and air, thus impacting surface water and air quality. Dredging could agitate sediments, which could lead to resuspension and dispersal. Nearby residents may experience increased exposure to VOCs during dredging and on-shore sediment treatment operations.	It is anticipated that RAOs would be reached upon completion of the CDF; based on current volume estimates, it is anticipated to be completed within two years from project start.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	Worker and community protection would be required and controls would need to be implemented during dredging, placement and dewatering of sediment and construction of the cap.	Dredging and dewatering activities could release volatiles from sediment into surface water and air, thus impacting surface water and air quality. Dredging could also agitate sediments, which could lead to resuspension and dispersal. Thermal treatment has the potential to release VOCs into the air during start-up or pilot operations until the unit is operating at optimal efficiency. Nearby residents may experience increased exposure to VOCs during dredging and on-shore sediment treatment operations. If sediment is disposed off site without treatment at a landfill there would be no future exposure to humans or biota because the access is controlled.	It is anticipated that RAOs would be reached upon completion of the cap and completion of thermal treatment; based on current volume estimates, it is anticipated to be completed within three years from project start.
Alternative SED-4: Removal, Treatment and/or Disposal and MNR	Worker and community protection would be required and controls would need to be implemented during dredging, dewatering, and treatment.	Dredging and dewatering activities could release volatiles from sediment into surface water and air, thus impacting surface water and air quality. Dredging could also agitate sediments, lead to resuspension and dispersal. Thermal treatment has the potential to release VOCs into the air during start-up or pilot operations until the unit is operating at optimal efficiency. If sediment is disposed off site without treatment, environmental liability is simply transferred to another location, thereby potentially impacting its new location. Nearby residents may experience increased exposure to VOCs during dredging	It is anticipated that RAOs would be reached upon completion of the dredging and thermal treatment; based on current volume estimates, it is anticipated to be completed within three years from project start.

Alternative	Protection of Community and Workers During Remediation	Environmental Impacts of Remedy	Time Until RAOs are Achieved
		and on-shore sediment treatment operations.	

4.4.2.4 Implementability

Implementability is based on the evaluation of technical feasibility, administrative feasibility, and the availability of services and materials. Technical feasibility considers the following factors:

- difficulties that may be inherent during construction and operation of the remedy;
- the reliability of the remedial processes involved;
- the flexibility to take additional remedial actions, if needed;
- the ability to monitor the effectiveness of the remedy;
- the availability of offsite treatment, storage, and disposal facilities; and,
- the availability of needed equipment and specialists.

Administrative feasibility considers permitting and regulatory approval and coordination with other agencies. Table 4-8 presents a summary of this evaluation.

Table 4-8 -Evaluation of Implementability of Potential Remedial Alternatives for Sediment

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
Alternative SED-1: No Action	There would be no technical issues associated with this alternative. The ability to complete additional investigation or remedial measures would not be prevented by this alternative.	Not applicable, since no technology is implemented. No monitoring would be conducted.	There would be no administrative issues related to the no-action alternative.	No services or materials would be needed for this alternative.
Alternative SED-2: CDF, Removal, and MNR	The technical aspects of this alternative, including dredging, placement and dewatering of sediment, and construction of a CDF, are all feasible technologies. Implementation of this alternative would not prevent completion of additional investigation or remedial measures. However, significant effort would be required to access impacted sediment in the CDF for additional evaluation or remediation.	The technologies and process options used as part of this alternative have been used elsewhere with success. Monitoring would allow accurate evaluation of effectiveness of remedial action through collection of samples outside and within the CDF to compare concentrations with pre-remedial action levels.	Administrative issues related to implementation of this alternative would include complying with ARAR requirements for dredging and construction of a CDF in navigable waters. According to WDNR, this alternative would need approval by the State Legislature and Governor, thus potentially making administrative implementability difficult.	Services necessary for this alternative are readily available and proven technologies. Companies that perform dredging, sheet-pile installation, and cover construction are located in relatively close proximity to the site.
Alternative SED-3: Removal, Treatment and/or Disposal, Capping, and MNR	The technical aspects of this alternative, including dredging, dewatering, treatment, and construction of a subaqueous cap, are all feasible technologies. Implementation of this alternative would not prevent completion of additional investigation or remedial measures. However, significant effort would be required to	The technologies and process options used as part of this alternative have been used elsewhere with success. Monitoring would allow accurate evaluation of effectiveness of remedial action through collection of samples outside and within the CDF to compare concentrations with pre-remedial action levels.	Administrative issues related to implementation of this alternative would include complying with ARAR requirements for dredging and construction of a cap in navigable waters, as well as operation of a treatment system at the site. According to WDNR, this alternative would need approval by the State	Services necessary for this alternative are readily available and proven technologies. Companies that perform dredging, sheet-pile installation, and sub-aqueous cap construction are located in relatively close proximity to the site. Thermal treatment units are transportable and can be readily transported to the site.

Alternative	Technical Feasibility	Reliability of Technology	Administrative Feasibility	Availability of Services and Materials
	access impacted sediment under the cap for additional evaluation or remediation.		Legislature and Governor, thus potentially making administrative implementability difficult.	
Alternative SED-4: Removal, Treatment and/or Disposal and MNR	The technical aspects of this alternative, including dredging, dewatering, treatment, and off site disposal, are all feasible technologies. Implementation of this alternative would not prevent completion of additional investigation or remedial measures.	The technologies and process options used as part of this alternative have been used elsewhere with success. Monitoring would allow accurate evaluation of effectiveness of remedial action through collection of samples outside and within the CDF to compare concentrations with pre-remedial action levels.	Administrative issues related to implementation of this alternative would include o complying with ARAR requirements for dredging as well as operation of a treatment system at the site. Furthermore, additional administrative actions could be required to meet the intent of ARARs.	Services necessary for this alternative are readily available and proven technologies. Companies that perform dredging, and thermal treatment are located in relatively close proximity to the site. Thermal treatment units are transportable and can be readily transported to the site.

4.4.2.5 Cost

For each remedial alternative, estimated capital, O&M, and periodic costs are prepared in accordance with the USEPA guidance document *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA and USACE, 2000). The cost estimates are developed primarily for the purpose of comparing remedial alternatives and not for establishing project budgets. The estimating process provides costs that are within a range of 30-percent below to 50-percent above expected actual costs, consistent with USEPA guidance. Present worth analyses are then performed on the cost estimates for each alternative for comparative purposes. A 30-year O&M period and a 7-percent discount rate are used to generate the present worth values, in accordance with USEPA guidance.

Annual O&M costs are estimated for each alternative independently. It is assumed that all work is contracted and the estimates do not account for possible economies of scale (i.e., completing all activities at the site that could be performed at the same time).

Table 4-9 presents a summary of the cost evaluation for all alternatives evaluated.

Table 4-9 Cost Summary of for Potential Remedial Alternatives for Sediment

Alternative	Estimated Cost
Alternative SED-2 - CDF	$ 30,459,000
Alternative SED-3A – Mechanical Dredge, Cap, No Treatment	$ 38,321,000
Alternative SED-3B - Mechanical Dredge, Cap, Thermal Treatment	$ 53,631,000
Alternative SED-3C – Hydraulic Dredge, Cap, No Treatment	$ 43,981,000
Alternative SED-3D – Hydraulic Dredge, Cap, Thermal Treatment	$ 59,223,000
Alternative SED-4A - Mechanical Dredge, No Treatment	$ 42,152,000
Alternative SED-4B - Mechanical Dredge, Thermal Treatment	$ 68,472,000
Alternative SED-4C – Hydraulic Dredge, No Treatment	$ 56,349,000
Alternative SED-4D – Hydraulic Dredge, Thermal Treatment	$ 85,496,000

4.4.3 Modifying Criteria

The third group, the *modifying criteria*, includes:

- State/Support agency acceptance; and
- Community acceptance.

As previously discussed, these last two criteria are typically formally evaluated following the public comment period, although they can be factored into the identification of the preferred alternative to the extent practicable.

4.5 Comparative Analysis of Alternatives

In this section, as required by CERCLA and NCP guidance a comparative evaluation is conducted. The advantages and disadvantages of the alternatives will be concurrently assessed with respect to each criterion. The criteria considered as part of this comparative evaluation were discussed in Section 4.4. Table 4-10 presents a summary of the comparative analysis.

Table 4-10 Summary of Comparative Analysis for Potential Sediment Remedial Alternatives

Criteria	Alternative SED-1: No Action	Alternative SED-2: Consolidation, CDF, and Monitoring	Alternative SED-3: Removal, Capping, Treatment and/or Disposal, and Monitoring	Alternative SED-4: Removal, Treatment and/or Disposal, and Monitoring
Overall Protection of Human Health and the Environment	Low	High	High	High
Compliance with ARARs and TBCs	Low	High	High	High
Long-term Effectiveness and Permanence	Low	Moderate	Moderate to High	High
Reduction of Toxicity, Mobility and Volume through Treatment	Low	Moderate	Moderate	High
Short-term Effectiveness	High	High	Moderate	Low
Implementability - Technical	Easy	Moderate	High	High
Implementability - Administrative	High	High	High	Moderate
Cost	Low	Moderate	High	High

4.5.1 Overall Protection of Human Health and the Environment

Alternative SED-1 – No Action – offers the least protection of human health and the environment, as no additional actions would be taken to address site issues.

Alternative SED-2 – CDF –assures protection of human health and the environment by eliminating access to impacted sediment. Under this alternative, there is no destruction of COPCs, but these materials are permanently contained and inaccessible to humans or biota, thereby reducing risk.

Alternative SED-3 – subaqueous capping of a portion of the sediment and removal of the remainder – is also protective of human health and the environment if the sediment is treated, because it isolates a portion of the sediment above the sediment PRG from exposure to humans or biota. The remaining sediment above the sediment PRG is removed. If that portion is thermally treated it reduces its volume and permanently eliminates its toxicity by treatment. If the sediment were to be sent for disposal without treatment, then this alternative it reduces in situ volume and eliminates exposure to humans and biota by transfer of these materials to an environment where access is controlled. There is no reduction in toxicity.

Alternative SED-4 – removal –is also protective of human health and the environment if the sediment is treated, because it results in decontamination of sediment above the PRG and removes it from the aquatic environment. If the sediment were to be sent for disposal without treatment, then this alternative would be roughly equivalent to Alternatives SED-2 and SED-3 (if Alternative SED-3 were also completed without sediment treatment); there would be no reduction in toxicity, but exposure to humans and biota is eliminated because access is controlled. There is no reduction in toxicity.

4.5.2 Compliance with ARARs and TBCs

Alternative SED-1 would not comply with regulations. Alternatives SED-2, SED-3, and SED-4 would be similar with respect to meeting ARARs and TBCs, as engineering and construction actions would be developed and completed in compliance with federal and state regulations.

4.5.3 Long-term Effectiveness and Permanence

Alternative SED-1 would not provide any long-term benefit, as any potential risk associated with impacted sediment is not eliminated through remedial action. The risk posed by the COPCs in sediment remains the same under Alternative SED-1.

Although there is no reduction in volume or toxicity of the contaminated sediment, Alternative SED-2 still provides a moderate level of permanence and effectiveness over the long term. Since no sediment is treated, the toxicity of the material remains the same, however accessibility and exposure to humans and biota is eliminated through containment.

Alternative SED-3 provides a high level of long term effectiveness and permanence for that sediment which is removed and treated. For the contaminated sediment that is capped there is no destruction of COPCs, but these materials are permanently contained and inaccessible to humans or biota, thereby reducing risk. A volume of approximately 78,000 cy would be permanently removed from the environment. If the sediment that is removed is not treated but disposed in a NR 500 landfill exposure to humans and biota is eliminated through access restrictions.

Alternative SED-4 would provide the highest effectiveness and permanence over the long term due to the permanent removal of the largest volume of sediment. If treated, thermal treatment of the sediment would eliminate toxicity and reduce volume and is permanent. If the sediment that is removed is not treated but disposed in a NR500 landfill exposure to humans and biota is eliminated through access restrictions.

4.5.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative SED-1 offers no reduction in toxicity, mobility, or volume through treatment, as no action is taken.

Alternative SED-2 would permanently reduce the mobility of contaminated sediments, and although the toxicity and volume would not change. While there is no destruction of COPCs, these materials are permanently contained and inaccessible to humans or biota, thereby reducing risk.

Alternative SED-3 would reduce toxicity, mobility and volume of a volume of approximately 78,000 cy of sediment which would be permanently removed from the environment. That sediment remaining under the cap would have permanently reduced mobility and since it would be inaccessible to humans or biota, it would eliminate exposure and risk. The inherent toxicity of that sediment remaining under the cap would not be reduced.

Alternative SED-4 would have the greatest degree of reduction of toxicity, mobility, and volume of impacted material. Mobility would be reduced by permanently containing it in a landfill. Likewise, toxicity would be reduced since exposure to humans and biota would be eliminated because access in a landfill is controlled.

4.5.5 Short-term Effectiveness

Alternative SED-1 would have the least short-term impact on human health and the environment, as impacted sediment would not be disturbed, thereby potentially releasing COPCs into surface water and air. Of the three active remedial options, Alternative SED-2 would have the least short-term impact, as sediment is not brought to shore for dewatering or treatment, but is disposed as part of the CDF, a portion of which is subaqueous. Adequate controls would be in place to ensure worker and community safety during remedial activities. All alternatives would have the potential of some short term risk from release of volatile emissions during debris removal and onshore dewatering and/or treatment. Release of volatile emissions from land-based activities including filling of a CDF could be better controlled than for dredging activities.

4.5.6 Implementability

Implementation of Alternative SED-1 would be easy, as no action would be performed. In addition, because no remedial action would occur, there would be no difficulty in implementing additional remedial actions at a later date.

Alternative SED-2 would be more difficult to implement than Alternative SED-1. The technology and equipment that would be used for this alternative is readily available, and has proven to be reliable at other similar sites. However, because WDNR has indicated that the governor and legislature must approve Alternatives SED-2 and SED-3, obtaining authorization to proceed may be problematic. Long term monitoring, included as a part of Alternatives SED-2, SED-3, and SED-4, would allow periodic evaluation of risks associated with materials left in place.

Alternatives SED-3 and SED-4 would be still more difficult to implement, as additional equipment, technology, and permitting would be required to perform the dewatering, thermal treatment, and disposal of sediment. Furthermore, the capping component included as part of Alternative SED-3 would add additional complexity to the implementation of this alternative.

4.5.7 Cost

Alternatives SED-1 would be the lowest cost alternative.

The cost for Alternative SED-2 would be greater than costs for Alternative SED-1, but less than either of Alternatives SED-3 or 4 (Table 4-9). It is anticipated that the cost for implementation of Alternative SED-2 would be approximately $29,000,000. Costs for Alternative SED-3 would be greater than Alternative SED-2, but less than Alternative SED-4. They would range from approximately $38,000,000 to $59,000,000. Cost for implementation of Alternative SED-4 would range between approximately $42,000,000 and $85,000,000

5.0 Summary and Conclusions

5.1 Soil

Based on this evaluation, unlimited removal and off site disposal **(*Alternative S3B*)** will provide the most long-term benefit with minimal short-term implementation issues. However, this benefit is outweighed by the costs and impacts associated with Restoration, which may include backfilling with clean fill to pre-excavation grade, or restoration as a wetland or shallow lakebed (i.e. pre-filling conditions). Limited removal and off site disposal (***Alternative S3A***), limited removal and on site disposal (***Alternative S4***), limited removal and thermal treatment (***Alternative S5A***), and limited removal and off site incineration (***Alternative S5A***) will provide long-term benefits with the minimal short-term implementation issues. A pilot test will be needed to further evaluate the feasibility of limited removal and on site soils washing (***Alternative S6***). Regardless, all potential remedial alternatives requiring limited removal are more cost effective than the unlimited removal alternative. Containment using engineered surface barriers (***Alternative S2)***) is a low cost response that would be easy to implement, but would need to be completed with a groundwater remedial response to be effective. Limited removal alternatives will result in the reduction in a significant mass of VOC, PAH, and NAPL contamination, but may need to be completed with other potential remedial alternatives for groundwater to provide maximum protection of human health and the environment. The no action alternative (***Alternative S1***) while costing little to nothing, will not provide any long-term protection, and should not be considered.

5.2 Groundwater

Groundwater remedial alternatives evaluated in this report include no action, containment, in-situ treatment, and removal technologies identified in the Alternative Screening Technical Memorandum (URS, revised May 2007). No Action (***Alternative GW1***) was also retained as required by the NCP as a basis for comparing the other alternatives. Containment alternatives include ***Alternatives GW2*** (containment using surface and vertical barriers) and ***Alternatives GW-5 (***in-situ treatment using PRB walls). If implemented, ***Alternatives GW5*** would be used with ***Alternatives GW2*** to minimize long-term treatment of shallow groundwater. The remaining in-situ treatment alternatives include the following:

- ***Alternative GW3*** - In-situ Treatment using Ozone Sparging;
- ***Alternative GW4-*** In-situ Treatment using Surfactant Injection and Removal using Dual Phase Recovery;
- ***Alternative GW6*** **-** In-situ Treatment using Chemical Oxidation;
- ***Alternative GW7*** **-** In-situ Treatment using Electrical Resistance Heating; and,

- ***Alternative GW8*** **-** In-situ Treatment using Dynamic Underground Stripping /Steam Injection.

Removal technologies evaluated for groundwater include dual phase recovery and removal using extraction wells. Dual phase recovery was evaluated with ***Alternative GW4*** (in-situ treatment using surfactant injection) and removal using groundwater extraction wells (***Alternative GW9)*** was evaluated as a stand alone remedial technology. However, all in-situ remedial technologies evaluated may require groundwater extraction is some capacity.

Containment is not a feasible remedial alternative for the underlying Copper Falls aquifer. The remaining groundwater remedial alternatives could be used for shallow groundwater in the upper area and Kreher Park and for the Copper Falls aquifer. Buried structures in the upper bluff area and the wood waste layer in Kreher Park may limit the effectiveness of in-situ treatment in these areas. If removal and disposal (on- or off site) or on site treatment is selected as a remedial response for soil, or if containment is selected for shallow groundwater, in-situ treatment and or removal will not be necessary for soil and shallow groundwater contamination. However, one or more of the in-situ or removal technologies evaluated in this report will be required for the Copper Falls aquifer.

5.3 Sediment

For sediment, Alternative SED-2 would provide the most long-term benefit with the lowest cost and fewest short-term implementation issues. However there would be permanent loss of approximately 6 acres of shallow lake bed habitat. WDNR has also indicated that the Governor and Legislature would have to approve this alternative, thus making administrative implementability more problematic.

Alternative SED-3 would provide a slightly higher level of performance only because under Alternative SED-3 approximately 78,000 cy would be removed from the environment and either treated or disposed in a NR500 landfill. However Alternative SED-3 would have a greater cost than Alternative SED-2 and arguably a subaqueous cap has the potential of being less permanent than a CDF. In addition the requirement for more debris removal and for sediment treatment increases the short term risk of implementation of this alternative due to the likelihood that these activities would result in release of potentially harmful volatile emissions. As with Alternative SED-2, WDNR has indicated that the Governor and Legislature would have to approve this alternative, thus making administrative implementability more problematic.

Alternative SED-4 would offer the greatest protection of human health and the environment, but at a cost that is almost 50% greater than Alternative SED-2 ($42,,000,000 versus $30,500,000). If all dredging is conducted mechanically and there is no need for thermal treatment Alternative SED-4 is approximately the same cost as Alternative SED-3 ($42,000,000 versus $38,000,000). However if hydraulic dredging is required and there is a need to thermally treat the sediments the cost for Alternative SED-4 could be as much as 50% greater than Alternative SED-3 ($85,500,000 versus $59,000,000) In addition the requirement for substantially greater debris

removal and for treatment of almost twice as much sediment as Alternative SED-3 results in this alternative having the greatest short term risk of implementation due to the likelihood that these activities would result in release of potentially harmful volatile emissions. Unlike Alternatives SED-2 and SED-3, Alternative SED-4 does not have to be approved by the Governor and Legislature.

Alternative SED-1, while costing little to nothing, would not provide any long-term protection, and therefore should not be considered.

Based on this evaluation, Alternative SED-2 would provide the most long-term benefit at the least cost and with the fewest short-term technical implementation issues. Although WDNR has indicated that it will require approval by the Governor and Legislature the effort to acquire this approval would be compensated for by:

1) Substantially less costs that have to be borne by Xcel Energy rate payers;
2) The least potential risk to the Ashland community; and
3) Creation of a waterfront park that would benefit the Ashland economy by enhancing recreational opportunities.

6.0 References

CES. 2006. Enhanced Free Product Recovery Using Low Temperature In-Situ Heating - An Option For MGP Sites.

Estes, T. J., Waugh, J., Schwartz, R. L., Green, G., Buhr, V., Braddock, B., and Detzner, H.-D. 2004. Mechanical dewatering of navigation sediments: Equipment, bench-scale testing, and fact sheets. DOER Technical Notes Collection (ERDC TN DOER-T7), U.S. Army Engineer Research and Development Center, Vicksburg, MS. http://el.erdc.usace.army.mil/dots/doer/doer.html

Miller, J.A. 1998. Confined Disposal Facilities on the Great Lakes," Great Lakes & Ohio River Division, U.S. Army Corps Of Engineers.

Palermo, M. R., Montgomery, R. L., and Poindexter, M. 1978. Guidelines for Designing, Operating, and Managing Dredged Material Containment Areas. Technical Report DS- 8-10, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Palermo, M., Maynord, S., Miller, J., and Reible, D. 1998. Guidance for In-Situ Subaqueous Capping of Contaminated Sediments. EPA 905-B96-004, Great Lakes National Program Office, Chicago, IL.

URS. 2007 Alternatives Screening Technical Memorandum - Ashland/Northern States Power Lakefront Superfund Site, January 22, 2007. Revised May 9, 2007.

USACE. 1987. Engineer Manual No. 1110-2-5027, Engineering and Design Confined Disposal Of Dredged Material. September 30, 1987.

USACE, United States Environmental Protection Agency (USEPA). 2003. Great Lakes Confined Disposal Facilities

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA: Interim Final. EPA/540/G-89/004. OSWER Directive 9355.3-01.

USEPA. 1994. ARCS Remediation Guidance Document. EPA 905-B94-003. Chicago, Ill.: Great Lakes National Program Office.

USEPA. 2000. Western Research Institute – Contained Recovery of Oily Wastes (CROW) Process. Innovative Technology Evaluation Report. Superfund Innovative Technology Evaluation (SITE). EPA/540/R-00/500. OSWER, Washington, D.C.

FIGURES

BASE MAP SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, ASHLAND, WISCONSIN, DATED 1964, PHOTOREVISED 1975.

QUADRANGLE LOCATION

NORTH

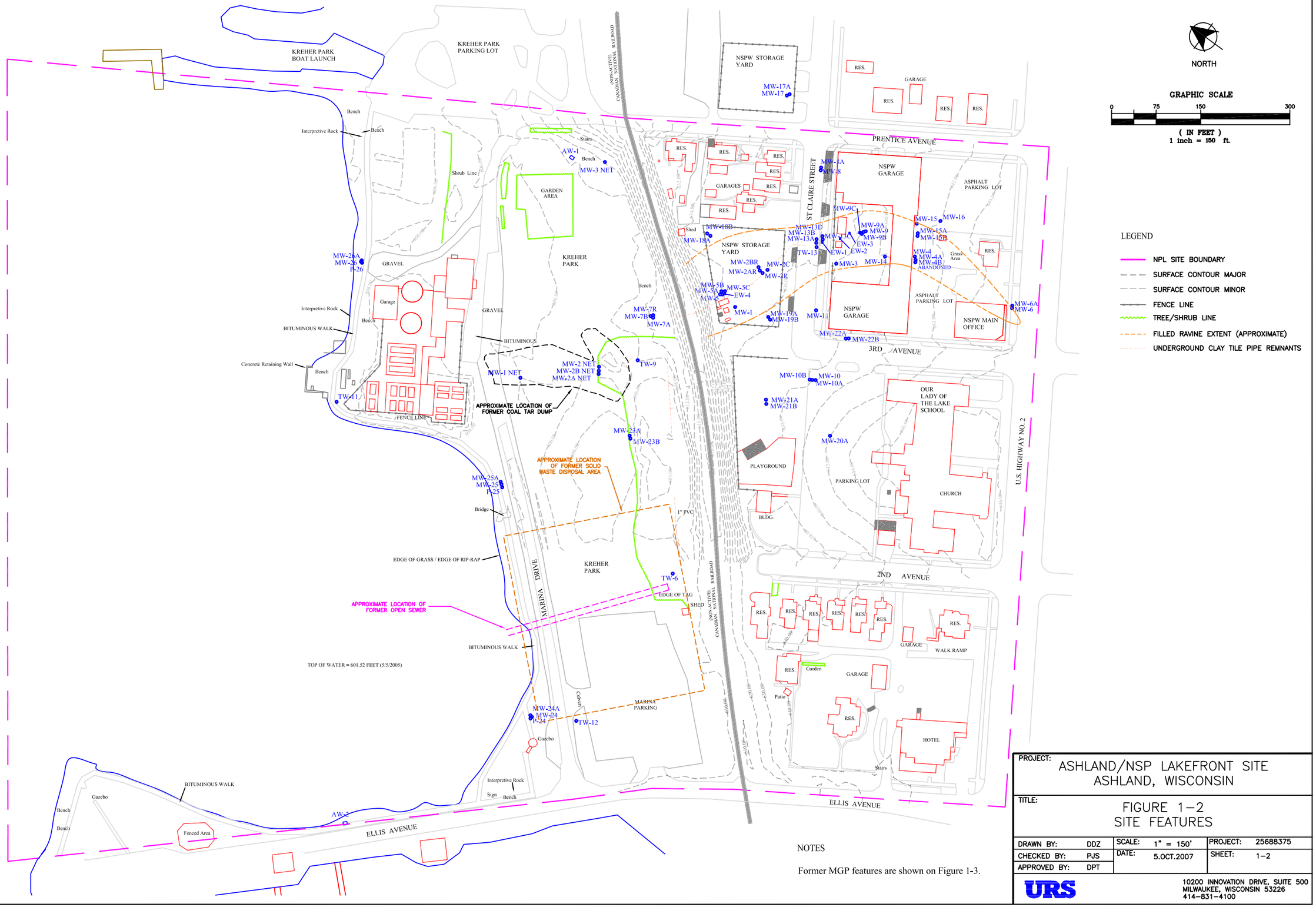
0 1320 2640 5280

SCALE IN FEET

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN		
TITLE: FIGURE 1–1 SITE LOCATION		
DRAWN BY: DDZ	SCALE: 1" = 2640'	PROJ. NO. 25688375
CHECKED BY: PJS	DATE: 5.OCT.2007	SHEET: 1–1
APPROVED BY: DPT		

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



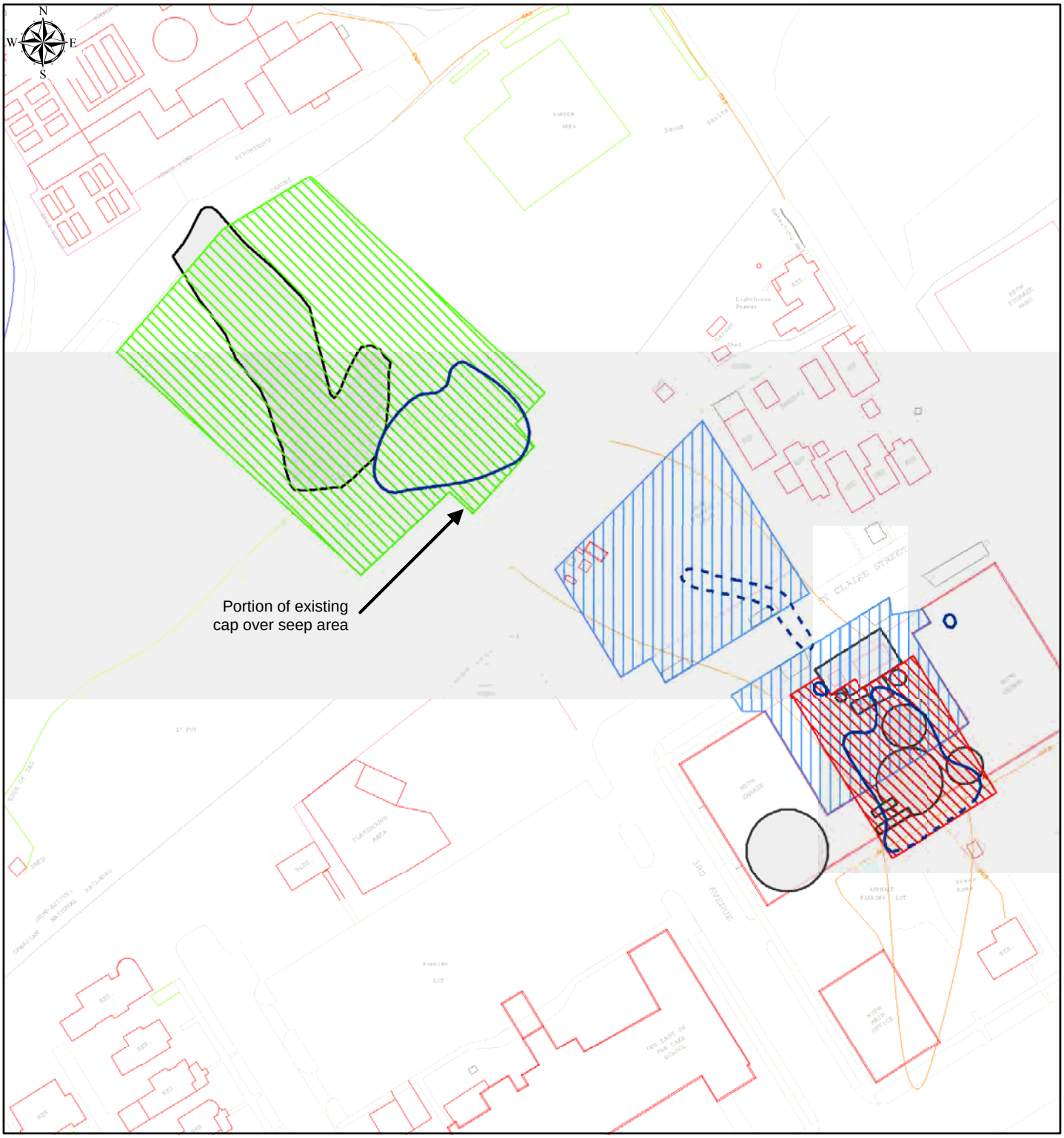
NOTES

Former MGP features are shown on Figure 1-3.

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: FIGURE 1–2 SITE FEATURES			
DRAWN BY: DDZ	SCALE: 1" = 150'	PROJECT: 25688375	
CHECKED BY: PJS	DATE: 5.OCT.2007	SHEET: 1–2	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



Legend

- Free Product Extent Inferred - Filled Ravine
- Free Product Extent - Filled Ravine
- Free Product Extent - Kreher Park
- Removal - soil excavation
- Asphalt pavement
- Low permeability cap
- Former coal tar dump
- Former tanks/holders

0 25 50 100 150 200 Feet

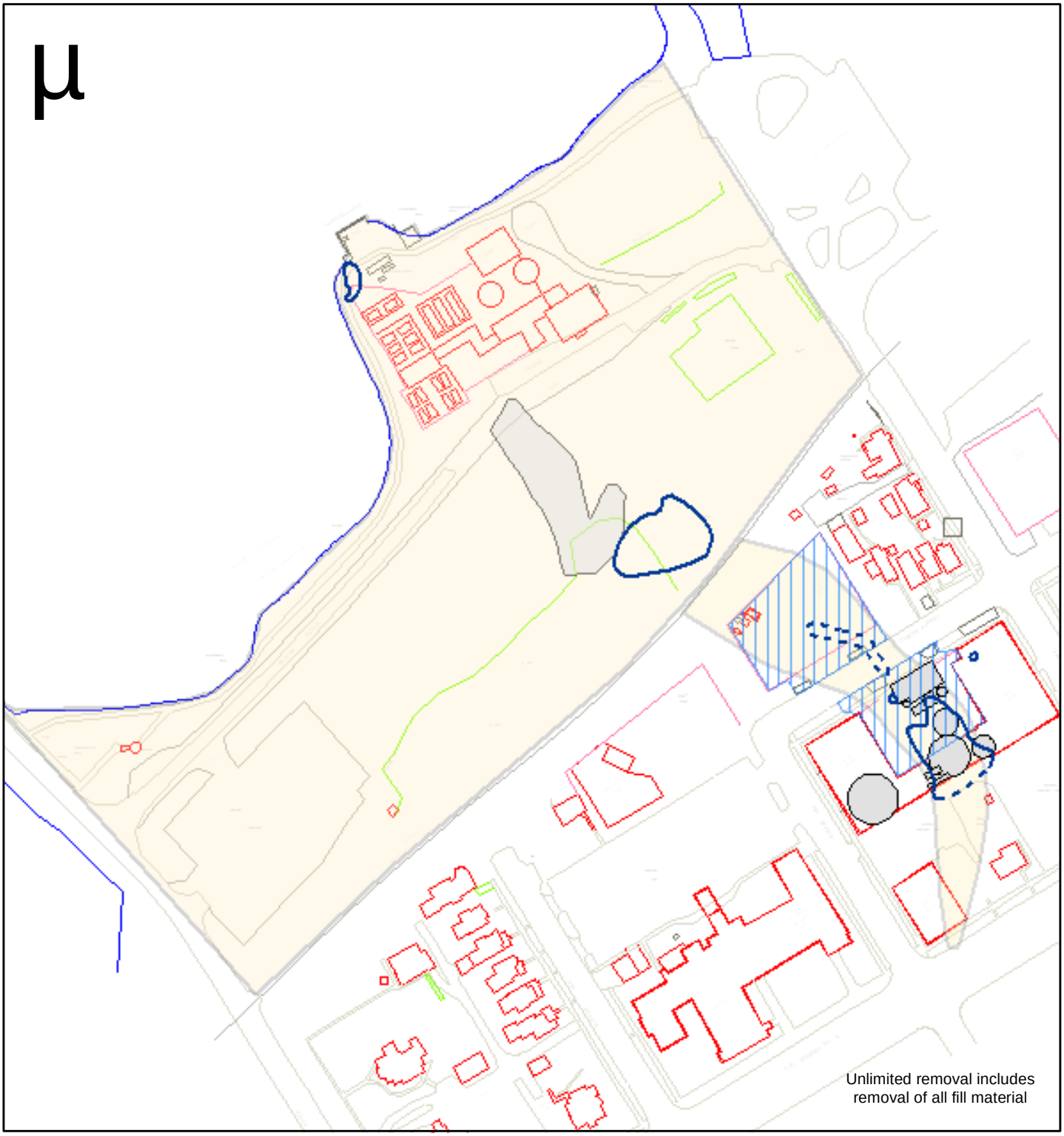
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 2-1
Limited Removal & Off-Site Disposal -
Upper Bluff Area & Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	2-1
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

- Free Product Extent Inferred - Filled Ravine
- Free Product Extent - Filled Ravine
- Free Product Extent - Kreher Park
- Asphalt pavement
- Former coal tar dump
- Former tanks/holders
- Kreher Park extent of fill
- Filled Ravine extent of fill

0 37.5 75 150 225 300 Feet

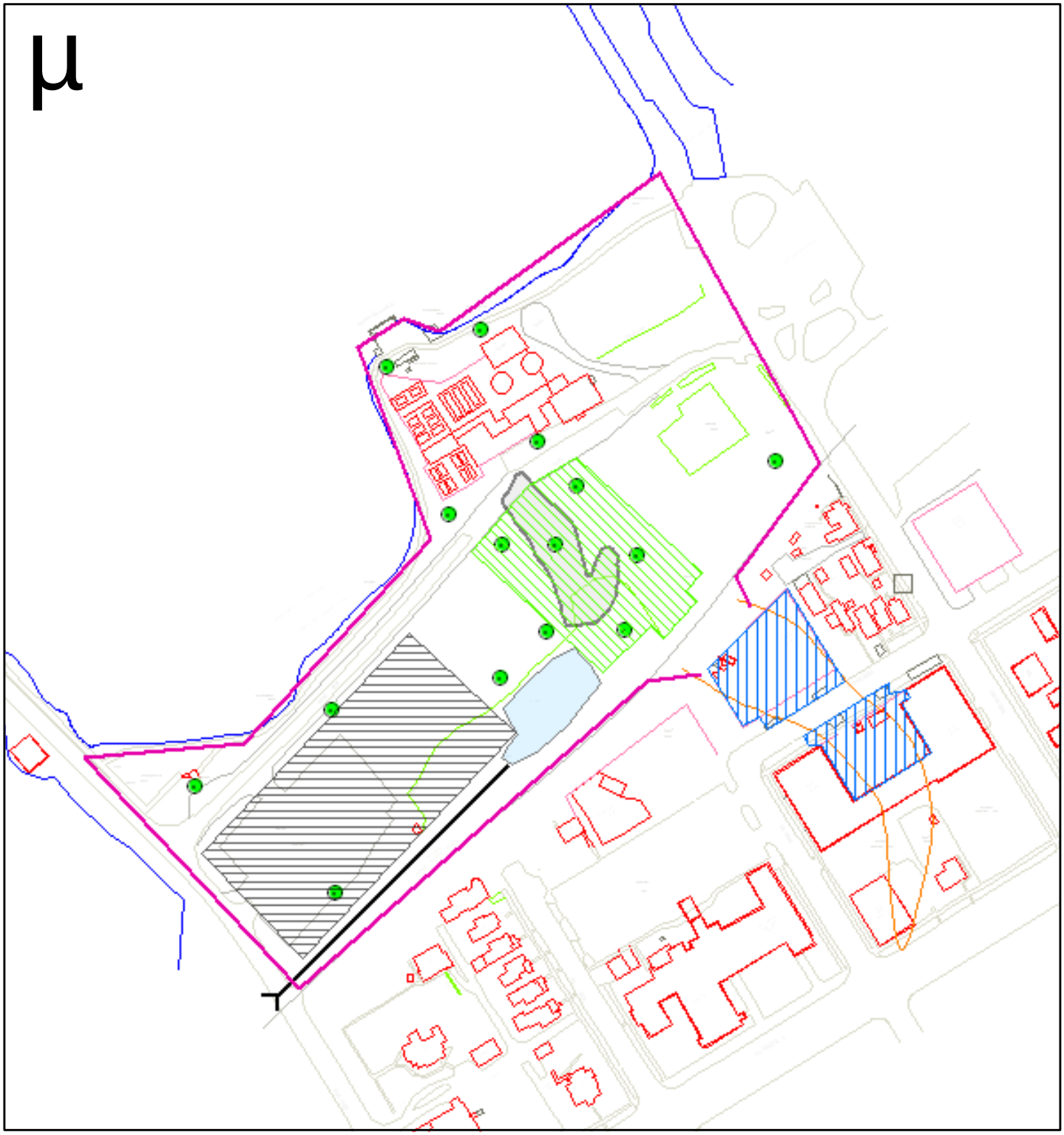
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 2-2
Unlimited Removal & Off-Site Disposal -
Upper Bluff Area & Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	2-2
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

- Asphalt - Marina parking lot
- Asphalt- St. Claire St.
- Low permeability cap
- Vertical Barrier Wall
- Pressure Relief Wells
- Stormwater outfall
- Stormwater Basin
- Former Coal Tar Dump

0 62.5 125 250 375 500 Feet

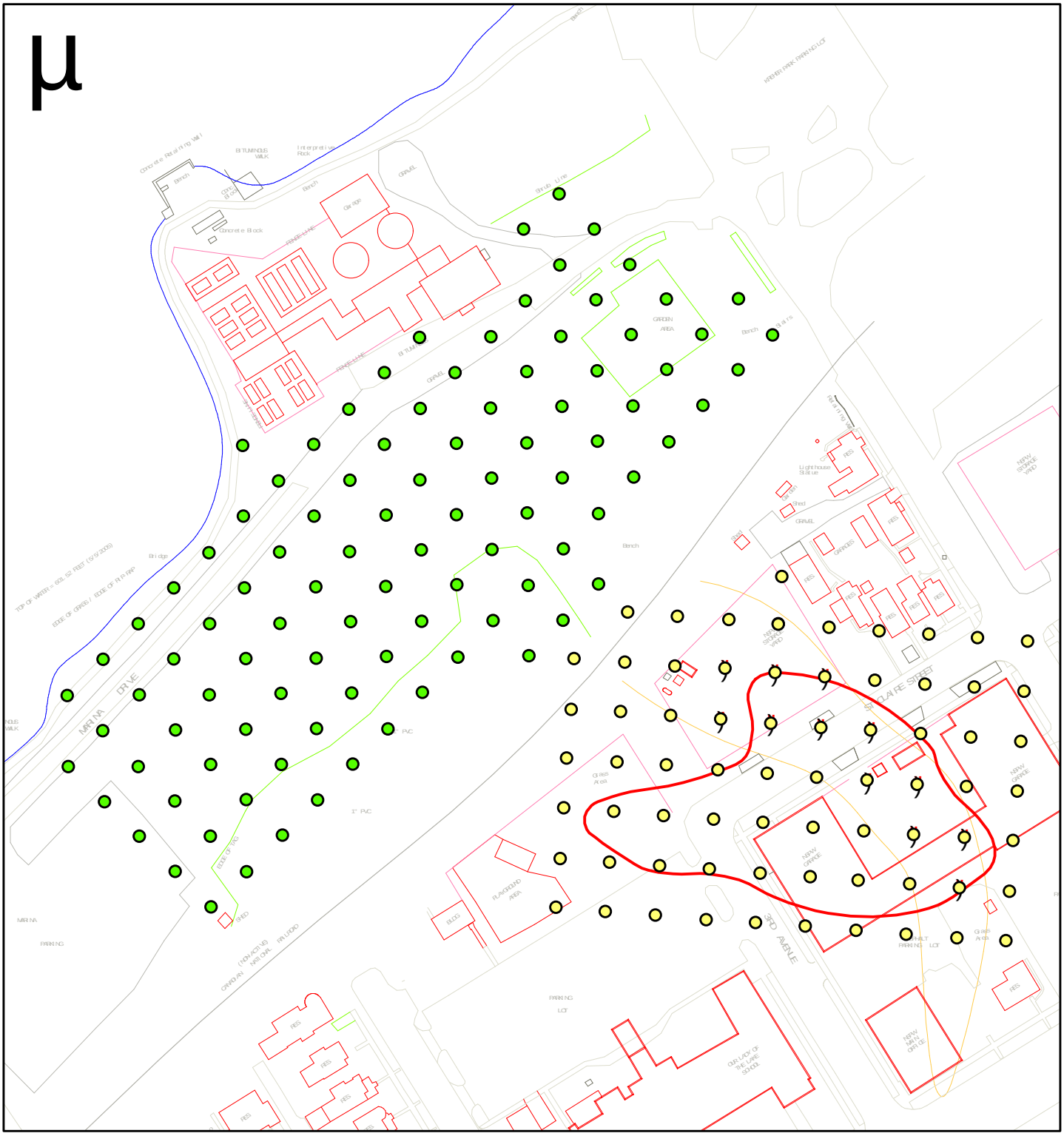
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-1
Containment Using Engineered Surface and Vertical Barriers

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	3-1
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

Groundwater ozone sparge

Description

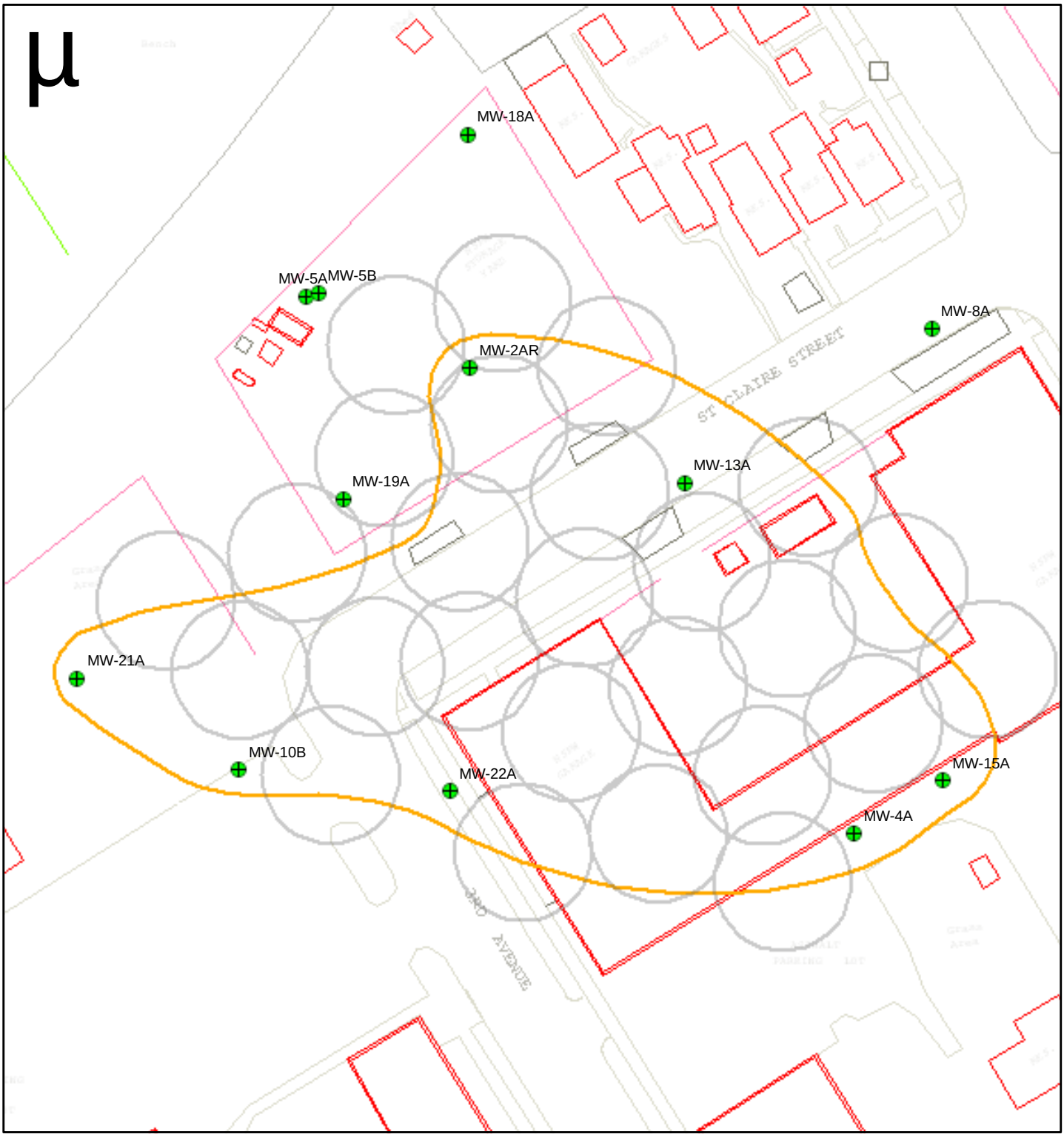
- Kreher Park
- Copper Falls
- Ravine
- Free Product - Copper Falls

0 37.5 75 150 225 300 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 3-2 In-Situ Ozone Sparging			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 5.OCT.2007	SHEET: 3-2	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

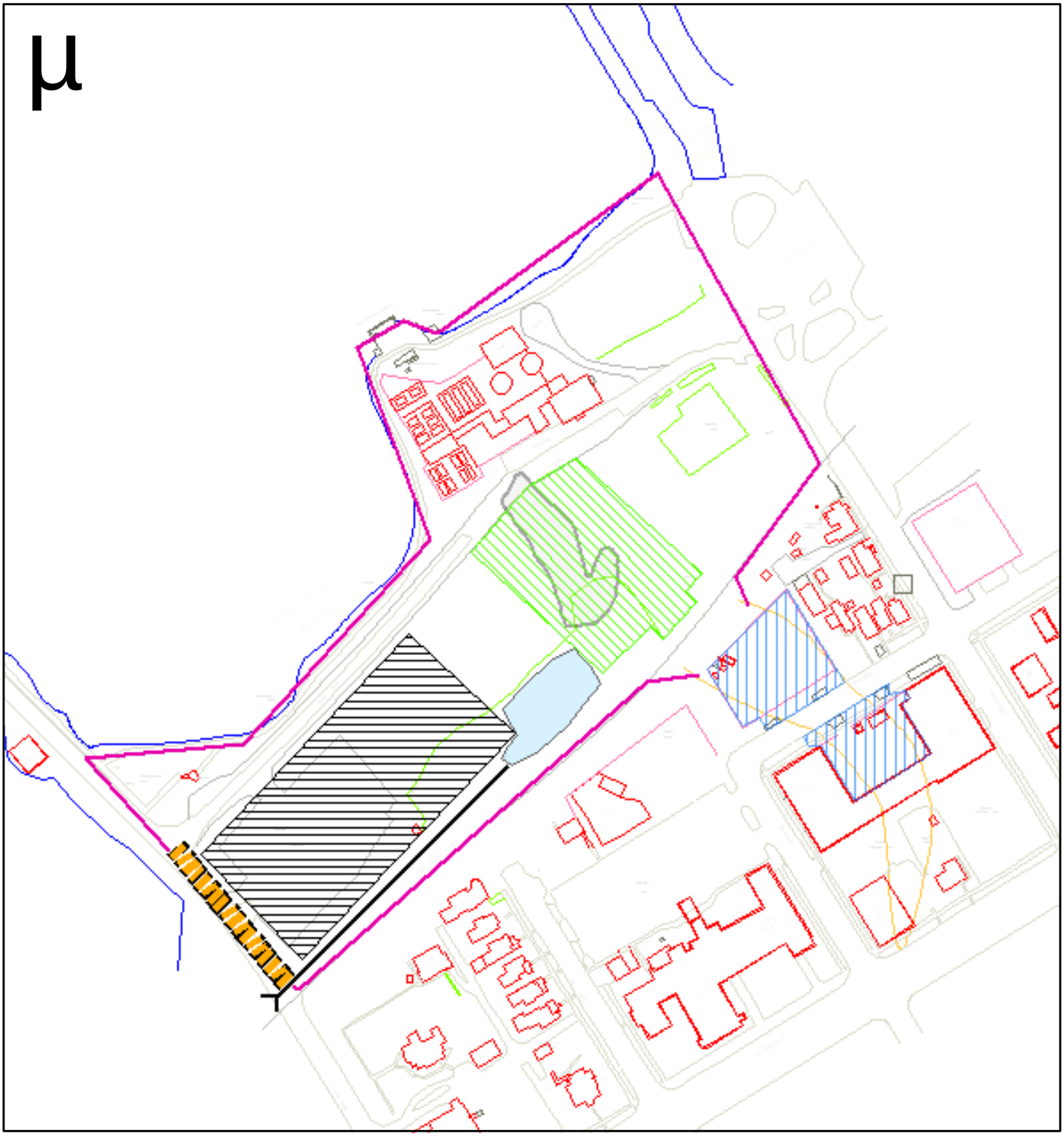
- Existing Piezometer
- Proposed injection/extraction well (area of influence)
- Free Product extent - Copper Falls aquifer

0 12.5 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 3-3 Surfactant Injection & Dual Phase Recovery - Copper Falls aquifer			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 5.OCT.2007	SHEET: 3-3	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

- Asphalt - Marina parking lot
- Asphalt - St. Claire St.
- Low permeability cap
- PRB wall
- Vertical Barrier Wall
- Stormwater outfall
- Stormwater Basin
- Former Coal Tar Dump

0 62.5 125 250 375 500 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-4
Permeable Reactive Barrier Wall & Containment
Using Engineered Surface & Vertical Barriers

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	3-4
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100

Legend

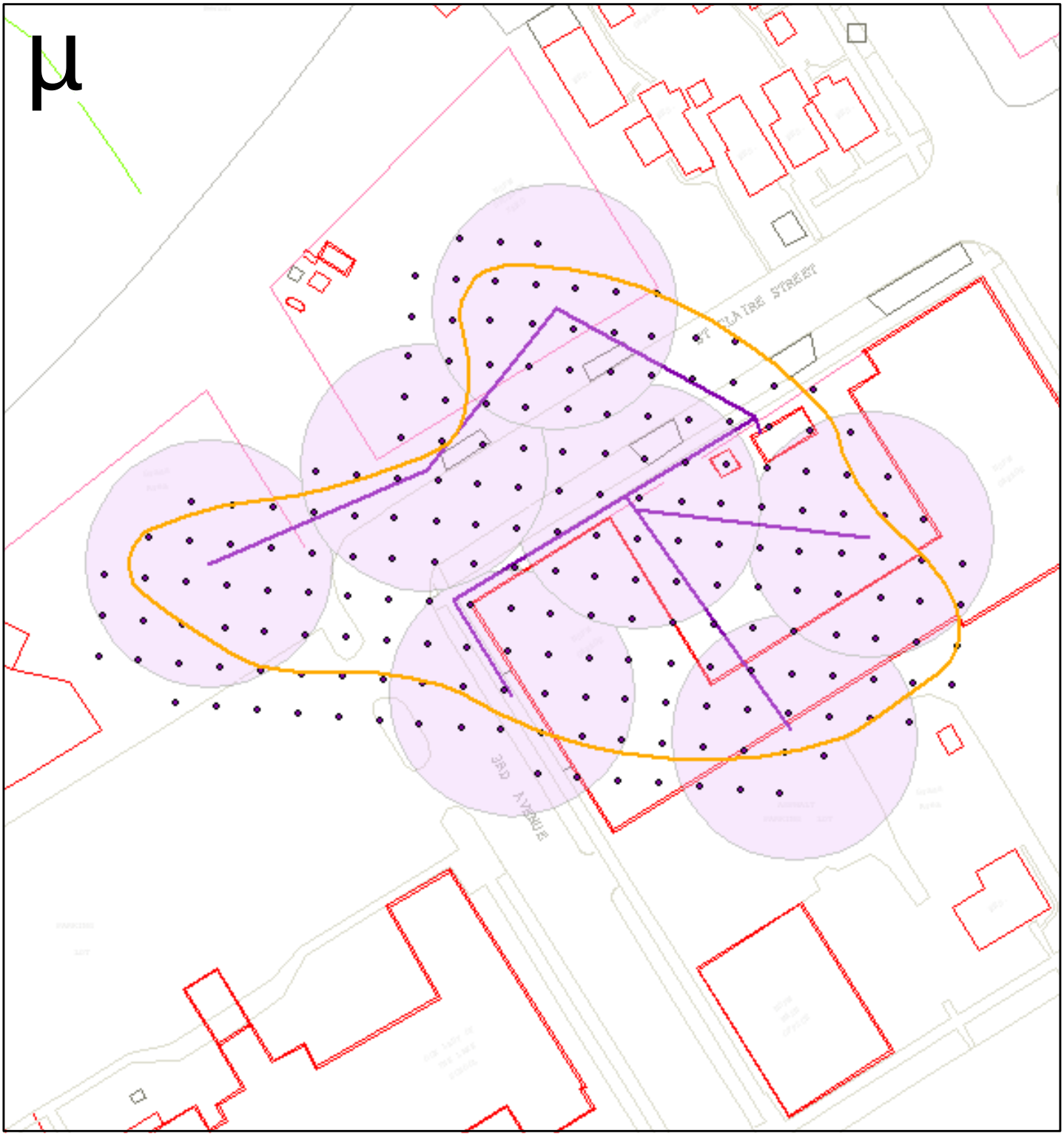
- Free Product Extent - Filled Ravine selection
- Free Product Extent Inferred - Filled Ravine selection
- Chem Ox injection borings
- SVE wells Passive

0 12.5 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 3-5A In-Situ Chemical Oxidation - Shallow Soil and Groundwater in Upper Bluff Area			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 5.OCT.2007	SHEET: 3-5A	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

- Free Product extent - Copper Falls aquifer
- Copper Falls Chem Ox borings
- Copper Falls recovery wells
- Lateral piping

0 12.5 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-5B
In-Situ Chemical Oxidation -
Copper Falls Aquifer

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	3-5B
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100

Legend

- Free Product Extent - Filled Ravine
- Free Product Extent Inferred - Filled Ravine
- ERH electrodes
- SVE wells Passive

0 12.5 25 50 75 100 Feet

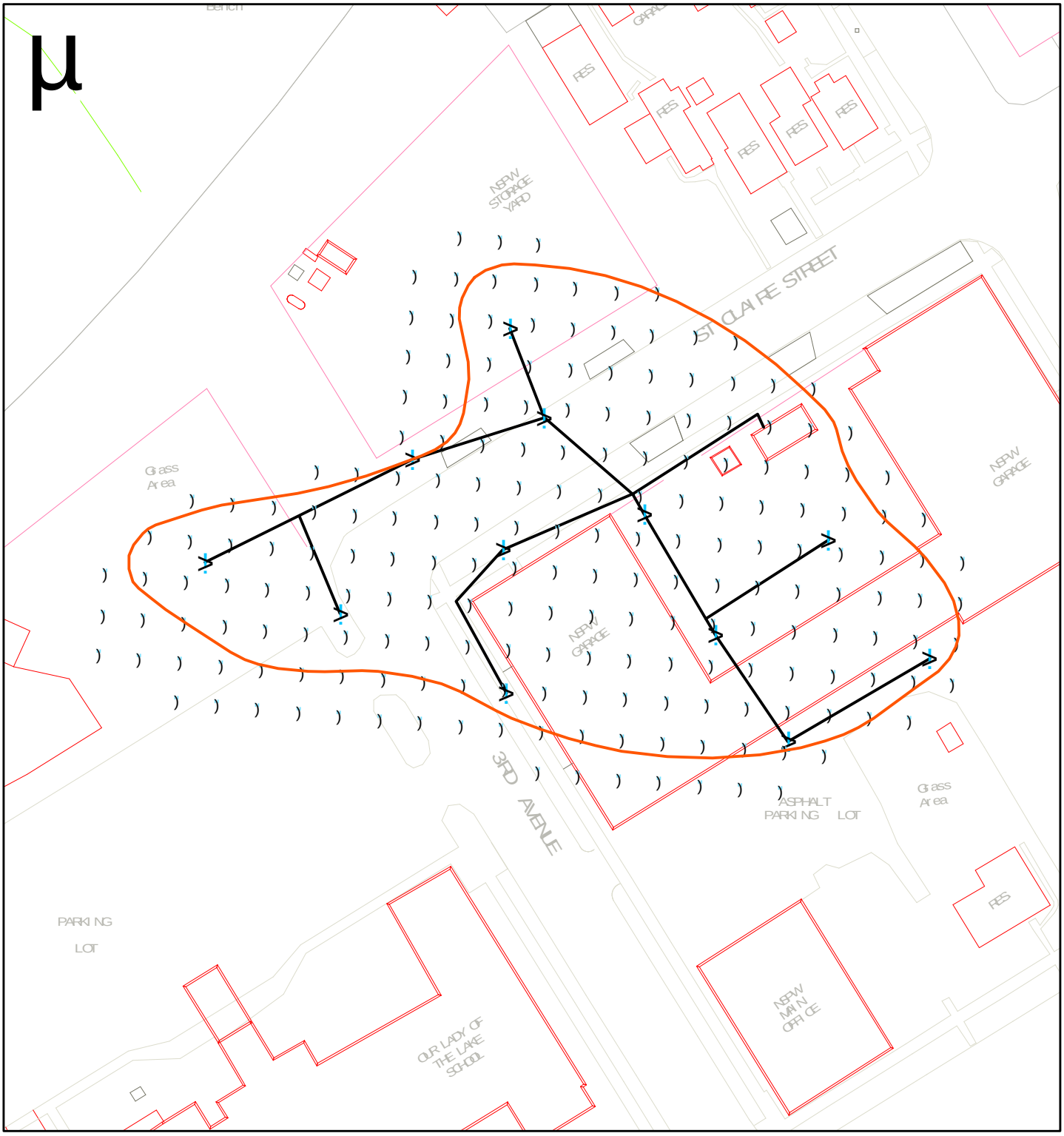
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-6A
In-Situ Electrical Resistance Heating -
Shallow Soil and Groundwater in Upper Bluff Area

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	3-6A
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

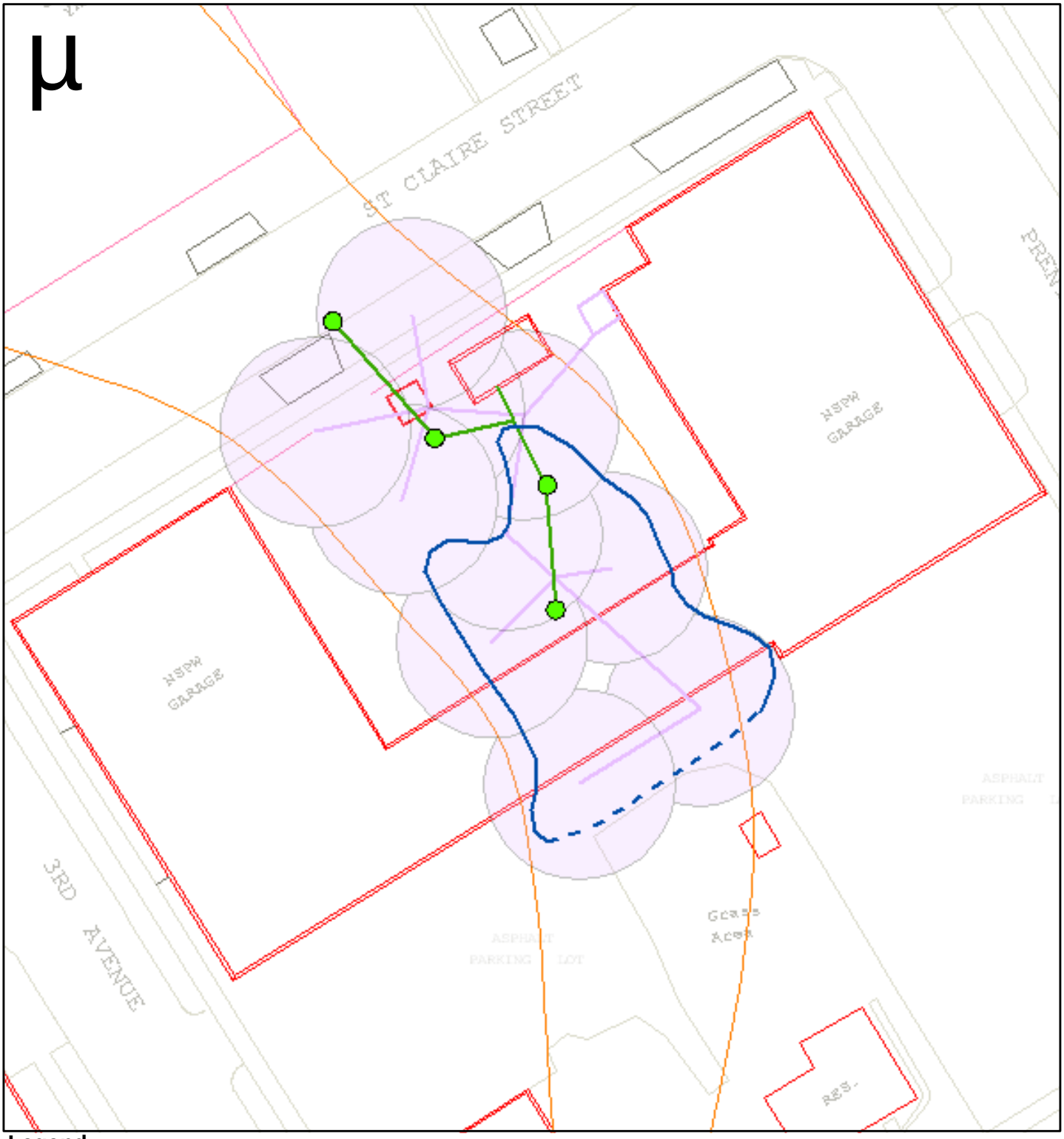
- Free Product extent - Copper Falls aquifer
- Copper Falls ERH electrodes
- Copper Falls ERH recovery wells
- ERH lateral piping

0 12.5 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 3-6B In-Situ Electrical Resistance Heating - Copper Falls Aquifer			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 5.OCT.2007	SHEET: 3-6B	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

- Free Product Extent - Filled Ravine
- Free Product Extent Inferred - Filled Ravine
- Recovery well
- Lateral piping
- SVE wells Active
- Active SVE lateral piping

0 12.5 25 50 75 100 Feet

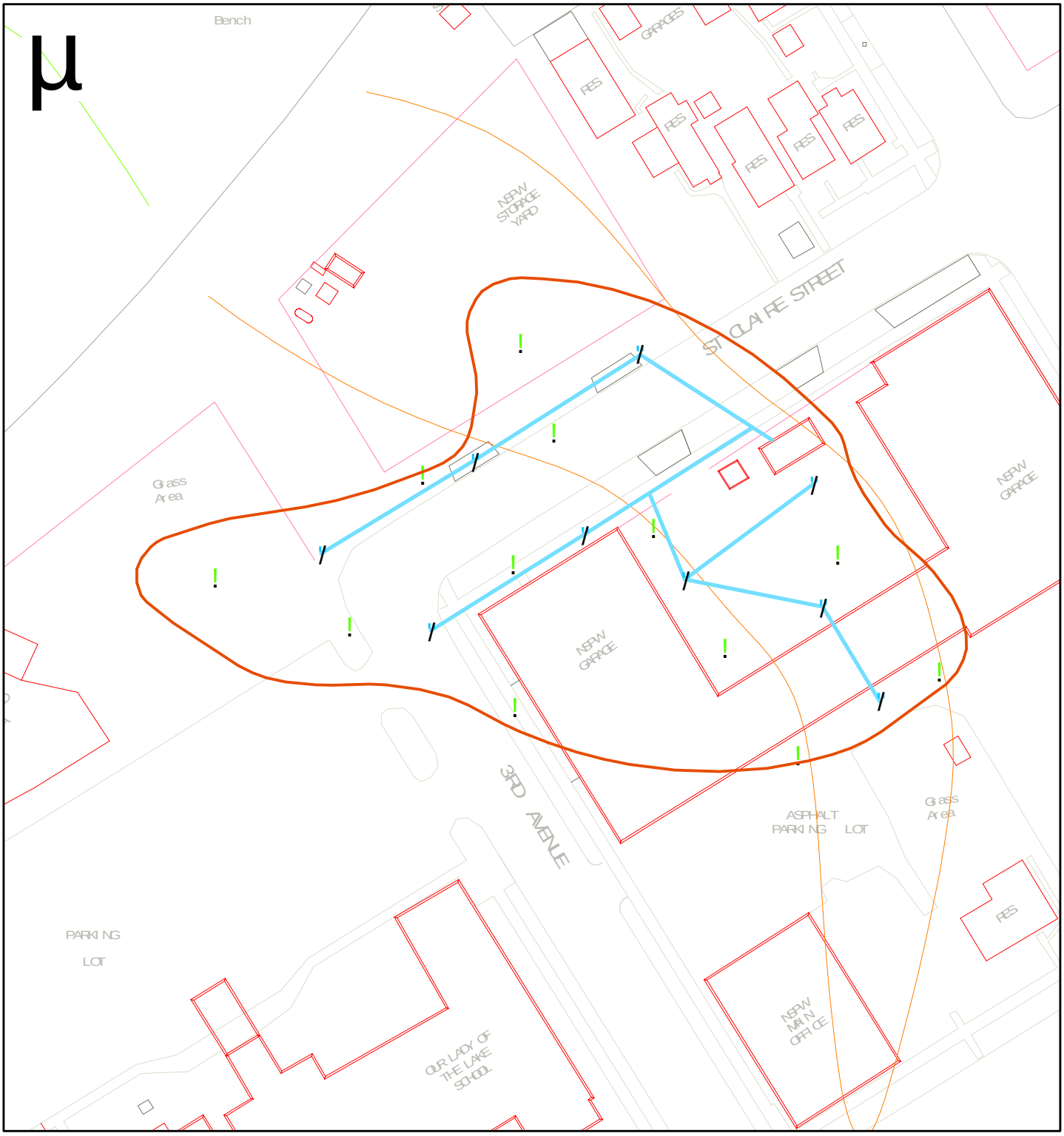
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-7A
In-Situ Steam Injection -
Shallow Soil and Groundwater in Upper Bluff Area

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	3-7A
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

Free Product -Copper Falls

Copper Falls Steam Injection wells

Description

- Injection well
- Steam recovery well
- Lateral piping

0 12.5 25 50 75 100 Feet

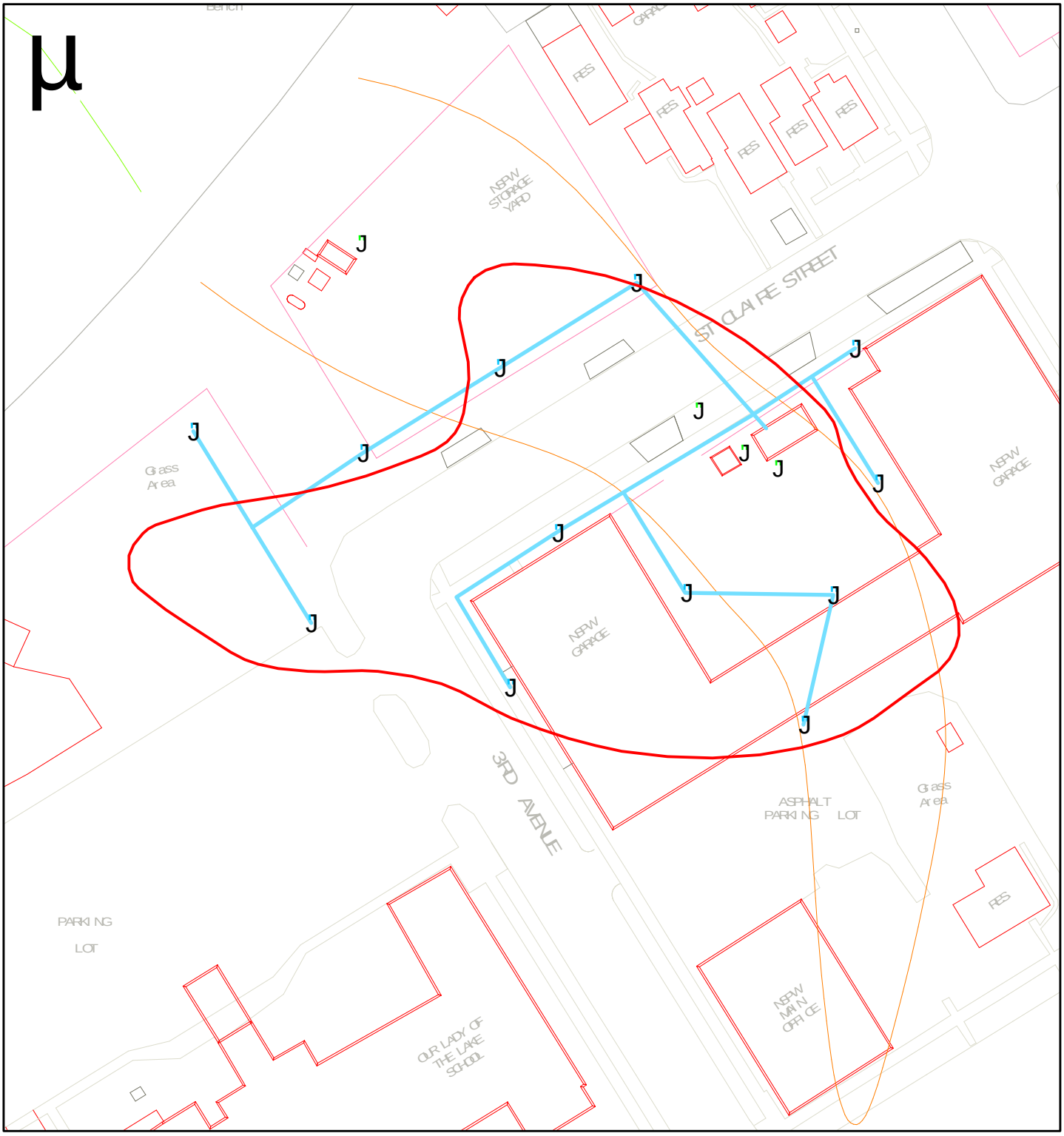
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-7B
In-Situ Steam Injection -
Copper Falls aquifer

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	5.OCT.2007	SHEET:	3-7B
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

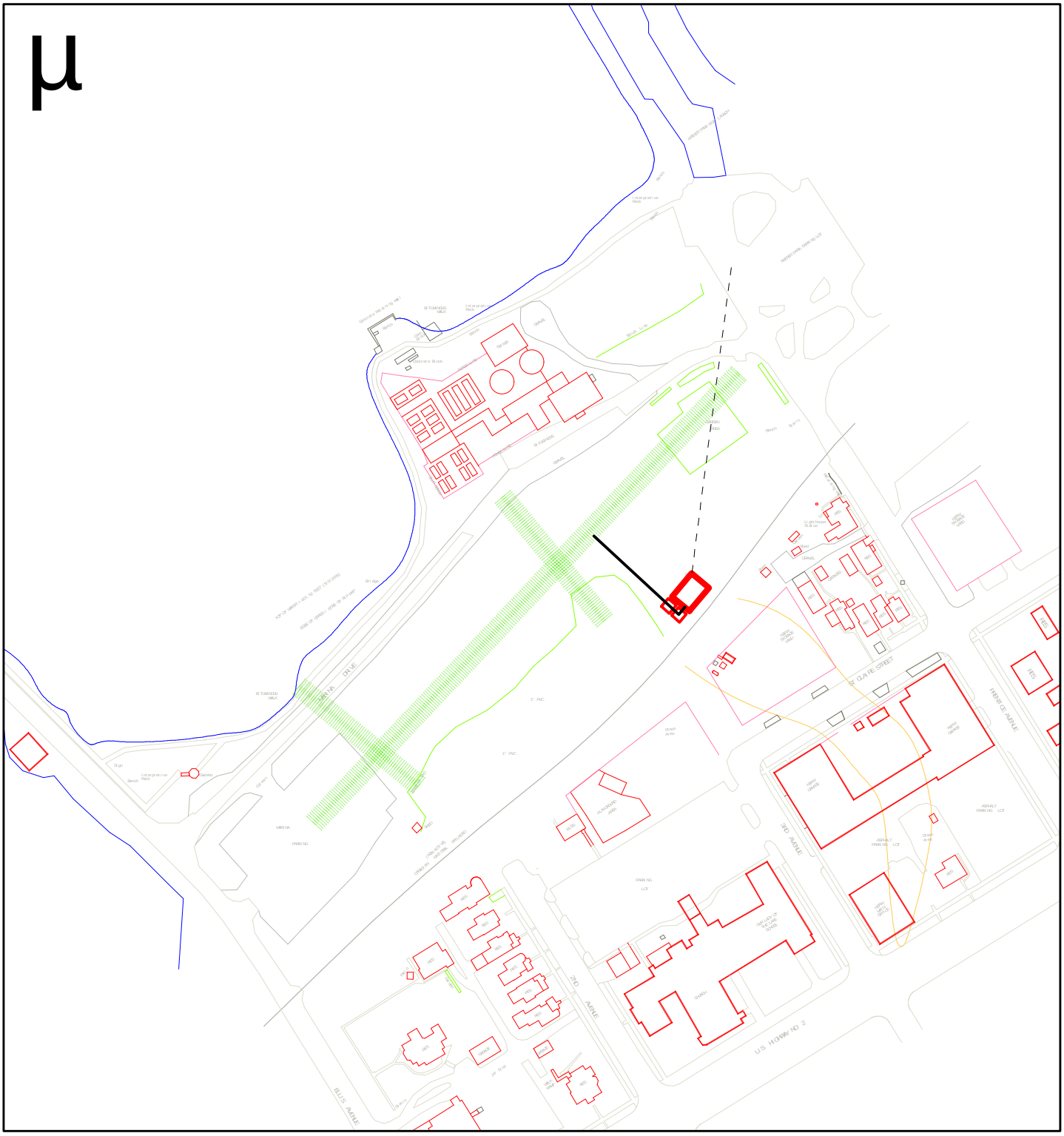
- Free Product extent - Copper Falls aquifer
- J Copper Falls GW extraction wells
- Copper Falls GW extraction lateral piping
- J Existing Extraction Wells

0 12.5 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 3-8A Removal Using Groundwater Extraction - Copper Falls Aquifer & Ravine Fill			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 5.OCT.2007	SHEET: 3-8A	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

Groundwater Extraction Trench

Description

- Discharge line
- GW extraction trench
- Influent Line
- OWS tanks
- Treatment Bldg

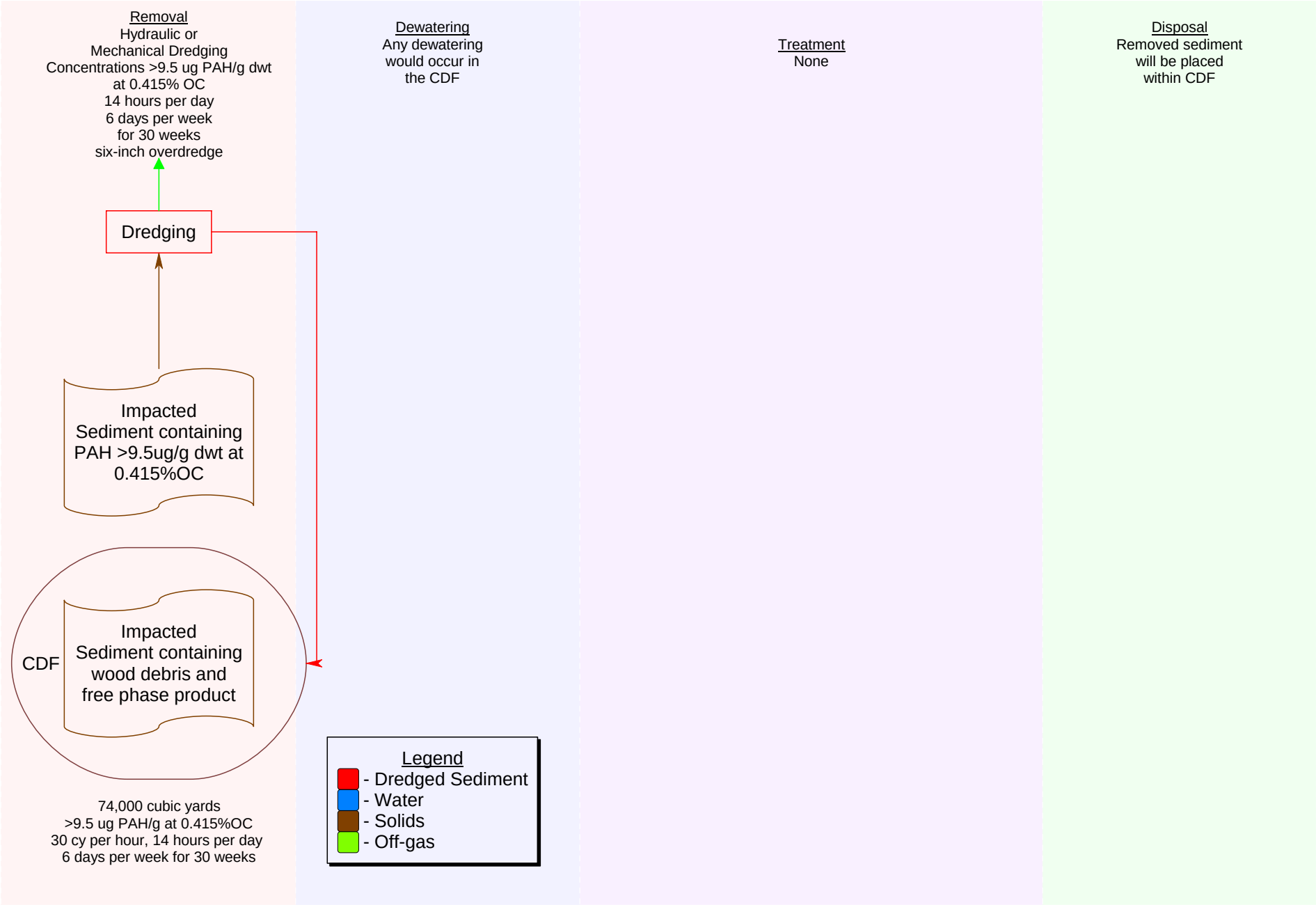
0 62.5 125 250 375 500 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 3-8B Removal Using Groundwater Extraction - Shallow Groundwater in Kreher Park			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 5.OCT.2007	SHEET: 3-8B	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100

Figure 4-1
Ashland/Northern States Power Lakefront Superfund Site
Alternative 2: Construct CDF over sediment containing significant wood debris and sediment with free phase,
remove sediment >9.5 ug PAH/g dwt at 0.415%OC outside the CDF footprint and place in CDF; monitor sediment areas>5.6 ug PAH/g dwt at 0.415%OC; No treatment



File: projects/ashland/process diagrams/Alt 4 frr.flo

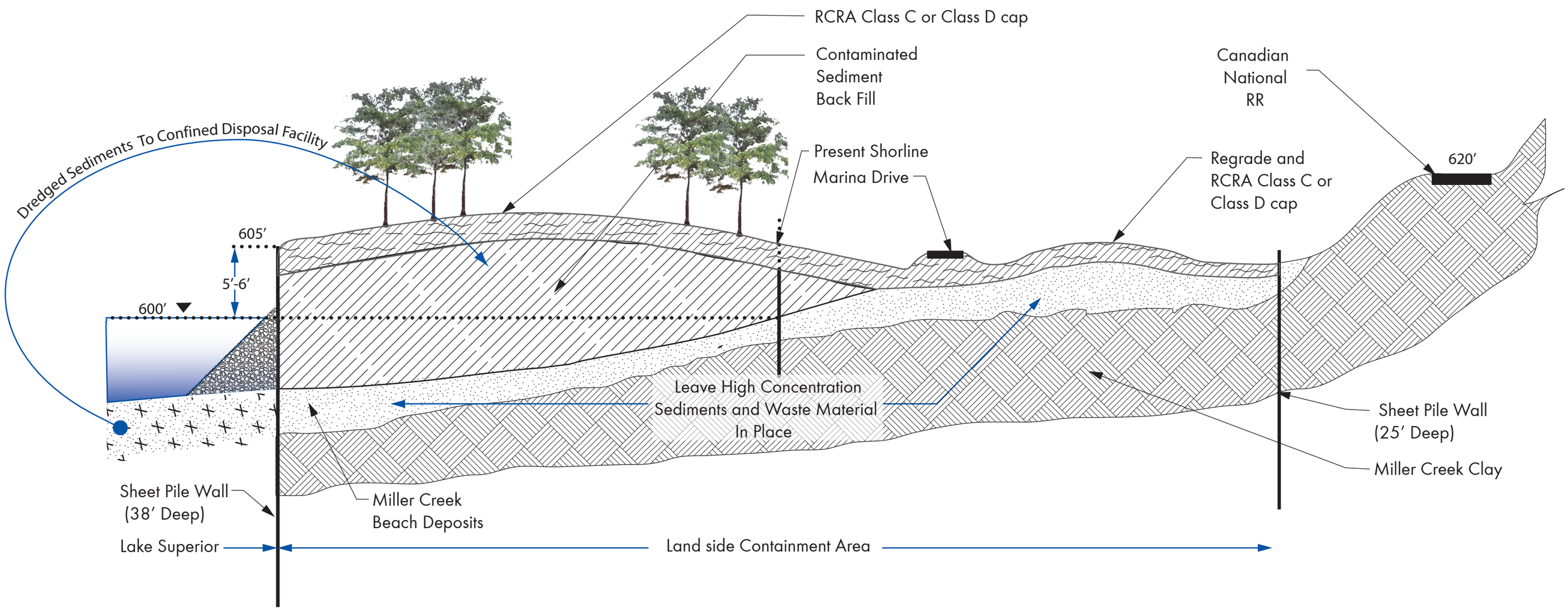


Figure 4-2

Ashland /NSP LakeFront Site

Section Concept

Ashland , Wisconsin

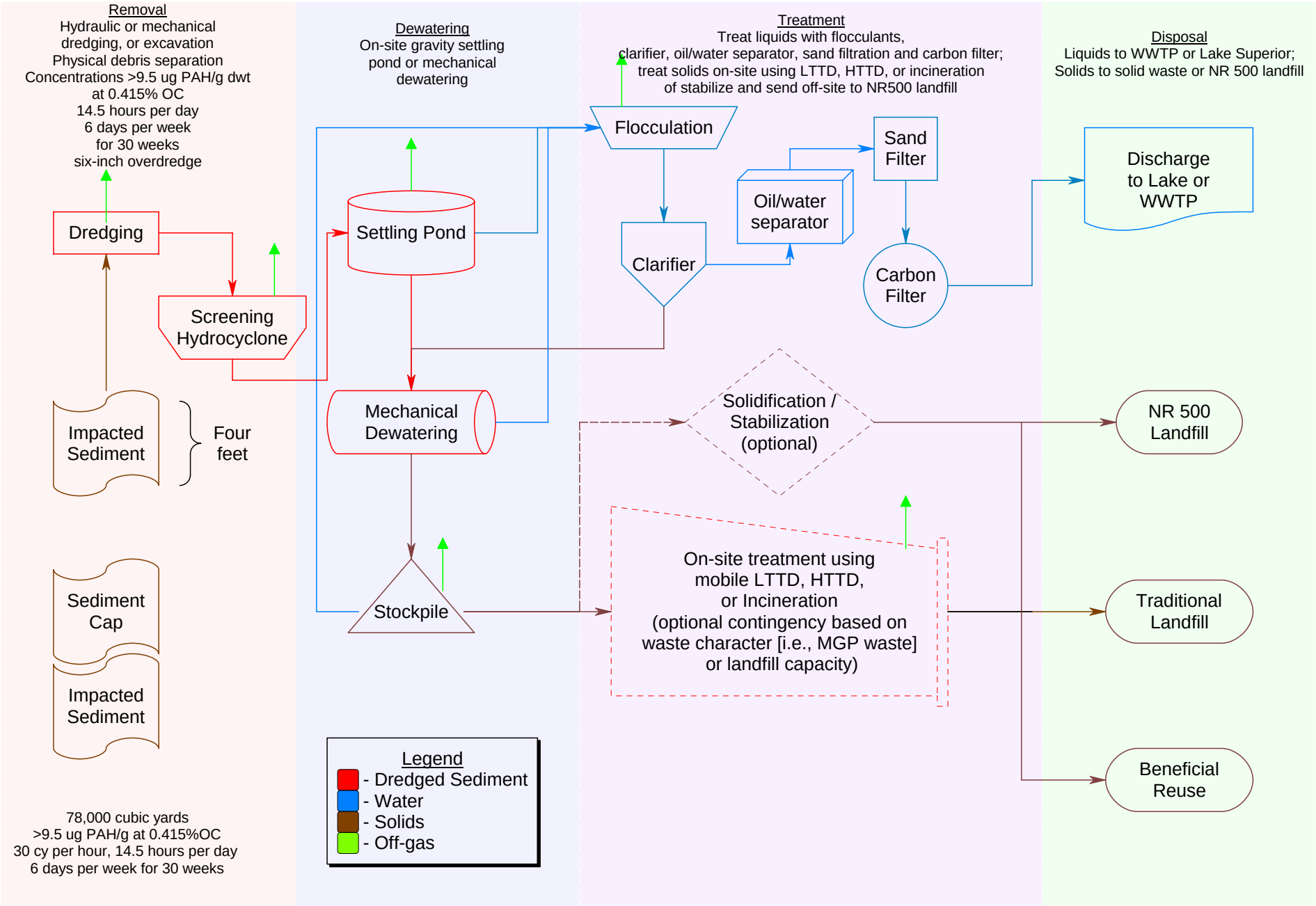
Figure 4-3

Ashland /NSP LakeFront Site

Redevelopment Concept Plan A

Ashland , Wisconsin

Figure 4-4
Ashland/Northern States Power Lakefront Superfund Site
Alternative 3: Remove sediment >9.5 ug PAH/g dwt at 0.415%OC to a depth of 4 feet; cap; treat sediment on-site, dispose of sediment off-site; monitor sediment areas >5.6 ug PAH/g dwt at 0.415%OC



File: projects/ashland/process diagrams/Alt 4 frr.flo

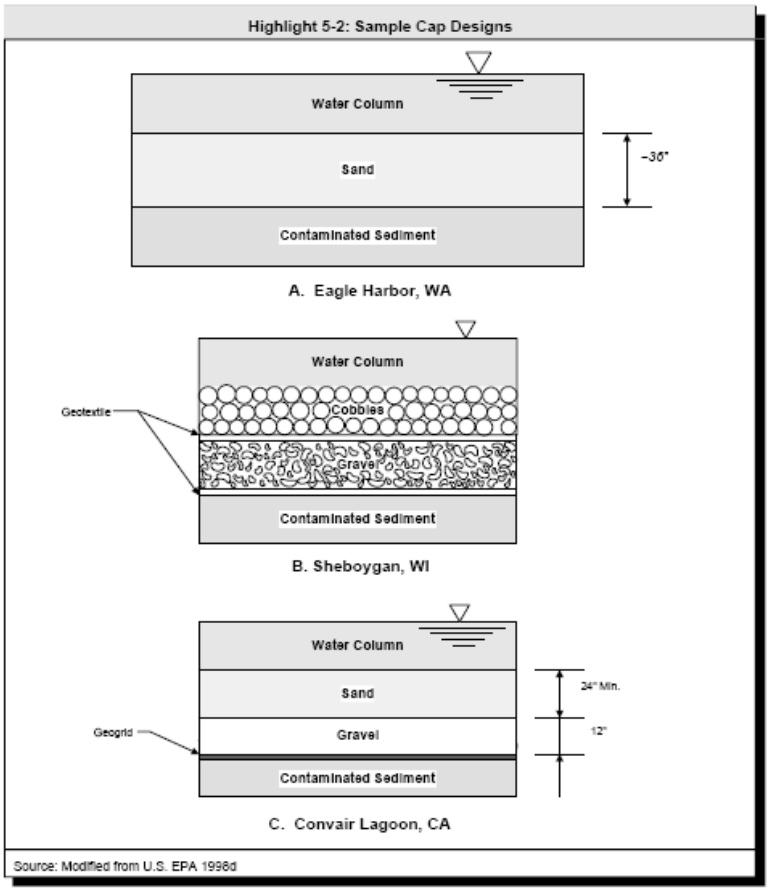
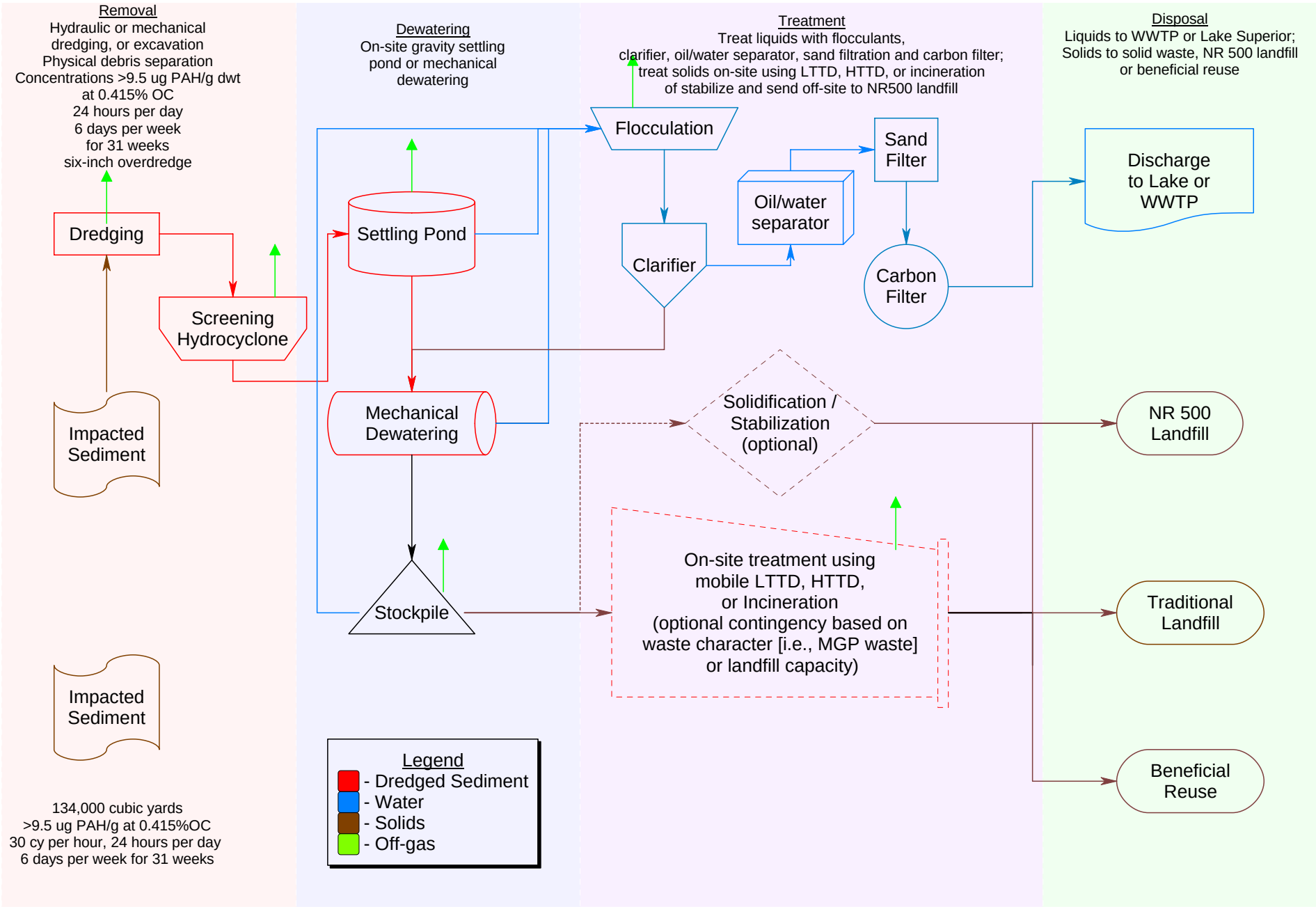


Figure 4-5. Elements of a Subaqueous Cap

Figure 4-6
Ashland/Northern States Power Lakefront Superfund Site
Alternative 4: Remove sediment >9.5 ug PAH/g dwt at 0.415%OC; treat sediment on-site, dispose of sediment off-site; monitor sediment areas >5.6 ug PAH/g dwt at 0.415%OC



File: projects/ashland/process diagrams/Alt 4 frr.flo

ATTACHMENTS

Attachment 1: Summary of Applicable or Relevant And Appropriate Requirements

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARARs can be divided into three categories: chemical-, action-, and location-specific and are summarized below.

Chemical-Specific

Chemical-specific ARARs identified in the Alternatives Tech Memo are as follows:

- Clean Air Act
- Clean Water Act
- Resource Conservation and Recovery Act (RCRA)
- State of Wisconsin Groundwater Quality Standards - WAC Chapter NR 140
- State of Wisconsin Water Quality Standards- WAC Chapter NR 300
- State of Wisconsin Air Quality Standards - WAC Chapter NR 400
- State of Wisconsin Hazardous Substance Spill Law and Soil Cleanup Standards - WAC Chapter NR 700

Action-specific

Action-specific ARARs identified in the Alternatives Tech Memo are as follows:

- Clean Air Act
- Clean Water Act
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- Resource Conservation and Recovery At (RCRA)
- Department of Transportation Rules for Hazardous Materials Transport
- Occupational Safety and Health Administration (OSHA)
- State of Wisconsin Requirements for Plans and Specification Submittal – WAC Chapter NR 108
- State of Wisconsin Environmental Policy Act - Sec. 1.11, Wis. Stats. and WAC NR 150
- State of Wisconsin Laboratory Certification and Registration Program – WAC Chapter NR 149
- State of Wisconsin Pollutant Discharge Regulations (WPDES) – WAC Chapter NR 200
- State Stormwater Pollution Control Program - WAC Chapter NR 216
- State of Wisconsin Water Quality Regulations – WAC Chapter NR 300
- State of Wisconsin Air Pollution Control Regulations – WAC Chapter NR 400
- State of Wisconsin Solid Waste Management Regulations - WAC Chapters NR 500 through 520
- State of Wisconsin Solid Waste Management Regulations – WAC Chapter NR 500 and Wisconsin Statute 289.43
- State of Wisconsin Hazardous Waste Management Rules – WAC Chapter NR 600
- State of Wisconsin Investigation and Remediation of Environmental Contamination – WAC Chapter NR 700
- State of Wisconsin Statutes Chapter 30

Location-specific

Location-specific ARARs identified in the Alternatives Tech Memo are as follows:

- Clean Water Act
- Section 10 – Rivers and Harbors Act
- State of Wisconsin - WAC Chapter NR 1.05 and Wisconsin Statute 30.01
- State of Wisconsin Statutes Chapter 289
- State of Wisconsin Solid Waste Management – Beneficial Reuse Exemption WAC Chapter NR 500.08
- State of Wisconsin Statutes Chapter 30

To Be Considered Information

TBCs can be grouped into chemical-, location-, and action-specific categories. Important laws, regulations and guidance that are TBCs for the Ashland/NSP Lakefront site are listed below. A complete discussion is presented in the Alternatives Tech Memo.

- USEPA's Contaminated Management Strategy
- USEPA's Contaminated Sediment Remediation Guidance
- Agency for Toxic Substances and Disease Registry
- Great Lakes Water Quality Initiative
- State of Wisconsin Interim Consensus Based Sediment Quality Guidance
- WDNR Dredge and Fill Requirements
- Federal Safe Drinking Water Act
- Great Lakes Water Quality Agreement
- Section 303(d) – Clean Water Act
- State of Wisconsin Water Quality Regulations - WAC Chapter NR 300
- WDNR Sediment Quality Assessment at MGP Guidance
- WDNR Management of Waste from Remediation of Manufactured Gas Plants
- WDNR Soil Cover Systems Guidance
- WDNR Soil Cleanup Levels for PAH Guidance
- WDNR Investigation Derived Waste Management Guidance
- WDNR Groundwater Discharge Guidance
- Sediment Remediation Implementation Guidance
- Local Permits

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

Table 1 – ARAR Summary
For Potential Soil Remedial Alternatives

ARAR / TBC	Alternative S2A		Alternative S2B		Alternative S3		Alternative S4		Alternative S5	
	Limited Removal and Off-site Disposal		Unlimited Removal and Off-site Disposal		Limited Removal and On-site Disposal		Limited Removal and Ex-situ Thermal Treatment		Limited Removal and Ex-situ Soil Washing	
	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply
Chemical Specific										
RCRA – Definition of Hazardous Waste 40 CFR 261	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Primary and Secondary Ambient Air Quality Standards (NAAQS) 40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR Part 61	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Hazardous Substance Spill Law and Soil Cleanup Standards Ch. 292.11, NR 720	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Groundwater Quality –WAC NR140	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Pollutant Discharge Elimination Systems - WAC NR 200	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations – WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Soil Cleanup Standards – WAC NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Guidance for Generic Soil PAH Cleanup Levels (WDNR PUBL-RR-519-97, April 1997)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Lab Certif. – WAC NR 149	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Action Specific										
CERCLA - Procedures for Planning and Implementing Off-site Response Actions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Subtitle D Non-hazardous Waste Standards 40 CFR 257	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Manifesting, Transport, and Record keeping Requirements 40 CFR 262	Yes	Yes	Yes	Yes	Yes	Yes	No	NA	No	NA
RCRA - Wastewater Treatment System Standards 40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Excavation and Fugitive Dust	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

Table 1 – ARAR Summary
For Potential Soil Remedial Alternatives

ARAR / TBC	Alternative S2A		Alternative S2B		Alternative S3		Alternative S4		Alternative S5	
	Limited Removal and Off-site Disposal		Unlimited Removal and Off-site Disposal		Limited Removal and On-site Disposal		Limited Removal and Ex-situ Thermal Treatment		Limited Removal and Ex-situ Soil Washing	
	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply
Requirements 40 CFR 264										
RCRA - Storage Requirements 40 CFR 264, 265	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations NR 400	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Solid Waste Management Regs NR 500	Yes	Yes	Yes	Yes	Yes	Yes	No	NA	No	NA
WI Hazardous Waste Regulations – NR 600	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Invest. & Remed. of Env. Contamination – NR 700	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Cover Systems (Cover Systems as Soil Performance Standard Remedies (WDNR PUBL-RR-709, Jan. 2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Management of Investigation Derived Waste (Interim Guidelines for the Management of Investigation – Derived Waste (WDNR PUBL-RR- 556-93, May 1993)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Groundwater Discharge Requirements (Informational Document for Wisconsin Discharge Permit; Contaminated Groundwater from Remedial Action Operations (WDNR PUBL- RR-583-01, May 2001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Management of Waste from Remediation of Manufactured Gas Plants (Draft Management of Waste from Remediation of Manufactured Gas Plants (WDNR PUBL – RR – 768, Feb 2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OSHA Occupational Safety and Health Standards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DOT Haz Mat Transport	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI SPCC – NR 216	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

Table 1 – ARAR Summary
For Potential Soil Remedial Alternatives

ARAR / TBC	Alternative S2A		Alternative S2B		Alternative S3		Alternative S4		Alternative S5	
	Limited Removal and Off-site Disposal		Unlimited Removal and Off-site Disposal		Limited Removal and On-site Disposal		Limited Removal and Ex-situ Thermal Treatment		Limited Removal and Ex-situ Soil Washing	
	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply
Location Specific										
Landfill Siting and Approval Pricess WI Statutes Ch. 289	No	NA	No	NA	Yes	Yes	No	NA	No	NA
Solid Waste Management Regs – NR 500	Yes	Yes	Yes	Yes	Yes	Yes	No	NA	No	NA
To Be Considered										
WI Water Quality Regs – NR 300	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Safe Drinking Water Act	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Great Lakes Water Quality Agreement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act 303(d)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Strategy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Guidance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Great Lakes Water Quality Initiative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local Permits	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

Table 3-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparging**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Chemical Specific																
RCRA – Definition of Hazardous Waste 40 CFR 261	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Primary and Secondary Ambient Air Quality Standards (NAAQS) 40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR Part 61	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Hazardous Substance Spill Law and Soil Cleanup Standards – Ch. 292.11, NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Groundwater Quality –WAC NR140	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Pollutant Discharge Elimination Systems - WAC NR 200	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations – WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Soil Cleanup Standards – WAC NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Soil Cleanup Standards – WAC NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Guidance for	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparging**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Generic Soil PAH Cleanup Levels (WDNR PUBL-RR-519-97, April 1997)																
WI Lab Certif. – WAC NR 149	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Action Specific																
CERCLA - Procedures for Planning and Implementing Off-site Response Actions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Subtitle D Non-hazardous Waste Standards 40 CFR 257	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Manifesting, Transport, and Record keeping Requirements 40 CFR 262	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Wastewater Treatment System Standards 40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Excavation and Fugitive Dust Requirements 40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Storage Requirements 40 CFR 264, 265	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations – NR 400	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Solid Waste Management Regs –	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

Table 3-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparging**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
NR 500																
WI Hazardous Waste Regulations – NR 600	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Invest. & Remed. of Env. Contamination – NR 700	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Cover Systems (Cover Systems as Soil Performance Standard Remedies; WDNR PUBL-RR-709, Jan. 2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Management of Investigation Derived Waste (Interim Guidelines for the Management of Investigation – Derived Waste; WDNR PUBL-RR- 556-93, May 1993	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Groundwater Discharge Requirements (Informational Document for Wisconsin Discharge Permit; Contaminated Groundwater from Remedial Action Operations; WDNR PUBL- RR-583-01, May 2001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Management of Waste from	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

Table 3-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparging**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Remediation of Manufactured Gas Plants (Draft Management of Waste from Remediation of Manufactured Gas Plants; WDNR PUBL – RR – 768, Feb 2007)																
OSHA – Occupational Safety and Health Standards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DOT Haz Mat Transport	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI SPCC – NR 216	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location Specific																
Landfill Siting and Approval Pricess WI Statutes Ch. 289	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Solid Waste Management Regs – NR 500	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
To Be Considered																
WI Water Quality Regs – NR 300	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Safe Drinking Water Act	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Great Lakes Water Quality Agreement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act 303(d)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Strategy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Guidance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

Table 3-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparging**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Great Lakes Water Quality Initiative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local Permits	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3 - Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Chemical Specific								
Clean Water Act	Ambient Water Quality Criteria	CWA Section 304 Quality, Criteria for Water, EPA 1986	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act	Water Quality Standards	CWA Section 303, 40CFR 131	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act	Proposed Sediment Quality Criteria	CWA Section 304 Sediment Quality Criteria, EPA, 1991	No	NA	No	NA	No	NA
Resource Conservation and Recovery Act	Definition of Hazardous Waste	40 CFR 261	No	NA	No	NA	No	NA
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act	National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	No	NA	No	NA	No	NA

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
USEPA Contaminated Sediment Management Strategy		EPA-823-R-98-001	Yes	Yes	Yes	Yes	Yes	Yes
USEPA Contaminated Sediment Management Guidance		EPA-540-R-05-012	Yes	Yes	Yes	Yes	Yes	Yes
Agency for Toxic Substances and Disease Registry, US Public Health Service		NA	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Water Quality Standards for Wisconsin Surface Waters	WAC NR 102-105	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Groundwater Quality	WAC NR 140	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin State Air Pollutant Control Regulations	WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Wisconsin State Environmental Protection Administrative Code (WAC)	Soil Cleanup Standards	WAC NR 720	No	NA	No	NA	No	NA
Sediment Quality Guidelines (CBSQGs)		Document Title: Consensus-Based Sediment Quality Guidelines, Recommendations for Use & Application, Interim Guidance; WDNR PUBL-WT-732 2003	Yes	Yes	Yes	Yes	Yes	Yes
Guidance for Generic Soil PAH Cleanup Levels		Document title: Soil Cleanup Levels for PAHs Interim Guidance: WDNR PUBL RR519-97, April 1997	No	NA	No	NA	No	NA

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Location Specific								
Clean Water Act	Great Lakes Critical Program Act of 1990 – Assessment of Remediation of Contaminated Sediments (ARCS) Program	CWA Section 118(c)(7) 40 CFR Part 132 (Appendix E)	No	NA	No	NA	No	NA
USEPA Contaminated Sediment Management Strategy		EPA-823-R-98-001	Yes	Yes	Yes	Yes	Yes	Yes
International Joint Commission (IJC)		IJC, 1992	No	NA	No	NA	No	NA
Rivers and Harbors Act		33 CFR 320	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Designated Waters Special Natural Resources Interest	WAC s. NR 1.05(4), and s. 30.01(1am), Wis. Stats.	No	NA	No	NA	No	NA
Solid Waste Management	Beneficial Reuse Solid Waste Exemption	WAC NR 500.08	No	NA	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Dredge and Fill Requirements		WDNR 1985, 1990	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
Local Permits (building, zoning, other)		---	TBD	TBD	TBD	TBD	TBD	TBD
Sediment Quality Assessment at Manufactured Gas Plant Sites		Document Title: Assessing Sediment Quality in Water Bodies Associated with Manufactured Gas Plant Sites: WDNR PUBL-WR-447-96, March 1996	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Statutes	Landfill Siting and Approval Process	Wis. Stats. Ch. 289	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
Wisconsin State Environmental Protection Statutes	Permit in Navigable Waters	Wis Stats. Ch. 30	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Action Specific								
Clean Water Act	National Pollutant Discharge Elimination System	CWA Section 401	No	NA (WPDES)	No	NA (WPDES)	No	NA (WPDES)
Clean Water Act	Effluent Standards – Technology – Based Discharge Requirements	CWA Section 301 (b)	No	NA	No	NA	No	NA
Clean Water Act	Dredge and Fill Requirements	CWA Section 404 (Inland Testing Manual)	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
Comprehensive Environmental Response, Compensation and Liability Act	Procedures for Planning and Implementing Off-site Response Actions	40 CFR 300.440	No	NA	Yes	Yes	Yes	Yes
Resource Recovery and Conservation Act	Manifesting, Transport and Recordkeeping Requirements	40 CFR 262	No	NA	No	NA	No	NA
Resource Recovery and Conservation Act	Wastewater Treatment System Standards	40 CFR 264	No	NA	No	NA	No	NA

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Resource Recovery and Conservation Act	Storage Requirements	40 CFR 264, 265	No	NA	No	NA	No	NA
Resource Recovery and Conservation Act	Subtitle D Non-hazardous Waste Standards	40 CFR 257	Yes	Yes	Yes	Yes	Yes	Yes
Resource Recovery and Conservation Act	Excavation and Fugitive Dust Requirements	40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes
Dept. of Transportation	DOT Rules for Hazardous Materials Transport	49 CFR 107-171	No	NA	Yes	Yes	Yes	Yes
Occupational Health & Safety	Occupational Safety and Health Standards	29 CFR Parts 1910.120, 1910.132, 1910.134, 1910.138	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Clean Air Act	National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	Yes	Yes	Yes	Yes	Yes	Yes
USEPA Contaminated Sediment Management Strategy		EPA-823-R-98-001	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Designated Waters Special Natural Resources Interest	WAC s. NR 1.05(4), and s. 30.01(1am), Wis. Stats.	No	NA	No	NA	No	NA
Wisconsin State Environmental Protection Administrative Code (WAC)	Plans and Specifications Review of Projects and Operations	WAC NR 108	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Environmental Analysis and Review Procedures	WAC NR 150	No	NA	No	NA	No	NA

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Wisconsin State Environmental Protection Administrative Code (WAC)	Laboratory Certification and Registration	WAC NR 149	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin Pollutant Discharge Elimination Systems	WAC NR 200	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
Wisconsin State Environmental Protection Administrative Code (WAC)	Water Quality Antidegradation	WAC NR 207	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Water Quality Antidegradation: Waste Load Allocated, Water Quality-related Effluent Standards and Limitations	WAC NR 212-220	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Lining of Industrial Lagoons and Design of Storage Structures	WAC NR 213	No	NA	No	NA	No	NA

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin's General Permit Program for Certain Water Regulatory Permits	WAC NR 322	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
Wisconsin State Environmental Protection Administrative Code (WAC)	Shoreline protection	WAC ch. NR 328	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Dredging Contract Fees	WAC NR 346	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Sediment Sampling and Analysis, Monitoring Protocol, and Disposal Criteria for Dredging Projects	WAC NR 347	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Wisconsin State Environmental Protection Administrative Code (WAC)	Wisconsin State Air Pollutant Control Regulations	WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Solid Waste Management	WAC NR 500-520	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Beneficial Reuse Solid Waste Exemption	WAC NR 500.08	No	NA	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Hazardous Waste Management	WAC NR 600-685	No	NA	No	NA	No	NA
Wisconsin State Environmental Protection Administrative Code (WAC)	Investigation of Remediation of Environmental Contamination	WAC NR 700	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Wisconsin State Environmental Protection Administrative Code (WAC)	Notification of the Discharge of Hazardous Substances	WAC NR 706	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Public Information and Participation	WAC Ch. NR 714	No	NA	No	NA	No	NA
Wisconsin State Environmental Protection Administrative Code (WAC)	Standard for Selecting Remedial Actions	WAC NR 722	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Administrative Code (WAC)	Remedial and Interim Action Design, Implementation, Operation, Maintenance and Monitoring Requirements	WAC Ch. NR 724	Yes	Yes	Yes	Yes	Yes	Yes
Dredge and Fill Requirements		WDNR 1985, 1990	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Great Lakes Water Quality Initiative (GLI)		WAC 102 and 106 EPA 1995	Yes	Yes	Yes	Yes	Yes	Yes
Sediment Quality Assessment at Manufactured Gas Plant Sites		Document Title: Assessing Sediment Quality in Water Bodies Associated with Manufactured Gas Plant Sites: WDNR PUBL-WR-447-96, March 1996	Yes	Yes	Yes	Yes	Yes	Yes
Guidance for Soil Cover Systems		Document title: Guidance for Cover Systems as Soil Performance Standard Remedies. WDNR-PUBL-RR-709, April 2004	No	NA	No	NA	No	NA

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Sediment Quality Guidelines		Document Title: Consensus-Based Sediment Quality Guidelines Recommendations for Use & Application Interim Guidance. WDNR-PUBL-WT-732 2003	Yes	Yes	Yes	Yes	Yes	Yes
Air Management, Public Participation and Risk Communication		Document Title: Health-based Guidelines for Air Management, Public Participation, and Risk Communication During the Excavation of Former MGPs, DHFS 2004	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin State Environmental Protection Statutes	Sediment Remediation Implementation Guidance	Strategic Directions Report, WDNR 1995	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 1 – Summary of Applicable or Relevant and Appropriate Requirements

ARAR OR TBC			Alternative SED2		Alternative SED3		Alternative SED4	
Program	**Requirements**	**Citation**	Apply	Comply	Apply	Comply	Apply	Comply
Wisconsin State Environmental Protection Statutes	Low-hazard Solid Waste Exemption	Wis. Stats. Ch. 289.43	Yes	Yes	Yes	Yes	Yes	Yes
Guidance for Management of Investigation Derived Waste		Document title: Interim Guidelines for the Management of Investigation-Derived Waste. WDNR-PUBL-RR-556-93, May 1993.	Yes	Yes	Yes	Yes	Yes	Yes
Groundwater Discharge Requirements		Document title: Informational Document for Wisconsin Discharge Permit; Contaminated Groundwater from Remedial Action operations; WDNR-PUBL-RR-583-01, May 2001	No	NA	No	NA	No	NA
Management of Wastes from Remediation of Manufactured Gas Plants		Document Title: Draft Management of Wastes from Remediation of Manufactured Gas Plants; WDNR PUBL - RR-768, Feb 2007	Yes	Yes	Yes	Yes	Yes	Yes

Attachment 2: Preliminary Analysis of Volatilization

Attachment 2:
Ashland/Northern States Power Lakefront Superfund Site
Preliminary Air Quality Modeling Results

Summary

Preliminary modeling using US Environmental Protection Agency (EPA) models and Wisconsin Department or Natural Resources (DNR) air toxics guidance has suggested that onshore sediment dewatering and treatment areas may potentially exceed the acceptable DNR air quality threshold values for naphthalene and perhaps benzene at locations near the source. Impacts beyond those areas are likely to be less than the DNR thresholds and therefore impacts should be minimal to the outlying areas. This modeling report preliminary and is based upon results that haven't been fully evaluated, including conducting sensitivity analysis and QC checks. A final report on these efforts will be available for inclusion in the Feasibility Study

Two remedial alternatives were preliminarily evaluated. These alternatives included Alternative 2: Construction and filling of a Confined Disposal Facility (CDF) and Alternative 4: Dredging all sediments (=dredge all alternative). Five years of local meteorological data were used to support the seasonal operations.

Modeling Overview

Several alternatives for remediation of impacted sediment in Chequamegon Bay along the shore of Ashland, Wisconsin are being evaluated.

Remedial operations including construction and filling of a CDF, dredging and dewatering and treatment of dredged sediment will result in the disturbance of the sediments and the potential release of VOCs including naphthalene, methylnaphthalene, and benzene., Both naphthalene and benzene are listed air toxic contaminants in the DNR regulation and air emissions associated with the planned operations potentially could impact local air quality.

The current plan suggests a dredge all alternative and a dredge/CDF alternative which includes about one-half the amount of dredging as the dredge all alternative. Locations where sediment was collected to evaluate likely dredge all source areas are shown in Figure 1a and 1b. The source areas in the offshore locations were assumed to be associated with active dredging and passive releases when dredging is not occurring. These source locations are result of the suspension of the sediment particles into the water from dredging and contaminants partitioning into the dissolved phase in the overlying water. The contaminants then partition into the air. This contaminant flux is measured in the wind tunnel tests as a basis for these emissions and used in the model. Onshore locations include a pond where dredged material would be dewatered as well as areas where sediment will be stockpiled while awaiting treatment and transportation. These locations will have both active and passive emission periods that are simulated in

the wind tunnel tests for determining contaminant flux to the air for this type of activity. Source locations for the dredge/CDF alternative are similar but do not include the onshore activity. Instead, the contaminant emissions flux is based on wind tunnel tests associated with the dredge filling operations of this CDF area and are similar to the onshore pond flux rates. Since dredging does not occur within the CDF, dredging emissions only include areas outside the CDF.

Preliminary modeling assessments have been completed for operations associated with these two alternatives to examine the potential for impacts to local air quality. The EPA AERMOD (version 07026) (USEPA 2007) model was used and worst-case short-term and annual assumptions were made so as to provide a conservative (i.e. environmentally protective) assessments of potential impacts.

For example, assumptions include that dredging will occur in small cells[1] for 1-4 days duration. The preliminary modeling used the worst case emission rate over this small area (100 ft x 100 ft or 30.48m x 30.48m) as if that area were being dredged continually for the duration of the dredging. Similarly, worse case emission rates for the dewatering ponds, CDF and stockpile areas are based on the dredging worst case cell for the full duration of dredging were applied.

Preliminary Modeled Results

The emissions scenarios evaluated in the analysis are shown in Table 1 and include all of the small cells shown as source ID for dredging. These cells and their numbers are based upon the schematization of the model. They include dredging as well as stockpile and dewater pond sources from the dredge all alternative as well as the limited dredging and associated water surface area of the CDF in Alternative 2. The naphthalene emission rates shown are based on active dredging in one area (at cell 25) with pond releases associated with cell 25 sediment contaminant concentrations. The emission rates of benzene are also based on cell 25 as the worst case cell. The same cell 25 was used for both alternatives since cell 25 is also dredged in Alternative 2. This approach was taken as cell 25 exhibited the greatest concentration naphthalene emission rate and resulted in the highest impacts compared with the short-term standard air quality standard of 1258 $\mu g/m^3$ for naphthalene. While benzene has no specific value listed it does have an annual averaging period listed in the DNR regulation (Table A, NR 445.07).

As shown in Table 1, each cell measured 100 x 100 ft and the assumed dimensions of the onshore pond are provided in that table for Alternative 4. For Alternative 2 the CDF option modeling assumed dredging only cells 22-42 along with the pond like water surface area of the CDF established over the area of cells 1-21.

Modeling was used to simulate successive cell-by-cell movement of a dredge. This includes modeling for the length of time (days) each cell is dredged and sequenced according to the cell number (source ID) in the Table 1. The start date then controls the calendar days for each cell to determine the appropriate weather conditions from the

[1] Reference to cells mean cells in the model schematization. This will be fully explained in the final report.

meteorological data base. For example, dredging was simulated to begin June 1 and each dredging period (lasting from 1-4 days in length) was modeled discretely. The active cell is modeled with full dredge emission rates, whereas the inactive cells are modeled with emission rates based upon water to air partitioning rates. The dredging activity was simulated to occur for 137 days for the dredge all option and 54 days for the CDF option. Dredging for the CDF option was simulated to begin on June 15 and end at the end of July. These assumptions may understate the actual dredging duration.

Modeling was conducted for each period in a five year local meteorological record. Surface wind data was obtained at the nearby airport and processed in AERMET (EPA version 06341) to provide necessary parameters for AERMOD. A wind rose of the five year period is shown in Figure 2 noting the general annual patterns of the Ashland area. The 5-year period shown is only for the active dredging times (June-October) which were those modeled.

Results of the preliminary modeling are shown in Table 2. These results are compared to the DNR ambient standards for naphthalene (24-hour value of 1258 $\mu g/m^3$) and $1/10^{th}$ of the Threshold Limit Values (TLV) for benzene (1600 $\mu g/m^3$) or 160 $\mu g/m^3$, which is a common adjustment used for air pollutant standards development.

As shown, the maximum short-term average impacts under each assumed remedial alternative are comparable whereas the annual impacts reflect the shorter dredging period for the CF alternative. These maximum concentrations were calculated using the receptor locations shown in Figure 3.

The short-term 24-hour impact is depicted in Figures 4 through Figure 6 which shows isopleths of concentrations overlaid atop aerial photographs of the Site area. As seen in Figure 4, with the onshore dewater and stockpile areas, the DNR compliant isopleth for naphthalene occurs in the onshore area near the dewater and stockpile areas, extending outward to near the boundary of the site.

The 24-hour benzene for the dredge all alternative exhibits a similar pattern as that for naphthalene, but using the 160 $\mu g/m^3$ $1/10^{th}$ TLV-TWA level, suggests the potential for impacts extending off-site toward City of Ashland proper (Figure 5). The short-term benzene impact from the CDF alternative shows a similar pattern extent for the 160 $\mu g/m^3$ isopleth, because of the location of the sources (Figure 6).

Draft

Figure 1a. Onshore Activity Areas for Dredge All Alternatives, including Dewatering Ponds and Stockpile Areas.

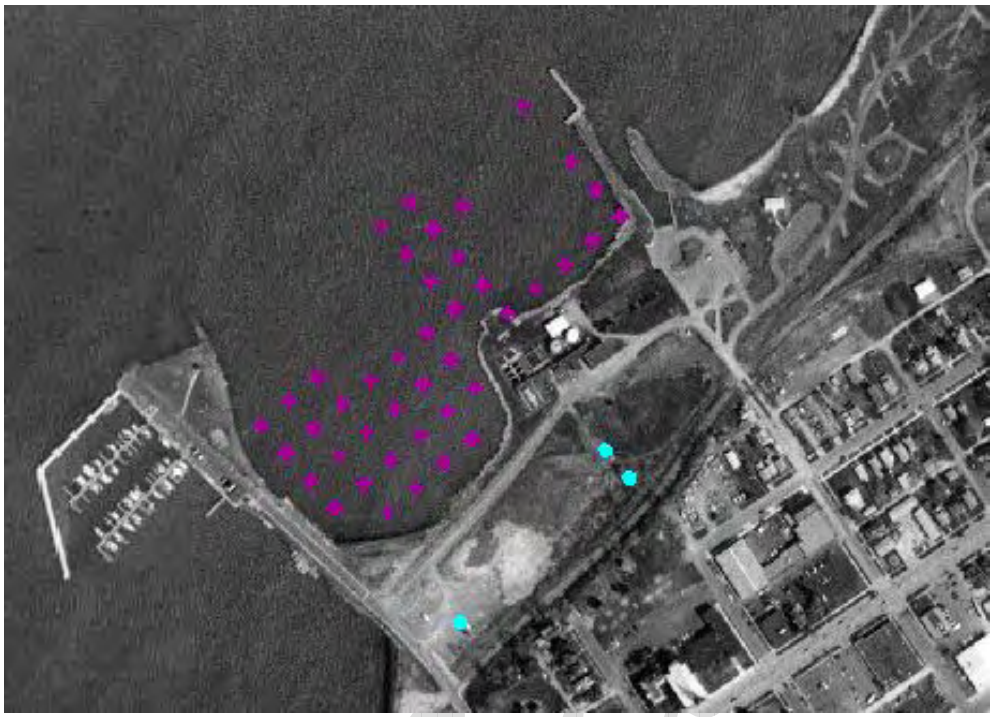


Figure 1b. Potential Offshore Air Emission Locations Used to Model both Dredging Activities As Well As CDF Construction and Operations .

Figure 2. Surface Wind Direction and Speed Frequency (Wind Rose) – Ashland, WI

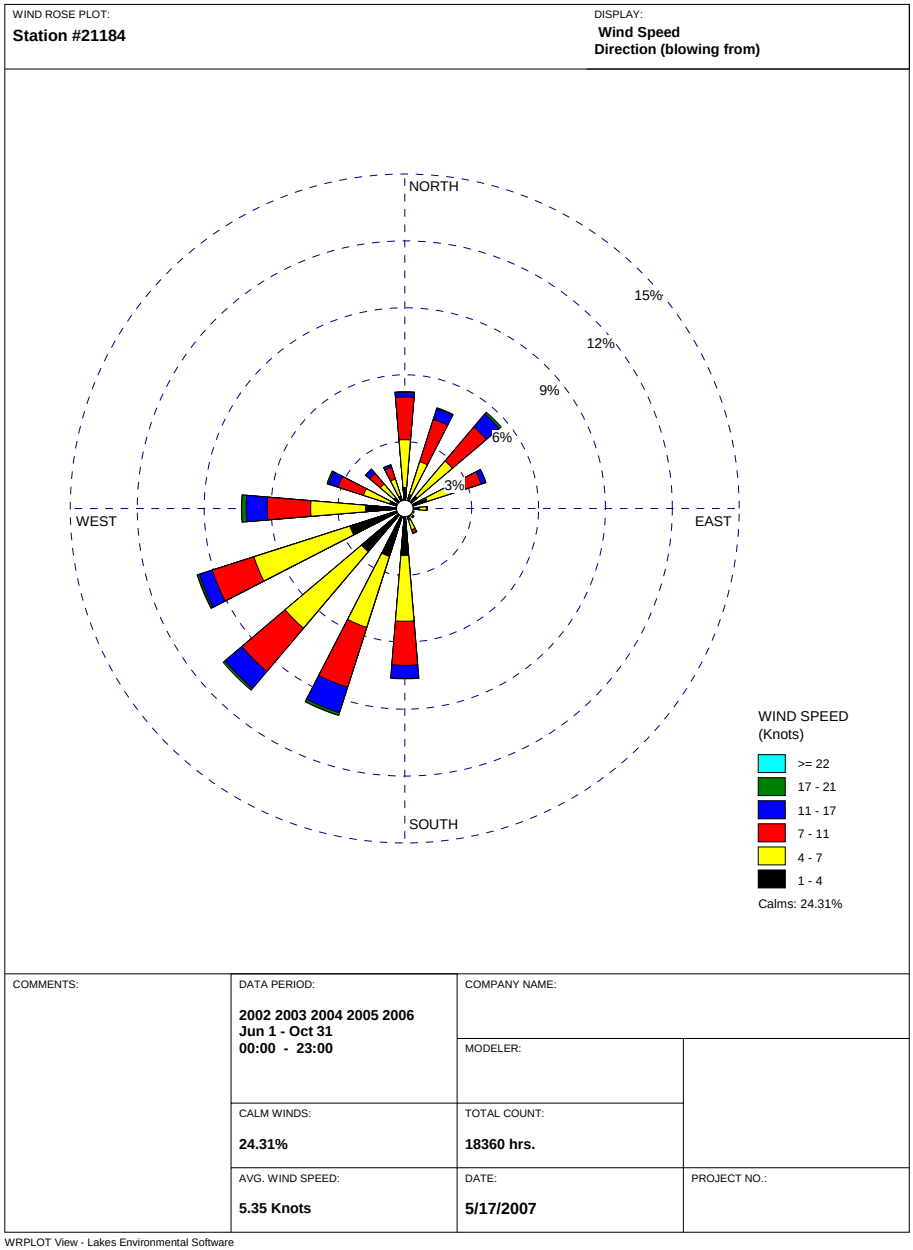


Table 1. Dredge-All Modeled Emission Parameters

Source ID	Type	X	Y	Height (m)	Length (m)	Width (m)	Angle	Naphthalene Emission Rate (g/m2-s)	Benzene Emission Rate (g/m2-s)
1	AREA	661958	5162296	0.01	30.48	30.48	319	9.28E-06	1.88E-05
2	AREA	661981	5162315	0.01	30.48	30.48	319	9.28E-06	1.88E-05
3	AREA	662004	5162335	0.01	30.48	30.48	319	6.51E-06	1.32E-05
4	AREA	662027	5162355	0.01	30.48	30.48	319	1.91E-05	3.87E-05
5	AREA	661915	5162299	0.01	30.48	30.48	319	2.04E-05	4.12E-05
6	AREA	661938	5162319	0.01	30.48	30.48	319	2.04E-05	4.12E-05
7	AREA	661961	5162339	0.01	30.48	30.48	319	2.12E-06	4.29E-06
8	AREA	661984	5162358	0.01	30.48	30.48	319	1.94E-05	3.92E-05
9	AREA	662007	5162378	0.01	30.48	30.48	319	7.08E-05	1.43E-04
10	AREA	662030	5162398	0.01	30.48	30.48	319	2.46E-06	4.97E-06
11	AREA	661895	5162322	0.01	30.48	30.48	319	7.06E-07	1.43E-06
12	AREA	661918	5162342	0.01	30.48	30.48	319	1.81E-05	3.67E-05
13	AREA	661941	5162362	0.01	30.48	30.48	319	2.95E-05	5.98E-05
14	AREA	661964	5162382	0.01	30.48	30.48	319	1.30E-05	2.63E-05
15	AREA	661987	5162401	0.01	30.48	30.48	319	6.64E-05	1.34E-04
16	AREA	662010	5162421	0.01	30.48	30.48	319	3.34E-05	6.77E-05
17	AREA	662056	5162461	0.01	30.48	30.48	319	1.57E-05	3.17E-05
18	AREA	662079	5162481	0.01	30.48	30.48	319	1.57E-05	3.17E-05
19	AREA	662102	5162501	0.01	30.48	30.48	319	3.58E-05	7.25E-05
20	AREA	662125	5162521	0.01	30.48	30.48	319	2.95E-06	5.98E-06
21	AREA	662148	5162541	0.01	30.48	30.48	319	1.47E-06	2.97E-06
22	AREA	661875	5162345	0.01	30.48	30.48	319	1.31E-07	2.65E-07
23	AREA	661898	5162365	0.01	30.48	30.48	319	1.05E-05	2.12E-05
24	AREA	661921	5162385	0.01	30.48	30.48	319	1.74E-05	3.52E-05
25	AREA	661944	5162405	0.01	30.48	30.48	319	1.31E-04	1.73E-04
26	AREA	661967	5162425	0.01	30.48	30.48	319	5.49E-06	1.11E-05
27	AREA	661990	5162444	0.01	30.48	30.48	319	1.96E-08	3.97E-08
28	AREA	662013	5162464	0.01	30.48	30.48	319	1.52E-07	3.07E-07
29	AREA	662036	5162484	0.01	30.48	30.48	319	2.01E-05	4.07E-05
30	AREA	662128	5162564	0.01	30.48	30.48	319	7.37E-06	1.49E-05
31	AREA	661855	5162368	0.01	30.48	30.48	319	1.31E-07	2.65E-07
32	AREA	661878	5162388	0.01	30.48	30.48	319	5.75E-06	1.16E-05
33	AREA	661901	5162408	0.01	30.48	30.48	319	2.05E-05	4.15E-05
34	AREA	661993	5162487	0.01	30.48	30.48	319	1.15E-05	2.32E-05
35	AREA	662016	5162507	0.01	30.48	30.48	319	3.40E-05	6.88E-05
36	AREA	662108	5162587	0.01	30.48	30.48	319	4.70E-07	9.52E-07
37	AREA	661973	5162511	0.01	30.48	30.48	319	1.07E-05	2.17E-05
38	AREA	661996	5162530	0.01	30.48	30.48	319	3.08E-06	6.24E-06
39	AREA	662019	5162550	0.01	30.48	30.48	319	2.77E-06	5.61E-06
40	AREA	661953	5162534	0.01	30.48	30.48	319	6.32E-06	1.28E-05
41	AREA	661976	5162554	0.01	30.48	30.48	319	2.14E-05	4.34E-05
42	AREA	662068	5162633	0.01	30.48	30.48	319	3.03E-06	6.14E-06
dewater	AREA	662016	5162205	0.01	152.4	60.96	319	2.00E-04	4.39E-05
stockpile	AREA	662135	5162348	0.01	60.96	30.48	319	6.32E-06	3.93E-05
dewater2	AREA	662155	5162325	0.01	60.96	30.48	319	1.41E-04	2.35E-05
cdf pond	AREA	661935	5162276	0.01	91.44	91.44	319	2.00E-04	3.44E-05
cdfspond	AREA	661984	5162358	0.01	182.88	91.44	319	1.41E-04	1.85E-05

CDF Option models only dredge emissions from cells 22-42 and from the CDF Ponds

Table 2. Modeled Area Source Impacts and Comparison with DNR and TLV Levels

Compound	Averaging Period	Modeled Concentration ($\mu g/m^3$)		TLV or MDNR Standard ($\mu g/m^3$)
		Dredge All	CDF Option	
Benzene	Annual	694.8	131.5	160[a]
	24-hour	6626	6409	
Naphthalene	24-hour	5599	5665	1258

[a] – Represents 1/10th of the TLV-TWA value of 1600 $\mu g/m^3$.

Draft

Figure 3. Ashland/NSP Waterfront Superfund Site – Modeled Receptor Locations.

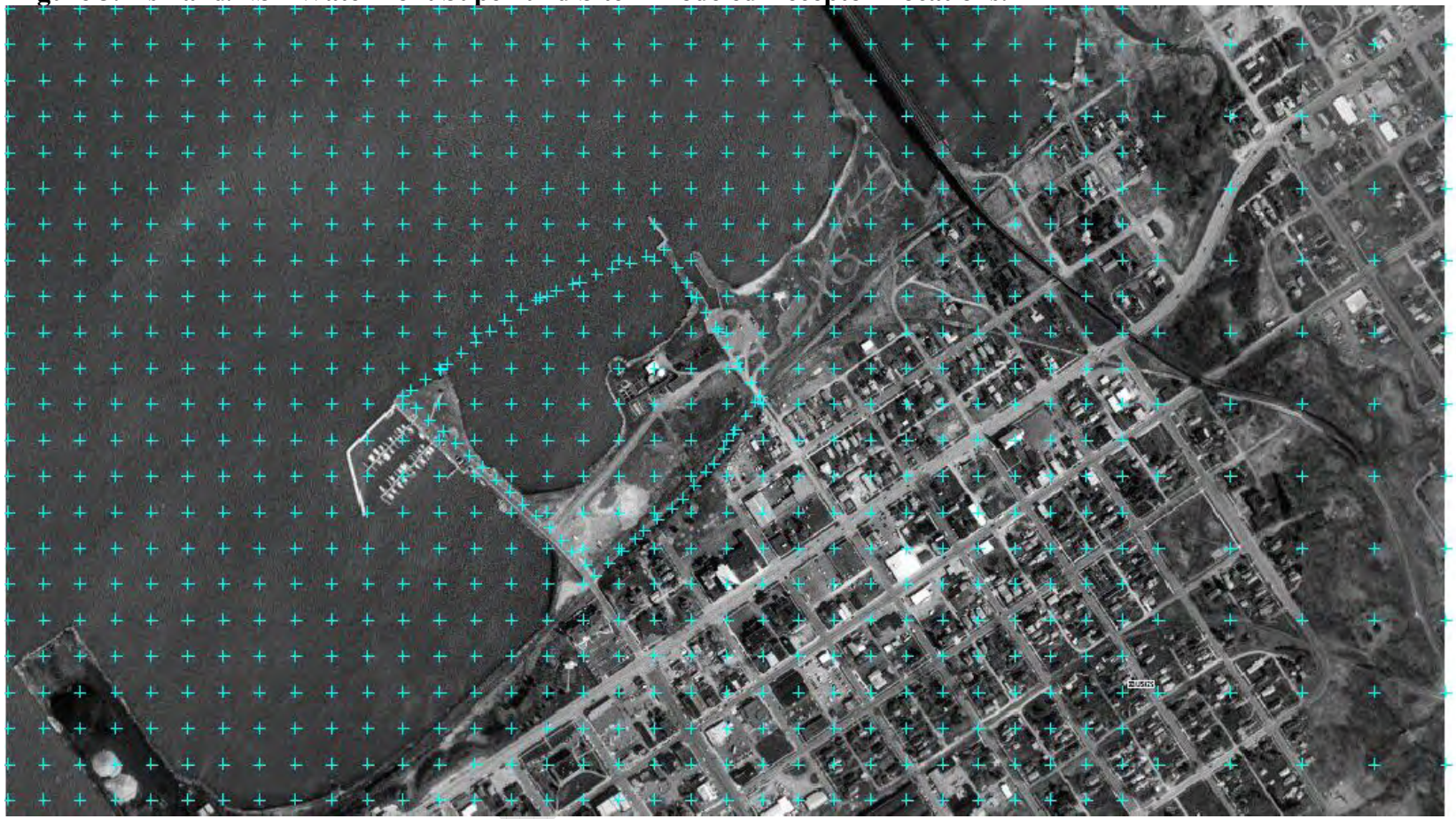


Figure 4. Ashland/NSP Waterfront Superfund Site – 24-hour Modeled Naphthalene Concentrations Alternative Dredge All with On-shore Dewatering. (Red contour is DNR Compliance Line – 1258 µg/m^3).

Figure 5. Ashland/NSP Waterfront Superfund Site – 24-hour Modeled Benzene Concentrations Alternative 4 Dredge All with Onshore Dewatering. (Red contours are TLV of 1600 µg/m^3 and 1/10th TLV or 160 µg/m^3).

Figure 6. Ashland/NSP Waterfront Superfund Site – 24-hour Modeled Benzene Concentrations Alternative 2: CDF. (Red contours are TLV of 1600 µg/m^3 and 1/10th TLV or 160 µg/m^3).

Attachment 3: White Paper: Precedent Sites and Technical Considerations for Placement of CERCLA Sediments in Confined Disposal Facilities (CDFs)

By Michael Palermo, Ph.D.

White Paper: Precedent Sites and Technical Considerations for Placement of CERCLA Sediments in Confined Disposal Facilities (CDFs)

Prepared by Michael R. Palermo
Mike Palermo Consulting, Inc.

Introduction

The Ashland NSP/Lakefront Superfund Site consists of land and sediment located along the shore of Lake Superior, in Ashland, Wisconsin. Soils, groundwater and sediments at the site are contaminated with tar-derived volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs).

URS is currently conducting a Feasibility Study (FS) for the site. One option for managing the contaminated sediments under consideration is construction of a diked nearshore confined disposal facility (CDF) adjacent to the site. The CDF would be constructed partly on land and partly in-water and would cover the majority of offshore contamination and provide storage for additional sediments to be removed by dredging. As part of the FS process, URS wishes to define the extent of similar CDF usage for sediment remediation projects and technical considerations that may be applicable for this sediment management approach.

This white paper describes the use of CDFs for placement and confinement of contaminated sediments from remediation projects, precedent CDF sites in the U.S. and worldwide, and technical considerations for design and operation of CDFs for sediment remediation.

CDFs as Sediment Remedy Components

A CDF is an engineered structure consisting of dikes or other structures that extend above any adjacent water surface and enclose a disposal area for containment of dredged material, isolating the dredged material from adjacent waters or land (USACE/USEPA 1992/2004). CDFs are one of the most commonly considered alternatives for contaminated sediments from navigation projects and are also an option commonly considered, and more recently used for disposal of contaminated sediments dredged for purposes of sediment remediation (USACE 2003 and USEPA 2005).

CDFs have been constructed for navigation dredged material since the 1950s. Most of the early CDFs were constructed using earthen dikes and were located in close proximity to navigation channels. Some of the early CDFs were not engineered, but merely constructed or upgraded for use by contractors as a part of a specific dredging contract (Murphy and Ziegler 1974). However, some of the early CDFs (e.g., the 2500-acre Craney Island nearshore site in Norfolk, Virginia) were rigorously engineered and have been in use for decades.

By the 1960s, sediment contamination was recognized as an issue for the nation's navigation dredging program, especially in the Great Lakes. Public Law 91-611 authorized a program for the confined disposal of contaminated sediments from federal navigation projects in the Great Lakes, and the USACE subsequently constructed and/or operated 45 CDFs (to include upland, nearshore and island sites) to manage over 90 million cubic yards of contaminated sediments dredged from Great Lakes harbors and channels. This same legislation authorized the initial USACE research program on dredged material assessment and management, which included efforts related to design and management of CDFs.

Design of CDFs has evolved over the years based on research and field experience. CDFs have combined design features and processes common to wastewater treatment, landfills, dams, and breakwaters. The designs for existing CDFs in the Great Lakes focused primarily on retention of sediment solids and physical stability of the dikes in the high-wave and ice-prone environment of the Great Lakes. In-water CDFs in the Great Lakes (e.g., the Duluth-Superior Harbor CDF) have dikes that resemble a breakwater, made of stone, gravel and other materials. Large armor stone is typically placed on the outside face of the dike to protect against wave attack. The inner core of the dike is often constructed with sand and gravel, sometimes in discrete layers. The dike, which is permeable, encircles the disposal area where the dredged material is placed. The sediment particles and contaminants bound to the particles settle out in the disposal area and excess water passes back through the dike. As the facility becomes filled, the dikes become less permeable, and water must be removed by overflow weirs, filters in the dikes, or is pumped. Upland CDFs are designed with earthen dikes that resemble a levee or berm. The dikes are most often constructed with soil excavated from the disposal site, and the sides seeded to prevent erosion (Miller 1998).

Development of a comprehensive technical basis for CDF design aspects related to management of contaminated sediments began in the mid-1970s with the USACE research programs initially authorized by PL 91-611. These efforts included evaluation of sedimentation and consolidation processes in CDFs; weir design; CDF effluent and leachate control; equipment and techniques for dewatering and reclamation; and beneficial reuse of material in CDFs. The first technical guidance for designing, constructing, and managing (CDFs) to maximize service life and minimize adverse environmental impacts were developed (Palermo and Poindexter 1978), and this guidance was subsequently updated and expanded in the USACE Engineer Manual *Confined Disposal of Dredged Material* (USACE 1987).

The knowledge base on CDFs expanded in the 1980s and 1990s, with more focus on contaminant pathways and evaluation of contaminant control measures for CDFs. Studies included development and verification of procedures for predicting contaminant mobility in CDF effluent, surface runoff; leachate to groundwater; volatilization to air; and mobility to upland plants and animals (Palermo and Engler 2002).

USACE and USEPA subsequently developed a Technical Framework for dredged material management (USACE 1992/2004) that included full consideration of CDF contaminant transport pathways and controls, and developed a supporting sediment testing manual that provided detailed testing and evaluation procedures for CDF contaminant pathways (USACE 2003). An expanded Engineer Manual *Dredging and Dredged Material Management* (USACE in publication) has also been developed that will include guidance on design of contaminant control measures for CDFs.

CDFs have also been adopted internationally as a sound management approach for contaminated sediment disposal, with many large-scale CDF projects constructed in both Europe and Asia. The Permanent International Association of Navigation Congresses (PIANC), developed technical guidance for CDFs that is applicable to both navigation and remediation projects that included the technical approaches developed by the USACE and USEPA (PIANC 2002).

Collectively, these developments provide a comprehensive technical basis for design of CDFs used for placement of contaminated sediments resulting from both navigation and sediment remediation projects.

Field experience and the availability of technically-based design procedures for CDF contaminant pathway evaluations and controls has led to increased consideration and use of CDFs for a number of sediment remediation projects. As a result, EPA recognized CDFs as an option for disposal of contaminated sediments at CERCLA sites and the knowledge base developed for design of CDFs for this purpose in its Superfund Sediment Guidance (USEPA 2005):

> "CDFs are engineered structures enclosed by dikes and specifically designed to contain sediment. CDFs have been widely used for navigational dredging projects and some combined navigational/environmental dredging projects but are less common for environmental dredging sites, due in part to siting considerations. However, they have been used to meet the needs of specific sites, as have other innovative in-water fill disposal options, for example, the filling of a previously used navigational waterway or slip to create new container terminal space (e.g., Hylebos Waterway cleanup and Sitcum Waterway cleanup in Tacoma, Washington). In some cases, new nearshore habitat has also been created as mitigation for the fill.
>
> For CDFs, contaminants may be lost via effluent during filling operations, surface runoff due to precipitation, seepage through the bottom and the dike wall, volatilization to the air, and uptake by plants and animals. The USACE has developed a suite of testing protocols for evaluating each of these pathways (U.S.

> EPA and USACE 1992), and these procedures are included in the ARCS program's *Estimating Contaminant Losses from Components of Remediation Alternatives for Contaminated Sediments* (U.S. EPA 1996). The USACE has also developed the [CDF] *Testing Manual* (USACE 2003), which describes contaminant pathway testing. Depending on the likelihood of contaminants leaching from the confined sediment, a variety of dike and bottom linings and cap materials may be used to minimize contaminant loss (U.S. EPA 1991c, U.S. EPA 1994d, Palermo and Averett 2000). Depending on contaminant characteristics, CDFs for sediment remediation projects may need control measures such as bottom or sidewall liners or low permeability dike cores. Project managers should also be aware that permeability across these barriers can decline significantly with time due to the consolidation process and blockage of pore spaces with fine materials. Therefore, site-specific evaluation is important."

As can be seen from the quote above, there are no prescriptive design features for CERCLA CDFs in the EPA guidance. This is appropriate, since a CDF for a CERLCA project would be designed based on the ARARs adapted for the project and sediment-specific and site-specific considerations.

CDF Precedent Sites for Sediment Remediation

A review of the readily available literature and web resources was conducted to identify precedent CDF sites used for purposes of sediment remediation. Table 1 summarizes the locations, and readily available information on volumes, surface areas, filling operations and contaminant control measures for a total of 29 CDFs used for placement of sediments from remediation projects. A large number of additional CDFs have been used for placement of contaminated sediments from navigation dredging projects (with a number of CDFs used for highly contaminated dredged sediments), but these CDFs were not included in the summary in Table 1. Note also that none of the sites listed in Table 1 are licensed landfills, but there are several sites listed in Table 1 that are upland CDFs. A total of 22 of the CDFs are in-water nearshore or island sites, with many constructed by enclosing berths, slips, or areas adjacent to other confining structures such as breakwaters (similar to the proposal for the Ashland-NSP site). These include several CERCLA projects in the Seattle/ Tacoma, WA area to include: Blair Waterway, Milwaukee Waterway, and Eagle Harbor CDFs. The Waukegan Harbor site is a similar nearshore CERCLA CDF created by enclosing 3 acres of Lake Michigan waters by a sheet pile wall structure. The Menominee River site in Marinette WI is similar to the Waukegan Harbor site in that approximately two acres was enclosed by a sheet pile structure. As part of a project very similar in design to what is being proposed for the Ashland site, the Hamilton Harbor, Canada CDF will be constructed as a nearshore CDF for disposal of contaminated sediments from Hamilton Harbor, a project conducted under the Canadian Cleanup Fund (similar to the U.S. CERCLA program). Several other sites in Table 1 are placements of contaminated sediments from remediation projects in existing CDFs in the Great Lakes. These placements were made in dedicated cells constructed within the larger existing CDFs.

In addition to the CDFs actually used for remediation placements to date, several large CDFs are now in the feasibility or design stages for large-scale CERCLA sediment remedies. These include the Onondaga Lake, NY upland CDF that would enclose a 160 acre site for placement of over 2.3 million cubic yards of contaminated sediment and two large nearshore CDFs, the Terminal 4 CDF site that would be created by enclosure of a 14 acre slip on the Willamette River near Portland, OR, and the Consolidated Slip CDF that would be created by enclosure of a 4 acre berthing area in the Port of Los Angeles.

These precedent sites represent a range of sediment characteristics and site conditions and contribute to an ongoing and potentially increasing experience base for use of CDFs as sediment remedy alternatives, including construction of nearshore CDFs in coastal, riverine and lake environments.

Regulatory Considerations for CDF CERCLA Placement

USACE/ USEPA Technical Framework. Just as there are no prescriptive design features for CERCLA CDFs, there are no prescriptive interpretations of regulatory requirements in the EPA Superfund Sediment Guidance (EPA 2005). Under CERCLA, no "permits" are required for on-site activities, however, the adoption of Applicable or Relevant and Appropriate Requirements (ARARs) for a CERCLA project brings with it a requirement to meet the substantive requirements of the regulations, standards, or criteria deemed applicable for the project. The USACE and EPA have jointly adopted a regulatory approach for CDFs based primarily on the Clean Water Act, since the principal contaminant pathways for a CDF are related to potential releases to surface water and such discharges are specifically identified in the CWA regulations (USACE/ USEPA 1992 (revised 2004); and USACE 2003).

For upland CDFs, there is potential for release to groundwater , and for this reason, some regulatory agencies have viewed CDFs in the same light as a permitted landfill under RCRA. However, for in-water CDFs there is little potential for groundwater impacts, and a regulatory approach based on the Clean Water Act is more technically appropriate. The USACE/USEPA Technical Framework for dredged material management (USACE/ USEPA 1992, updated 2004) (referred to here as the Technical Framework) is proposed here as an appropriate framework for evaluation and regulation of the CDF proposed for the Ashland project. Considerations for adopting this regulatory framework for in-water CDFs are provided in the following paragraphs.

Regulation of CDFs has evolved beginning with the passage of National Environmental Policy Act (NEPA) of 1969 and subsequent regulations and the development of the joint agency Technical Framework. The goal of the Technical Framework with respect to CDFs is to ensure that consistent, predictable, and reliable regulatory practices are employed when contaminated sediments are proposed for disposal in CDFs.

Disposal of dredged material in inland, near-coastal, and ocean waters has a clear regulatory basis. The discharge of dredged material into waters of the United States is regulated under the Clean Water Act. Waters of the United States subject to the Clean

Water Act are defined in 33 CFR Part 328 and 40 CFR 230.3(s). The CWA states that any "discharge of dredged or fill material into the navigable waters" would be regulated.

The regulatory path for disposal of dredged material in CDFs is not as clear. However, both the CWA and NEPA provide strong mandates for regulation of contaminated sediment placement in CDFs, to include placement of sediments from remediation projects. The discharge of return flow (effluent and surface runoff) to waters of the United States is specifically defined as a dredged material discharge under the CWA (Section 1.6.1). Under NEPA, the direct, indirect, and cumulative impacts associated with an action that may significantly affect the environment (Section 1.6.1) must be evaluated; therefore the Technical Framework requires that the potential environmental impacts associated with all aspects of CDFs to include potential releases of contaminants from all pathways must be evaluated and contaminant pathway controls incorporated into the design as needed.

Clean Water Act. The CWA, specifically Section 404 (b)(1), requires the development and application of environmental guidelines covering a broad range of effects to human health and ecological systems. The 404(b)(1) Guidelines (referred to here as the Guidelines) are at 40 CFR 230 and contain a number of evaluation provisions applicable when proposing dredged material disposal in CDFs. Section 230.10(b)(1) prohibits the disposal of dredged material that might violate applicable water quality standards, after consideration of disposal site dilution and dispersion. This provision is aimed at the effluent or runoff discharges from the CDF. That same section requires consideration of "effects on municipal water supplies" and is reinforced at Section 230.50. This section specifically addresses municipal and private water supplies including groundwater, which is a potential concern for the CDF leachate pathway. Section 230.11(h) requires consideration of a broad range of secondary effects from proposed dredged material discharges. Exposure pathways from a CDF such as plant or animal uptake could be considered secondary effects under this section. Other sections of the Guidelines address methods to minimize adverse effects at CDFs, such as the use of chemical flocculants to enhance deposition of suspended particulates, or treatment to neutralize contaminants. Other potential actions at CDFs suggested in CFR Section 230.72 include liners to reduce leaching, cover crops to reduce erosion, and containing discharged material to prevent point and non-point sources of pollution. Many of the compliance measures of the 404 (b)(1) Guidelines are aimed at protecting ecological and human health from proposed dredged or fill material discharges into waters of the United States. The Guidelines do not focus on CDFs nor do they exclude use of the Guidelines to capture potential contaminant releases from CDFs. Instead, the Guidelines take a common sense approach to potential contaminant releases from proposed dredged material discharge activities.

The CWA regulatory mandate for CDF effluent and runoff discharges is very specific. The discharge of effluent from a CDF is defined as a dredged material discharge in 33 CFR 323.2 (d) and 40 CFR 232.2 (e):

> "The term 'discharge of dredged material' means any addition of dredged material into waters of the United States. The term includes, without limitation, the addition of dredged material to a specified discharge site located in waters of

the United States and the runoff or overflow from a contained land or water disposal area.

In addition, Section 401 of the Clean Water Act provides the States a certification role as to project compliance with applicable State water quality standards; effluent limitations may be set as a condition of the certification. For purposes of the USACE regulatory program 'The return water from a contained disposal area is administratively defined as a discharge of dredged material by 33 CFR 323.2(d) even though the disposal itself occurs on the upland and thus does not require a Section 404 permit.' "

Resource Conservation and Recovery Act (RCRA). One of the purposes of RCRA is to ensure that generated waste "should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment." Since April 1988, with publication of the USACE maintenance dredging and disposal regulations at 33 CFR 335-338, the USACE has asserted that dredged material is not a hazardous waste and should not be regulated under RCRA (Federal Register Vol. 53, No. 80, April 28, 1988, pages 14903 and 14910). Throughout the 1990's, the USACE made a concerted effort to demonstrate that the CWA/MPRSA protocols provided a level of environmental protection commensurate with that accorded under RCRA. Based on that demonstrated experience, the EPA excluded dredged material as a hazardous waste on 30 November 1998, providing the dredged material is regulated under either the CWA or MPRSA (Federal Register Vol. 63, No. 229, November 30, 1998). The effective rule date was 1 June 1999. Specifically, 40 CFR 261.4 of that rule provides that dredged material regulated under "a permit that has been issued under Section 404 of the Federal Water Pollution Control Act (33 U.S.C. 1344) or Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1413) is not a hazardous waste." The term permit also applies to congressionally authorized Civil Works projects undertaken by the USACE using the CWA or MPRSA regulatory regimes. The RCRA exclusion for dredged material only applies to activities permitted under either the MPRSA or CWA.

Volatile Emissions. Volatile emissions may be of concern for dredged material containing high concentrations of volatile organic contaminants. Volatile emissions from dredged material in CDFs are not regulated under the Clean Air Act (CAA), since the CAA regulates point and mobile sources. CDFs are neither. In most cases, air quality is regulated under the CAA only for gaseous emissions that could be sampled from a waste stream, not for volatilization from an areal source. Air quality from areal sources is more typically regulated, considering the resulting quality at a point of compliance or at the nearest receptor. Moreover, there have been no documented CAA concerns with any CDF anywhere in the nation. However, the Occupational Safety and Health Administration (OSHA) air quality standards apply when workers are exposed to inhalation or dermal contact with vapors while handling and managing dredged material containing certain volatile organic compounds in CDFs. When volatile emissions are of concern, evaluations may be performed and predicted emission concentrations compared to OSHA standards to determine compliance.

Applicability of Technical Framework. The joint USACE/USEPA Technical Framework developed for dredged material is especially relevant to in-water CDFs used for sediment remediation. Under the Technical Framework, a CDF can be designed to be as environmentally protective as a hazardous waste landfill under RCRA, with contaminant control measures (e.g. liners, covers, and impermeable dike sections) designed for the project-specific sediment characteristics and site conditions. This Technical Framework has been applied to a number of precedent sites, to include those used for CERCLA placement in the Great Lakes region.

Considerations for CDF Design for CERCLA Placement

A CDF intended for placement of sediments from a CERCLA project would require design evaluations for both the conventional engineering aspects such as dike design and physical containment of the dredged sediments and control measures related to the potential contaminant migration pathways of concern for the site. Descriptions of the various technical evaluations that would potentially be required for a CDF intended for CERCLA placement are presented in the following paragraphs.

Dike and Containment Design

Retaining dikes for a CDF should be designed considering geotechnical stability. For in-water CDFs, the dikes should also be designed to resist erosive forces due to currents and/or wave action. Episodic flood or storm events should be factored into the design. In-water CDFs in the Great Lakes region should also be designed to resist ice scour. These design aspects can be addressed with conventional geotechnical and coastal engineering evaluations.

The dike design for stability considerations should also be closely coordinated with the storage capacity and contaminant pathway evaluations. Specific design features for the main retaining dike may be required for contaminant pathway control.

Solids Retention and Volumetric Capacity

When contaminated sediments are hydraulically placed in a CDF, the design, operation, and management of the site should be carefully managed to ensure retention of the sediment solids within the CDF (especially during active filling operations). This includes aspects relating to both the volume required for effective sedimentation for hydraulic placement and the storage capacity of the site. Procedures for such evaluations are presented in Engineer Manual 1110-2-2-5027 *Confined Disposal of Dredged Material* (USACE 1987). These design procedures will determine the surface area and ponding depth required to achieve effective sedimentation, the required containment volume for storage (including required freeboard), and the proper sizing of weir structures. The evaluations are based on results of column settling tests conducted to determine the zone, flocculent, and compression settling behavior of the sediments.

Contaminant Pathway Evaluations

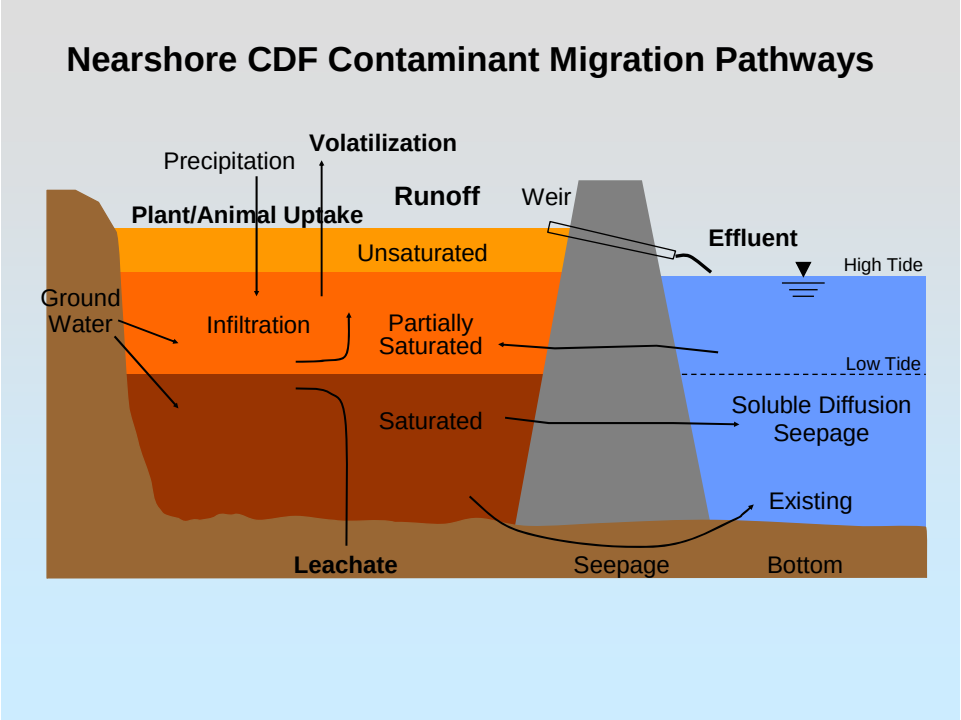
If contaminated sediments are placed in a CDF, consideration of pathways for migration of contaminants from the site and potential contaminant impacts may be required. Contaminant migration pathways are routes by which contaminants may move from the sediments placed within the CDF into the environment outside the site. The possible pathways from a nearshore CDF are illustrated in Figure 1. These pathways are:

- Effluent discharges to surface water during filling operations and subsequent settling and dewatering, to include displacement of water as material is placed within the site.
- Precipitation surface runoff.
- Leachate into groundwater or through dikes to surface water (to include movement via fluctuating water levels).
- Volatilization to the atmosphere.
- Direct uptake by plants and animals living on the dredged material and subsequent cycling through food webs.

A primary advantage of a nearshore CDF is that contaminated dredged material may remain within the saturated zone so that anaerobic conditions prevail and contaminant mobility is minimized. A potential disadvantage is water level fluctuation via water level changes or other mechanisms, which cause a pumping action through the exterior dikes, if the dikes are constructed of permeable material. The pumping action may result in soluble convection through the dike in the partially saturated zone and soluble diffusion from the saturated zone through the dike. The potential for such pumping action can be controlled by constructing the dikes with impermeable cores or cutoff walls.

A suite of evaluation procedures and laboratory test procedures has been developed by the USACE to evaluate CDF contaminant pathways. These procedures are presented in detail in *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities - Testing Manual* (commonly called the Upland Testing Manual or UTM even though it equally applies to island or nearshore CDFs) (USACE 2003). From a technical standpoint, the procedures in the UTM are equally applicable to both navigation dredging and contaminated sediment remediation projects. The UTM presents both screening procedures to determine if a contaminant pathway is potentially an issue for a specific situation, and detailed testing and evaluation procedures to apply if needed.

Figure 1. Potential Transport Pathways from CDF.



Evaluations can be conducted using a tiered approach in the UTM, with the initial tiers as screening based on sediment contaminant concentrations of the materials to be placed in the CDF. Contaminant pathway tests in later tiers would determine if contaminant controls should be included in the CDF design.

CDF Contaminant Control Measures

If applicable environmental standards or guidelines are not met for one or more of the contaminant pathways, contaminant control measures can be considered to reduce impacts to acceptable levels. Control measures may consist of treatment of sediments or pathway releases or operational or engineered containment features (USACE/USEPA 1992, updated 2004; Palermo and Averett 2000).

Containment in a CDF may be defined as an operational approach or engineered feature intended to function as a contaminant control measure to reduce the migration or transport of contaminants via one of the pathways. Containment refers to the ability of the site with associated features to hold the contaminants within the site as opposed to treatment approaches intended to destroy or degrade contaminants or immobilize the contaminants within the sediment. Contaminant measures may include operational modification, selective placement of dredged material, and engineered site controls or containment features, such as liners, surface covers, and lateral cutoffs

Operational Controls. Site operations can be used as a control measure for CDFs to reduce the loss of contaminants through the surface water, volatilization, and groundwater pathways. Operational controls may include selective placement of layers of clean and contaminated material to provide for attenuation or containment of contaminants (sandwiching); taking advantage of the fine-grained nature of dredged material, which yields low permeability when subjected to consolidation in a CDF (self-sealing or self-lining); placing cleaner dredged material with suitable chemical and physical properties as the final layer in a CDF (defacto surface covers); placement of drainage layers to enhance dewatering and consolidation; and control of ponded water to reduce hydrostatic head or maintain a negative hydraulic gradient (conditions causing seepage flow into the CDF as opposed to flow from the CDF).

Selective placement configurations with respect to water levels are possible for nearshore and in-water CDFs. Selective placement below the groundwater or surface water elevation keeps that portion of the CDF fill anaerobic, which reduces the potential for release of some classes of contaminants of concern (especially metals) to the dissolved phase.

Self-Sealing of Fine-Grained Sediment. The self-sealing or self-lining properties of fine-grained dredged material should be fully considered in evaluation of the need for engineered containment for leachate control. Dredged material is initially pumped into CDF at high water content, but quickly settles to a condition approaching in situ bulk density. With time, the newly placed material begins to consolidate. Measured permeabilities of dredged material at 50 percent of primary consolidation range from 8.5 x 10^{-10} to 4.1 x 10^{-7} cm/sec (Bartos 1977). This permeability is comparable to that required for liners in licensed solid waste landfills (1 x 10^{-7} cm/sec). Therefore, the initial layers of a fine-grained dredged material selectively placed in the bottom layers of a CDF will begin to "self-seal" as consolidation progresses, especially as more layers of dredged material are placed over the older layers.

Engineered Controls. Engineered CDF containment features or control measures are specifically designed and constructed to enhance containment of the dredged material and control potential contaminant release pathways. Containment features are not widely practiced for dredged material management because simply retaining sediment solids in a CDF has adequately met regulatory requirements for most navigation dredging projects. However, CDFs are often recommended and have been required for some sites receiving highly contaminated material or for sites located in environmentally sensitive areas. For these CDF's engineered features may be needed. The major categories of engineered containment features include bottom and sideliners (with and without leachate collection) surface covers, dike cores, and cutoff walls.

CDF Monitoring

Any CDF used for placement of contaminated sediments will require monitoring to ensure that pathways are controlled both during the construction and filling operation and in the long term. In most cases, effluent will be monitored by sampling during filling operations. If the CDF includes an engineered cover, the pathways for surface runoff and

direct uptake by organisms will be controlled and should not require long-term monitoring. Depending on the dike design, monitoring wells in the dike and/or around the CDF perimeter may be required, with periodic monitoring for leachate releases.

Summary

This white paper has addressed a number of factors associated with the potential use of a CDF for storage of contaminated sediments at the Ashland NSP/Lakefront Superfund Site including:

- Early CDFs, including many in the Great Lakes, were designed prior to development of technical approaches for control of contaminant pathways. CDFs used for placement of sediments from remediation projects should be designed to account for potential contaminant pathways and designs should include measures for contaminant pathway control as needed.

- There are numerous precedent CDF sites used for placement of sediments from remediation projects; this precedent includes CERCLA projects in the Great Lakes region.

- There is no prescriptive requirement under CERCLA to adopt a given regulatory approach (e.g. RCRA) as an ARAR. A well-established Technical Framework has been developed by USACE and USEPA for CDFs under the CWA and NEPA. This Technical Framework is especially relevant to in-water CDFs. A CDF can be designed to be as environmentally protective as a hazardous waste landfill under RCRA, with contaminant control measures (e.g. liners, covers, and impermeable dike sections) designed for the project-specific sediment characteristics and site conditions.

- Standardized technical procedures are available for engineering design of CDFs and for evaluation of CDF contaminant pathways and contaminant controls.

- Contaminant controls, to include both operational controls and engineered controls such as covers and liners, can be incorporated into the design of CDFs when needed. Such controls can be designed to be environmentally protective and serve as effective sediment remedy components for CERCLA projects.

- Monitoring programs for CDFs ensure that pathway controls are effective both during construction and operations and in the long-term.

- In-water CDFs will have impacts with respect to loss of water surface area, but in many cases the water area lost is already impacted by contamination. Further, water loss impacts can be mitigated, and, in most cases, the resources can be mitigated with improved resources as compared to pre-project conditions.

References

Bartos, M. J., Jr. (1977). "Classification and engineering properties of dredged material," Dredged Material Research Program, Technical Report D-88-18, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Miller, J. 1998. Confined Disposal on the Great Lakes. http://www.lrd.usace.army.mil/navigation/glnavigation/cdf/#Download

Murphy, W.L.; Ziegler, T.W. 1974. Practices and Problems in the Confinement of Dredged Material in Corps of Engineers Projects. Technical Report D-74-2, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Myers, T.E., Averett, D.E., Olin, T.J., Palermo, M.R., Reible, D.D., Martin, J.L., and McCutcheon, S.C. 1996. Estimating Contaminant Losses from Components of Remediation Alternatives for Contaminated Sediments. EPA 905-R96-001, March 1996, Assessment and Remediation of Contaminated Sediments (ARCS) Program, U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, Illinois. http://www.epa.gov/glnpo/arcs/EPA-905-R96-001/EPA%20905-R96-001.pdf

Palermo, M. R., and Averett, D. E. 2000. "Confined disposal facility (CDF) containment measures: A summary of field experience," *DOER Technical Notes Collection* (ERDC TN-DOER-C18), U.S. Army Engineer Research and Development Center, Vicksburg, MS. http://el.erdc.usace.army.mil/elpubs/pdf/doerc18.pdf

Palermo, M. R., Montgomery, R. L., and Poindexter, M. L. 1978. Guidelines for Dredging, Operating, and Managing Dredged Material Disposal Areas. Technical Report DS-78-10, U. S. Army Engineer Waterways Experiment Station, Vicksburg, MS. http://el.erdc.usace.army.mil/el/dots/pdfs/ds78-10/ds78-10a.pdf

Palermo, M.R. and J.R. Wilson. 2000. "Corps of Engineers Role In Contaminated Sediment Management And Remediation," Proceedings, American Bar Association, Section of Environment, Energy, and Resources, Panel on Contaminated Sediments: Science, Law, and Politics, 8th Section Fall Meeting, 22 September, 2000, New Orleans, Louisiana.

Palermo, M. and R. Engler. 2002. Thirty Years of Dredging Research at the USACE Waterways Experiment Station. Proceedings, 22nd Annual Meeting of the Western Dredging Association (WEDA XXII) and 34th Annual Texas A&M Dredging Seminar, Denver, CO

Palermo, M., J. Wilson, and R. Engler. 2002. USACE Perspectives on Sediment Remediation. Proceedings, 22nd Annual Meeting of the Western Dredging Association (WEDA XXII) and 34th Annual Texas A&M Dredging Seminar, Denver, CO.

Permanent International Association of Navigation Congresses. 2002. Guidelines for Marine, Nearshore, and Inland Confined Disposal Facilities, Report of Working Group No. 5 of the Permanent Environmental Committee, Permanent International Association

of Navigation Congresses, Brussels, Belgium. (Available from PIANC http://www.pianc-aipcn.org/)

U.S. Army Corps of Engineers (USACE). 1987. Confined Disposal of Dredged Material. Engineer Manual 1110-2-5027, Office, Chief of Engineers, Washington, D.C. http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-5027/toc.htm

U.S. Army Corps of Engineers (USACE). 2003. Evaluation of dredged material proposed for disposal at island, nearshore, or upland confined disposal facilities - Testing Manual (Upland Testing Manual). Technical Report ERDC/EL TR-03-1, U.S. Army Engineer Research and Development Center, Vicksburg, MS. http://el.erdc.usace.army.mil/dots/pdfs/trel03-1.pdf

U.S. Army Corps of Engineers (USACE). In publication. Dredging and Dredged Material Management. Engineer Manual in publication, Office, Chief of Engineers, Washington, D.C.

USACE/USEPA. 1992. (Revised 2004). Evaluating Environmental Effects of Dredged Material Management Alternatives - A Technical Framework. EPA842-B-92-008, US Environmental Protection Agency and US Army Corps of Engineers, Washington, D.C. http://el.erdc.usace.army.mil/el/dots/pdfs/epa/tech-frame.pdf

USEPA. 1991c. Handbook: Remediation of Contaminated Sediments. U.S. Environmental Protection Agency, Office of Research and Development, Cincinatti, OH. EPA 625/91/028. April 1991.

USEPA. 1996. Estimating Contaminant Losses from Components of Remediation Alternatives for Contaminated Sediments. EPA 905-R96-001, March 1996, Assessment and Remediation of Contaminated Sediments (ARCS) Program, U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, Illinois. http://www.epa.gov/glnpo/arcs/EPA-905-R96-001/EPA%20905-R96-001.pdf

Environmental Protection Agency. 1994. Assessment and Remediation of Contaminated Sediments (ARCS) Program - Remediation Guidance Document. EPA 905-R94-003, U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, ILL. http://www.epa.gov/glnpo/arcs/EPA-905-B94-003/EPA-905-B94-003-toc.html

U.S. Environmental Protection Agency (USEPA). 2005. Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. OSWER 9355.0-85, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. http://www.epa.gov/superfund/resources/sediment/guidance.htm

Table 1. Summary of Precedent CDF Sites Used for Sediment Remediation

	Project Name and Location	Project Type	Area and/or Volume	Dike and Containment Features	Filling Operations	Comments	References
	GREAT LAKES						
1	Kinnickinnic River/ Milwaukee Harbor WI	Great Lakes Legacy Act; cellfor disposal of contaminanted sediment within larger Island CDF; in planning stages	25 acres; 175 k cy	a cell within the CDF is planned; will dig within the CDF and raise the dikes;; will not require a liner; 10-11 ft deep over about half of the CDF			David Bowman, USACE Detroit District
2	Black Lagoon/ Point Mouille MI	Great Lakes Legacy Act; cell within larger Island CDF for disposal of contaminanted sediment; in planning stages	110 k cy; 15 acres	EPA built cell within the R. river cell at Point Mouille Island CDF; pushed up dikes and clay liner; site was capped	mixed in lime and CalCement in scow; offloaded scow; placement also by trucks	Overall CDF 700 acre site designed for navigation material	POC: Dave Bowman, USACE Detroit District; EPA Mark Tuckman
3	Waukegan Harbor; Waukegan, IL	CERCLA Remedial Action; Nearshore CDF	3 acres; 38 k cy	Slip 3 closed off by constructinmg double sheet pile wall retaining dike with sand and bentonite mix fill;slurry wall around sides of slip; spread 6 ft sand surcharge over top with clamshell; after 2 years, placed RCRA cap – HDPE and sand; bottom was hardpan with positive GW flow; so no liner required; pumping once a year for a few weeks to maintain a negative head;	pumped from upper harbor 50 -500 ppm	Material > 500 ppm PCB was taken to incineration; This is the best example of an in-water CDF constructed solely for CERCLA;	Tim Harrington; EPA RMP Kevin Adler
4	Menominee River, Marinette WI	RCRA Corrective Action; In water CDF	~ 2 acres	Slip 8 closed off by surrounding it with sealed sheet piling. Filled to near grade and asphalt cap.			Weldon Bosworth, URS
5	Saginaw Bay CDF, MI	NRDA settlement ; sediments from outside nav channel;	10-15 acres	Pushed up berms to create dedicated cell for disposal of contaminanted sediment within existing island CDF;	mechanical dredging with Cable Arm and conventional clam;	Saginaw CDF – GM was PRP, Det Distrcit was being sued; under negotiated settlement;	David Bowman, USACE Detroit District
6	Hamilton Harbor – Randle Reef, ONT	Great Lakes Sustainability Fund (Canada); Nearshore/in-water CDF	9.5 ha; 640k m3			CDF very similar to what we propose. Construction scheduled to begin 2009	http://www.harbourwest.com/_pdf/2004/041126-ScopingDocumentFinal.pdf
7	Thunder Bay, ONT	Cleanup; Nearshore CDF	81 ha; 21,000 m3				
8	Collingwood Harbour ONT	Environment Canada; Nearshore CDF	8000 m3; 30,000 m2 estimated	CDF capped with clean sediment;	Demonstration project using Pueuma Pump;		http://www.ijc.org/php/publications/html/cases/studies.html
9	Grand Calumet River	RCRA Corrective Action; Upland CDF	55 acres750 k cy	Partial liner on inside of dikes; CAMU; is being pumped into again since additional sediment required dredging; built upland on an old unconfined dm site;	Hydrualic filling	PAHs; 750k cy; TSCA cell with isolation wall; 55acres; liners with leaks; capacity remaining; will be filled before capping;	Tim Harrington;
	US SITES						
10	Long Slip Canal NJ	Cleanup: Nearshore CDF	190,000 cy and covered 4.6 acres	CDF constructed by sealing the open end of the canal.		This CDF provided remediation (isolation) of contaminated sediments in the canal	
11	Ted Williams Tunnel MA	Navigation/ Cleanup; Nearshore CDF	4 ha; 89Kcy of contaminated seimdent	Upland CDF; lined; material stabilized			http://www.pbworld.com/library/technical_papers/pdf/42_ContaminatedSedimentCDF.pdf
12	Ft McHenry/Seagirt Terminal	Navigation/ Cleanup; Nearshore CDF	59 ha, 3.5 MM cy capacity 600K cy contaminated				http://www.pbworld.com/library/technical_papers/pdf/42_ContaminatedSedimentCDF.pdf
13	Wycoff Eagle Harbor (West Harbor Operable Unit)	CERCLA; Nearshore CDF	1 acres	Sediments confined below raised GWT; HDPE liner; 1.5 m clean soil and asphalt cap;	Materials placed in CDF by front-end loaders		WODCON 1998 paper
14	Thea Foss Waterway/ St. Paul Waterway, Tacoma, WA	CERCLA; Nearshore CDF	13.6 acres; 646kcy	CDF constructed by diking off upper St. Paul WW;	Hydraulic dredging;		WEDA 2000 paper
15	Sitcum/Milwaukee Waterway Commencement Bay	CERCLA; Nearshore CDF	327k cy	CDF constructed by diking off upper Milwaukee WW; Berm constructed of native sediments and structural fill; Capped and converted to marine terminal	Dredging in Sitcum WW; combination of mechanical and hydraulic dredging;	PCBs; PAHs; metals	http://www.smwg.org/Puget%20Sound%20Workshop/Case%20Study2-Sitcum.pdf
16	Middle Waterway/ Blair Waterway; Tacoma WA	CERCLA; Nearshore CDF	108k cy;	CDF constructed by diking off Blair WW Slip 1;	Clamshell dredging; barge placement via notched dike;	PAHs, Hg, Metals;	WEDA 2004 paper
17	Southwest Slip; Port of Los Angeles, CA	Nearshore CDF; Navigation	25 acres; 1Mcy	CDF constructed by diking across slip in LA Harbor	Partial fill by barge via notched dike; hydraulic fill for completion;		
18	Consolidated Slip/ Berth 243-245; Port of Los Angeles, CA	CERCLA; Nearshore CDF	4 acres (approx)	Plans call for CDF to be constructed by diking off Berths 243-245 at POLA; CDF will be capped;	Filling planned by barge via notched dike and mechancial rehandling for final fill;		
19	Terminal 4; Port of Portland, OR	CERCLA Non-Time Critical Removal Action; Nearshore CDF; in 60% design	14 acres; 700k cy projected capacity	Berm will enclose across the mouth of an existing slip in the Willamette River; impermeable cap;		PAHs, PCBs, Pesticides, metals, and TBTs; site will be used for additional placements for Willamette River CERCLA site River mi 2 to 11;	POC: Krista Koehl 503 944 7062; see paper in Battelle Savannah
20	Pointe Comfort/ Lavaca Bay, TX	Lavaca Bay – built upland CDF in the interior of a 375-acre Dredge Island				Hg and PAH contamination (former chlor-alkali plant)! The dredged material has been placed in the CDF, but the CDF is still open.	
21	Onondage Lake, NY	CERCLA; Upland CDF; presently in Remedial Design	160 acres; 1.2M cy	Diked CDF build atop Solvay wastebed; liner and cap planned;	Hydraulic fill planned	Highly contaminated sediments; PAHs, Hg, volatiles;	ROD; consent decree
22	Island End River; Chelsea, MA	Cleanup; Nearshore CDF			Parsons old info: HON is one of PRPs, MGP/Coal Tar site. Spoke with M. Crystal - Nearshore CDF, filling of CDF to begin in June with stabilization of "cut-off" waste. Dredging scheduled to begin in July	Island End River trib of Mystic River; in Boston Chelsea MA – private project, Sevenson was contractor; built steel sheet containment, made a fill; coal tar; has pic on Sevenson calendar;	Mark Otis
23	New Bedford Harbor (Hot Spot Operable Unit); New Bedford, MA	CERCLA; Nearshore CDF	7600 cy	Syntheic liner; synthetic cover for volatiles control;	Hyraulic fill;	PCB, High concentration	Weldon Bosworth, URS
	WORLDWIDE SITES						
24	Parrot's Beak, Rotterdam, Netherlands	Upland CDF; navigation and cleanup	40 ha; 1.5 M m3	clay liner; clay dike core	Hydraulic filling		PIANC 2002; WES TN-DOER-C18
25	Ijsseloog, Lake Ketelmeer, Netherlands	Large Island CDF; navigation and cleanup;	21M cy;	Clay bottom liner placed by hydraulic methods; operational controls	Hydraulic filling		PIANC 2002; WES TN-DOER-C18
26	Minamata Bay, Japan	Nearshore CDF; cleanup		Surface Cover		This is the well-known "Minimata Disease" site; Hg	PIANC 2002; WES TN-DOER-C18
27	Takamatsu Harbor	2 Nearshore CDFs; cleanup	63k m3	Sheetpile wall containment	Mechanical dredging with solidification prior to placment		PIANC 2002
28	Tresse Island, Venice Italy	Reconstructed island landfill		Liner; cover; sheetpile cutoff walls;			WES TN-DOER-C18
29	Geuzenhoek, Belgium	Upland CDF; navigation/ cleanup	500k m3	HDPE liner; slurry wall; leachate collection;			WES TN-DOER-C18

APPENDIX B

TREATABILITY STUDY REPORTS

APPENDIX B1

SITE DEMONSTRATION REPORT

DeepEarth Technologies, Inc.

DCI ENVIRONMENTAL, INC.
Environmental Remediation Contractors

www.deepearthtech.com www.dustcoating.com

A Draft Report© for the Pilot Demonstration of

Controlled In-Situ Chemical Oxidation Technology

Cool-Ox™

at

Ashland/Xcel Energy Lakefront Site
d.b.a Xcel Energy, a subsidiary of Xcel Energy ("NPSW")
Ashland, WI

June 1, 2007

DTI Project # 1162-R2
Joint Project

Prepared for

Jerry C. Winslow, P.E., J.D.
Principal Environmental Engineer

Xcel Energy
414 Nicollet Mall
(Ren. Sq. 8)
Minneapolis, MN 55401

©This document is a copyright of DeepEarth Technologies Inc, all rights reserved

June 1, 2007

Jerry C. Winslow, P.E., J.D., Principal Environmental Engineer
Xcel Energy
414 Nicollet Mall, Ren. Sq. 8)
Minneapolis, MN 55401

Re: ***A Draft Report for the Application of Cool-Ox™ Controlled In-Situ Chemical Oxidation Technology at Ashland/Xcel Energy Lakefront Site, d.b.a. Xcel Energy, a subsidiary of Xcel Energy ("NSPW"), Ashland, WI, DTI/DCI Joint Project # 1162-R2***

Dear Mr. Winslow:

Attached please find the DCI/DTI (TEAM) Joint Project Draft Report outlining the activities and findings of the *Cool-Ox*™ in-situ chemical oxidation (ISCO) Pilot Demonstration conducted at subject site under the direction of the USEPA SITE Demonstration Program. The Report has been compiled based upon information collected from all participants including Field Supervisors and Technicians, the EPA technical team, Consultants, WDNR personnel, Coleman Engineering and others.

Because the USEPA Site Team had not previously conducted a demonstration project involving an on-going dynamic technology, they were concerned that as many aspects of the study as possible, be examined. This included information developed from the January and April (2007) sampling events subsequent to injection work. Therefore, time was necessary to evaluate and assimilate those findings into this document.

(Frank please add your comments)

Acknowledgements:

The DCI/DTI TEAM (TEAM) is most grateful to personnel from Newfields, Coleman, Tetra-Tech, the USEPA and the WDNR for their contribution of information and exceptional cooperation during the execution of this project. Although many obstacles were encountered requiring the modification of the Scope of Work (SOW) as well as the Quality Assurance Project Plan (QAPP), the TEAM enjoyed a genuine sense of the "*spirit of curiosity and cooperation*" and the definite "*desire to understand the nuances of this new Technology*" from all those involved. A special thank you is reserved for the goodwill and support of the local NSPW staff and employees at the site. Their assistance and cooperation was key to the successful completion of the work.

Forward:

In his poem "*To a Mouse*", the eighteenth-century Scottish poet, Robert Burns penned the cryptic reference to the brevity of the "*best laid schemes o' mice an' men.*" This phrase can certainly be applied to the SOW and QAPP designed to direct the execution of this pilot demonstration. From the beginning it became apparent that work activities based upon historical records and the old Sanborn Maps must be modified to speak to current site conditions. Injection activities in both treatment zones (MW-15 and MW-13), located structures that had been described in the old records as having been removed. The presence of these artifacts and the associated unexpected masses of contaminants dramatically changed the anticipated scope of the Technology application as well as the monitoring procedures of the QAPP. These points were discussed in the teleconferences and on-going amendments, based upon frequent new information derived from the dynamic nature of the Technology, were incorporated into the SOW. In the end, these open discussions resulted in a communication conduit that spoke to the concerns of all parties.

Three discoveries were made during the site work that dramatically changed the course of the demonstration project. These were that:

1. the location of the Filled Ravine was actually located to the west of the MW-15 demonstration area, placing it beyond the influence of the Technology,
2. the MW-15 monitoring well was actually located inside of a gas holder that the historical record had reported to have been removed, (this actually turned out to be a critical benefit to the project), and;
3. the Copper Falls Aquifer contained a much higher concentration of rock and cobbles than was anticipated which greatly increased the difficulty in penetrating to design depth.

The affect of this newly developed information, based upon observations made during the application activities in both pilot areas as well as the January and April sampling events at the MW-15 monitoring well nest, were dramatic. The information collected under-pinned the observations made at previous MGP applications and provided the validation of the Technology as a useful remedial tool in this industry.

As such, interpretation of the sampling and analytical data collected during the January and April sampling events is critical to the technical understanding of the effect of the Technology on the contaminants as well as the observations made for the entire pilot demonstration. Because of the complex turn of events during the course of the project and the need to attempt to clearly understand the associated ramifications, additional time was necessary to interview all participants and assimilate as much information as possible. TEAM members experienced in numerous applications of the *Cool-Ox*™ Technology, have had several communications with the USEPA, WDNR, Tetra-Tech, Newfields and Coleman project personnel in effort to provided practical insight into the project and mutually develop an understanding of the results. This report will attempt to present the findings as they were encountered and the activities necessary to bring the project to a useful conclusion.

Background:

Initially, the proposed *Cool-Ox*™ Technology pilot demonstration project conducted at NSPW, called for treating only the area around the **MW-15** monitoring well nest. The purpose of the project was to demonstrate the ability of the Process to validate itself in three areas. These were, its capability to:

1. locate contaminant sources,
2. reduce the concentrations of contaminants, and;
3. stimulate and accelerate the proliferation of intrinsic microbial degraders.

In short, the project was designed to validate the Technology in areas where it had already been proven successful. However, this program was not congruent with the interests of WNSP.

At the meeting convened in Madison, Wisconsin at which the Ashland pilot demonstration team (APDT) was formed (including representatives from WNSP, Newfields, David Crass (WNSP corporate attorney) and the DCI/DTI Team (TEAM)), Mr. Winslow of WNSP expressed his desire to investigate the applicability of the Process to contribute to the enhanced removal of coal tar present in the deep Copper Falls Aquifer. It was, therefore, decided that the project could be split into two parts that would embody the objectives of the USEPA (to validate the claims of the Technology) and yet speak to the concerns of WNSP. Thus, two demonstration areas were selected in separate areas of the site to meet the concerns of both parties.

One demonstration zone measuring approximately thirty (30) by fifty (50) feet (1,500 square feet), was located in the alley south of the maintenance building and positioned at the up-gradient end of both the shallow and deeper contaminant plumes. The area was roughly centered on the MW-15 monitoring well nest, and was selected to validate previous claims of the Technology (contaminant destruction, characterization & bioenhancement). A second area measuring forty (40) by sixty (60) feet (2,400 square feet), was located at the south side of St. Claire Street (including part of the courtyard) at the north side of the maintenance building. This area included the

MW-13 monitoring well nest as well as the three (3) operating extraction wells **EW-1, EW-2** & **EW-3**. This demonstration zone was selected to address the concerns of WNSP to evaluate the potential of the Technology to increase the efficiency of the coal tar extraction system in the deep Copper Falls Aquifer. The blue shaded area in **Figure 1** (attached) denotes the pilot demonstration area around **MW-15**, while the pink shaded area denotes the pilot area around **MW-13** and the extraction wells **E-1, E-2** and **E-3**.

The vertical treatment interval for the pilot demonstration in the **MW-15** area was divided into three (3) zones. The shallow zone, from ground surface to approximately fifteen (15) feet below ground surface (fbgs) was designed to treat contaminants in the Filled Ravine (a geological artifact extending in a curving manner from U. S. Highway 2 south of the site, through the site to the old shoreline of Lake Superior to the north). Underlying this treatment interval, from approximately fifteen (15) to twenty-five (25) fbgs, is a ten (10) foot layer of a hard clay aquitard known as the Miller Creek Formation. Underlying the Miller Creek Formation is the Copper Falls Aquifer. A treatment interval from approximately twenty-five (25) to forty (40) fbgs was selected to investigate the up-gradient extent of the coal tar contaminants in the Copper Falls Aquifer.

The QAPP design called for the injection to be performed from the bottom of the treatment interval (forty (40) fbgs) up through the Copper Falls formation to the bottom of the Miller Creek Aquitard (twenty-five (25) fbgs). At this point the Miller Creek was to be grouted up to the bottom of the Filled Ravine (fifteen (15) fbgs). The Filled Ravine was then to be treated to the surface. This injection sequence was to be conducted in a single placement of the injection tooling. The application was then to be repeated until all of the designed injection points (twenty-three (23) in all) had been completed. Prior to the implementation of the injection program, U.S. EPA and their SITE contractor (Tetra-Tech) were to collect soil and groundwater samples to develop baseline concentrations for the various contaminants.

The remedial design for the **MW-13** pilot area called for the injection of the *Cool-Ox*™ reagent from eighty (80) fbgs in the Copper Falls Aquifer to thirty (30) fbgs the bottom of the Miller Creek Aquitard. The injection points (twenty-seven (27) in all) were then to be grouted from thirty (30) fbgs to the surface to seal the Aquitard. This would prevent cross-contamination of the Copper Falls Aquifer and Filled Ravine. **Figure 1** depicts the areal locations of the pilot demonstration areas while **Figure 2** depicts the cross-sectional configuration of the vertical injection zones.

MW-15 Application and Findings:

Before the injection work began, problems arose that necessitated amendments to the QAPP. While implementing the work scope of the sampling protocol to establish base-line contaminant concentrations for the soils in the **MW-15** area, it was discovered that contamination in what was thought to be the Filled Ravine (FR) was virtually nonexistent in areas greater than ten (10) feet from the south wall of the maintenance building. This meant that the southern twenty (20) feet (two-thirds (2/3)) of the **MW-15** pilot demonstration area was for the most part free of contaminants. At this point, the

QAPP was amended and the majority of the samples were collected within the area ten (10) feet from the wall of the maintenance building. **Figure 3** depicts what was defined to be the free product in the shallow Filled Ravine and deeper Copper Falls Aquifer. **Figure 4** should be consulted for the approximate locations of the sampling points as they were ultimately located. Deeper samples revealed that coal tar residuals were present in the Copper Falls Aquifer in the pilot demonstration area. Sampling points were placed to develop data on the contamination of the Copper Falls Aquifer are also found on **Figure 4**. Analysis of the samples collected coincide with the consultants (Newfields) prior conclusions of contaminant locations as depicted in **Figure 3**.

Photo 1 above, taken in July 2006, depicts the **MW-15** pilot demonstration area. The dark depression at the base of the down spout to the left of the gas service (see arrow), reveals the location of the gas holder discovered during the injection activities in November. This area corresponds to the depression in the foundation of the men's lavatory just inside the wall.

Photo 2 depicts the site undergoing treatment. The green enclosure (see arrow) housed the *Deep-Shot Rig* to protect mixing equipment from the cold and snow.

Injections:

Initially, twenty-three (23) injection points (IPs) arranged on an eight (8) foot matrix were to be completed in the **MW-15** pilot demonstration area. As explained above, the vertical injection design for these IPs was to include injecting *Cool-Ox*™ reagents from the bottom-up, beginning at forty (40) fbgs (in the Copper Falls Aquifer) up to twenty-five (25) fbgs (the bottom of the Miller Creek Aquitard), then grouting up to fifteen (15) fbgs (the bottom of the Filled Ravine), then again injecting *Cool-Ox*™ reagents up to the asphalt surface and

grouting the upper two (2) feet with bentonite to seal the formation. The injection event was initiated with Deep Injection Point (**DIB-1**) (see **Figure 4**).

As winter comes to northern Wisconsin **Photo 3** reveals the wisdom of providing heated cover for the pumping equipment.

This IP location was selected because it was believed it was far enough west to include all three (3) geologic formations. However, from the surface, the injection was indicative of penetrating only very hard clay. Although the forty (40) fbgs depth was achieved and the injection completed in the Copper Fall Aquifer, retrieval of injection tooling was extremely difficult with the bottom ten feet of rod being lost. The IP was grouted from twenty-five (25) feet to the surface with Portland cement. It was the opinion of the experienced TEAM Direct Push Technology (DPT) rig operators, that there was no variation in the consistency of the upper twenty-five (25) feet and that the hard clay formation of the Miller Creek Aquitard was encountered at the surface. On-Site Environmental (OSE) was conducting sampling at the time and investigation of the core samples and discussions with the OSE operator led to the conclusion that the homogeneity of the upper twenty-five (25) feet of strata did not contain fill material indicative of backfill activity in the Filled Ravine. Because of these findings, all four-hundred eighty-five (485) gallons of reagent slated for this IP was injected in the twenty-five (25) to forty (40) foot interval. When the injection head was disconnected, expelled foam through the injection rod indicated the presence of contaminant. However, the

The yellow arrow in **Photo 4** above depicts the location of **MW-16**. The orange arrow shows the location of the soil sampling point where the *Cool-Ox*™ reagent was expelled to the surface. The unreacted white residue and the absence of odor indicate the absence of contaminant.

typical odor associated with coal tar was not observed. Instead, odor associated with reacted coal tar was noted. It was concluded that coal tar residuals were present in the Copper Falls Aquifer at this IP.

Deep Injection Points (**DIB-2**) and (**DIB-3**) were completed in the manner stated above with coal tar artifacts observed when the injection head was disconnected. It was concluded that coal tar residuals were present in the Copper Falls Aquifer at these IPs. However, when **DIB-3** was injected, reagent was reflected to the surface through **MW-16** and deep sampling point **SBS** (see **Figure 4**) located in the lawn just off the asphalt driveway to the southwest of **DIB-3**. Because the depth of **MW-16** was approximately fifteen (15) feet, it was concluded that a transmissive seam served as the transport mechanism for the reagent. This elevation coincided with the soil boring taken at the breakout point **SBS** in the lawn. In all three (3) of these IPs there was no indication of a heterogeneic strata usually associated with backfill activity.

At this point in the application work it became evident that the Filled Ravine was not located in any part of the pilot demonstration zone that had been treated. Conversations with the OSE personnel led to the belief that the Ravine was actually located at the far west extent of the proposed injection zone and perhaps out side of it entirely. In an attempt to define the exact location of the Ravine, TEAM member Kellogg conferred with the Newfields Project Manager, Dave Trainor and it was concluded that the Ravine may not be located in the demonstration zone. Since the contaminants in Filled Ravine were thought to be ideal for demonstrating the ability of the *Cool-Ox*™ Technology to locate coal tar and stimulate bioremediation, another strategy had to be adopted.

As previously stated, the design of the QAPP for injections in the **MW-15** area called for an injection vertical in the Copper Falls Aquifer from forty (40) to twenty-five (25) fbgs, then grouting through the Miller creek formation to fifteen (15) fbgs, then treating to the surface in the Filled Ravine. With the discovery that the Ravine was located outside of the treatment zone a modification of the QAPP was necessary.

Photo 5 above depicts a contaminant source (**SIB-07** (see **Figure 4**) just outside of the west wall of the holder. Although most of the soil around the holder appeared to be relatively clean, three of the IPs outside of the holder near **SIB-07** exhibited characteristics of significant contamination.

During the baseline sampling event, it was discovered that the shallow soils in more than approximately ten (10) feet south of the maintenance building wall, contained very low concentrations of contaminants. However, the area within the ten (10) foot line between the maintenance building wall and the gas main in the alley, contained high concentrations of contaminants. It was, therefore, mutually determined by the TEAM and USEPA representatives that the application could be divided into two work tasks. The first, would address the contaminants in the Copper Falls Aquifer by treating from forty (40) to twenty-five (25) fbgs as defined in the original design. However, the Miller Creek Aquitard would then be grouted with Portland cement, entirely to the surface. In a second work task, the vertical injection zone originally designed to address the Filled Ravine (fifteen (15) fbgs to ground surface), would be treated in a separate series of injections. The surface would then be sealed with bentonite grout.

The shallow application would concentrate on the area near the building instead of the entire demonstration zone, as was originally designed. It was believed that this modification would address the two vertical intervals in a manner that would speak to the original objectives of the QAPP. Namely, locating contaminants with the Process, facilitating their destruction and accelerating subsequent bioremediation. While this modification called for the placement of nearly double the injection points, the work could be accomplished in approximately the same amount of time as originally estimated because of the additional work necessary for the three phases of injecting into the Copper Falls Aquifer, grouting the Miller Creek, injecting the Filled Ravine and grouting the surface as was originally planned. The greatest time savings was in not having to clean-up the grout pump and flush injection hoses twice for each injection point.

Photo 6 (see arrow) above depicts another location **(SIB-16)** where a contaminant source was located.

Modifying the QAPP necessitated the redistribution of the IPs and *Cool-Ox*™ reagent to attempt to retain the objectives of the pilot demonstration. Because of the reactions observed in **DIBs-1, 2** and **3**, it was decided that the contamination in the Copper Falls Aquifer had intruded into the areas of these IPs. Therefore, it only remained to find out how much further to the south the plume extended. The TEAM concluded that this could be accomplished with the placement of fourteen (14) deep injection points. However, it was quite evident

that the concentration of contaminants and their location in the shallow (Miller Creek Aquitard) posed a challenge that required a more concentrated effort. Thus, it was decided to place twenty-five (25) IPs in a random pattern to treat the area where the baseline sampling event had located the majority of contaminants. The 11,110 gallons of reagent slated for the treatment of both zones was divided into approximately 7,500 gallons for the shallow zone and 3,600 gallons for the deeper Copper Falls Aquifer. The injection work began with the treatment of the shallow soil.

Treating the Miller Creek Aquitard

In effort to delineate the contaminant sources located by the baseline sampling in the shallow zone an IP (**SIB-01**) was placed approximately two (2) feet east of **MW-15** (see **Figure 4**). It was also reported that this well had produced free product. Evidence of coal tar on the probe rods during the initial stages of the work as they were extracted from the IP, indicated the presence of significant concentrations of contaminant. Heavy thick foam at the surface was another indicator. A second IP (**SIB-02**) was placed just south of the underground gas line in the alley. No indication of a contaminant source was observed, either by odor or foam. This coincided with the findings of the consultant and the baseline sampling event. However, monitoring well **MW-16** and sampling point **SBS** were influenced. Since the IP did not penetrate the Copper Falls Aquifer, it was assumed that a transmissive seam was present. After consultation with the SITE team, it was concluded that the majority of the shallow injections should be placed within an area between the maintenance wall and the underground gas line to the south.

Photo 7 above depicts the location of the holder wall (see flags) revealed by utilizing the probing technique of the DPT rig. The top of the wall was approximately eight (8) fbgs. The holder floor was found to be at eighteen (18) fbgs.

As the injection work near the building commenced, several IPs encountered refusal at approximately eight (8) feet fbgs. While IPs to the south of the refusals demonstrated very little contaminant concentrations, those to the north were replete with coal tar. This discovery brought TEAM member Kellogg to the conclusion that the holder shown on the Sanborn Maps that was reported to have been removed, may in fact still be in place. This supposition was based upon the experience DCI has gained remediating numerous MGP sites and the norm of finding old plant artifacts that were suppose to have been removed. If the holder was there, the wall should be present in a semicircular pattern.

To verify this possibility and attempt to locate the holder, a point was driven near an IP where refusal had been encountered at the eight (8) fbgs elevation. When the probe again met refusal at the eight (8) foot level, the exercise was repeated at four (4) foot linear intervals until a semicircular arc was delineated. Based upon the type of reactions noted in **Photos 5** and **6**, it could be determined that with the exception the soil located to the west outside the holder, most of the area outside the holder was relatively clean. However, it appeared that the holder itself contained several feet (perhaps as much as six (6) to eight (8) feet) of coal tar. A discussion of the activity concerning treatment of the holder can be found below.

Photo 8 above depicts the location of the holder wall (see flags) from a west to east direction. The arrow indicates the location of the contaminants found outside the holder wall in the shallow (Miller Creek Aquitard). The remainder of the shallow pilot demonstration area outside the holder was relatively free of pollutants.

As stated earlier, the objectives of the pilot demonstration in the **MW-15** zone, were to determine if the Technology could:

1. actually locate contaminant sources,
2. reduce concentrations of contaminants by abiotic chemical oxidation and;
3. demonstrate that subsequent bio degradation was enhanced by the oxidation process.

Detecting Contaminant Sources: **Photos 5** and **6** graphically demonstrate that the Technology is reacting with contaminants and thus indicating that sources have been located. When these injection points are compared to other IPs such as **SIB-15**, **SIB-2**, and **SIB-9,** where prior sampling confirmed that little or no contamination was present and where no surface reactions for noted, it is evident that the Technology can detect contaminant sources, under the conditions present at this site. It should be pointed out that this feature is a qualitative technique that is useful in characterizing source areas at sites. To some degree, the experienced operator can determine if the sources contains free product or merely adsorbed contaminants. Although, the Process does not provide

the quantitative feature necessary to calculate the mass of contaminants present in the source, it does provide the consultant with a useful tool to conduct subsequent sampling events with more surgical precision than current random sampling procedures provide.

***Fostering of Biologic Degradation*:** While the site work was on-going, the TEAM received a series of questions concerning on-site observations as well as the results of the January sampling event. These questions are quite relevant to understanding the application of the Technology and will be included in bold italics at appropriated places in the narrative.

TEAM member Tom Douglas reviewed the soil and groundwater data from the site with members of the Tetra-Tech and EPA SITE group and determined that many of the soil borings in the **MW-15** area were actually within the former holder. Because of the very large mass of coal tar present in the holder, it was difficult to determine the results of the Technology application on contaminant reductions or microbial proliferation inside that the vessel. However, observations made by Mr. Douglas at other sites where significant free product was encountered as well as at other MGP sites confirmed that the *Cool-Ox*™ application had a positive remedial effect in the holder. These phenomenon will be discussed later in this report.

Question: The HPC data indicates that bacterial population has increased in some locations, but again, the data are scattered, and there are no strong or clear overall trends.

Although the mass of coal tar in the holder certainly presented challenges to the conclusive analysis of the effect of the Technology on determining mass reductions and bioremedial impact, contaminated soils outside the holder provided an acceptable venue for these determinations. Comparison of samples taken outside the holder with those taken inside the vessel proved quite useful. The biologic and contaminant concentration data were evaluated specifically in two locations. These were borings **SB-12** and **SB-N** (see **Figure 4**). Soil boring **SB-12** was obviously within the former gas holder and this data proved very insightful. To evaluate and compare data, contaminated soil data from a location outside of the gas holder was selected. To accomplish this, the TEAM focused on soil boring **SB-N** because it was located in a contaminated area just west of the holder. This data also provided very useful results.

Soil and groundwater biologic and contaminant concentration data were tabulated and are presented on the attached **Charts 1** to **8**:

1. **Chart 1** shows that the 24 Hour Heterotrophic Plate Count dramatically increased in **MW-15** although the well was in the former gas holder and extremely high levels of contaminants were present in both the soil and groundwater. Counts increased from less than 10 MPN of CFU/ml to 93,200 between October 2006 and January 2007.

2. **Chart 2** has a similar trend for the Hydrocarbon Degraders detected in **MW-15**. Such counts went from less than 10 MPN of CFU/ml to 36 between October 2006 and January 2007. This provides further evidence that the treatment fostered or enhanced Hydrocarbon Degrading bacteria even when oxidation occurred and while very high contaminant concentrations were present. This is very significant and supports the findings of Cassidy's bench scale experiments to determine the effect of the *Cool-Ox*™ Technology on coal tar collected from other sites. Not only did the indigenous bacteria survive the initial oxidation they were able to multiply and proliferate, even under such harsh conditions. Several of Cassidy's papers have been attached as bench scale examples to corroborate these findings.

3. **Chart 3** provides more evidence to document that biologic enhancement occurred. The Total Plate Count in water from **MW-15** increased from 18 MPN of CFU/ml in October 2006 to 1,511 MPN of CFU/ml in January of 2007. Although only three (3) orders of magnitude, this demonstrated that indigenous bacteria were enhanced and biologic activity was fostered as a result of the *Cool-Ox*™ treatment. To some observers, this may not be significant however, again given the harsh environment, it is remarkable that the microbes survived at all.

4. **Charts 4** and **5** demonstrate that the levels of contaminants dissolved in the groundwater decreased significantly from October 2006 to January 2007. This decrease may have resulted from many mechanisms including the increased biologic activity at the site. A separate discussion on contaminant contaminations follows below.

5. **Chart 7** displays the results provided for soil boring **SB-12**, which was in the gas holder. The biologic data for the soil does not show dramatic increases for the parameter analyzed (24 and 48 hour THPC, HD, and TPC) as was noted in the groundwater. However, the soil results do indicate that the biologic activity was still present in the soil and that it had not been inhibited by the treatment. This was observed even though most of the contaminants were present in the soil and the chemical oxidants had obviously reacted strongly with the heavily contaminated soil. Therefore, it is believed that the data demonstrates that the biologic activity is still ongoing and the biota are viable and are contributing to the reduction of contaminants in the soil even under such extremely difficult conditions. As the mass of contaminants are converted oxidatively to less toxic and more biodegradable molecules, the biologic activity should be sustained and will likely increase even in this soil providing sufficient nutrients, moisture and oxygen are available.

6. **Chart 8** displays slightly more promising results for the biologic activity in the soil. It appears that subsurface conditions were more favorable for biologic activity in the area outside of the former gas holder after the *Cool-Ox*™ treatment was performed. This occurred between October 2006 and

January 2007. It appears that biologic activity increased following the treatment performed in the **SBN** area. A dramatic increase in the Total Heterotrophic Plate Count (THPC) was noted at a depth of nine (9) to ten (10) fbgs. Significant increases were also noted at the eleven (11) to twelve (12) fbgs and the thirteen (13) to (15) fbgs sampling locations. The increases were so dramatic that the vertical axis (24 hour Heterotrophic Plate Count) had to be logarithmically presented. Based upon the historical bio-inactivity in this location it no doubt occurred because of the treatment performed in and around the holder.

Treatment of the MW-15 Holder

Photos 7 & 8 depict the position of the holder as determined by DPT probing. Subsequent to locating the vessel additional points were driven to determine the relative thickness of the wall. It was found that the wall was approximately one (1) to one and one half (1½) feet thick and extended from circa eight (8) to eighteen (18) fbgs where the holder floor was encountered. No refusal of the type associated with striking concrete was noted, therefore, it appeared that the holder floor was composed of the same type of clay as is present in the Miller Creek Aquitard. This was later confirmed when samples taken from the bottom of the holder during the January and April sampling events, contained this type of soil. From an east to west direction, the arc of the holder began approximately two (2) feet from the "L" (by the gas service) in the maintenance building and extended westward along the wall approximately twenty-four (24) feet. Bisecting the arc, the wall extended approximately eight (8) feet from the building wall at the furtherest point. The remainder of the holder is located under the maintenance building. **Figure 4** depicts the approximate location of the holder.

Photo 9 above reveals emulsified coal tar expelled to the surface after reaction with the Cool-Ox™ reagent. Note the physical appearance of the material has changed from the sticky, honey-like consistency to that more resembling "cake batter." The edges of the "puddle" show folding and the "rough dull" surface feature is caused by the presence of reaction gasses. The temperature was indicative of groundwater. The slight bump in the middle (see arrow) reveals the IP (**SIB-14**) where the reaction is venting.

During the treatment of the **MW-15** area, it became apparent that the majority of the contaminants were located in the holder. Of the twenty-five (25) injection points placed in the **MW-15** treatment area, sixteen (16) were placed inside the holder. Although the team had treated other coal tar sites with the *Cool-Ox*™ Process, the volume of coal tar expelled to the surface during the application was by far the greatest at the Ashland site. Although odors and a minor degree of foaming had been noted during the treatment of the holder, it was not until injection at **IP-SIB-14** that anything resembling coal tar was expelled to the surface. **Table 1** may be consulted for a complete review of the treatment in the holder and the remainder of the **MW-15** injection area.

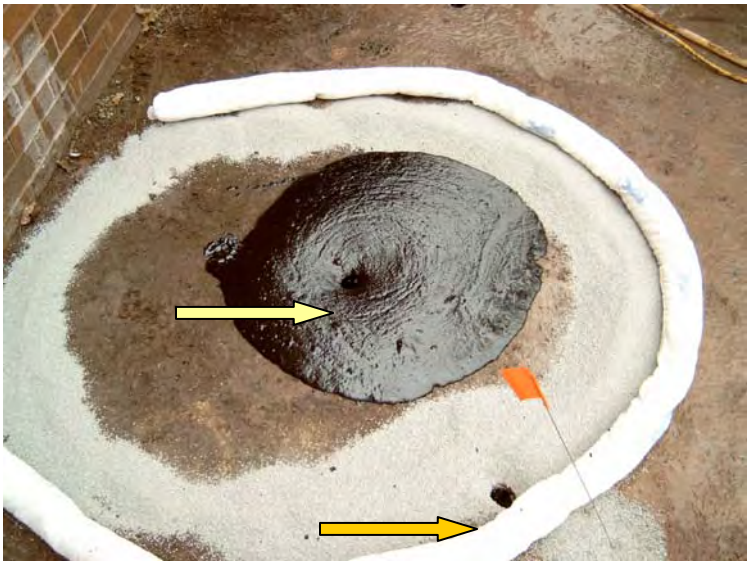


Photo 10 above depicts the reaction as it subsides and the emulsified coal tar runs back down the IP (see yellow arrow) as the reaction pressure subsides. Normally, the IPs are grouted after each injection is completed. However, (**SIB-3**) (see orange arrow) and some other IPs in the holder were left open to allow venting outside as a precaution because the majority of the holder was located beneath the maintenance building and the TEAM was concerned that vapors would intrude into the building.

Emulsification of Coal Tar

When coal tar was expelled to the surface through **IP-SIB-14**, it was an event that startled many of the TEAM members. Comments by all of the of the observers included such comments as "they had never seen coal tar flowable before." In fact, the coal tar that had been observed on DTP probe rods and on samples collected by OSE appeared as a sticky black substance that adhered to everything and was nearly impossible to remove. Conversely, the material percolating to the surface from the gas holder resembled previous coal tar samples in color only. The viscosity was no longer a thick honey like residue. Rather a watery black flocculent substance that had lost its sticky adhesive characteristic and exhibited a much milder odor. Of course, it was no longer conventional coal tar. Instead, it had been emulsified by the action of the *Cool-Ox*™ Process. We are indebted to Paul MaCauley who had the quick wit to record the event as a video. Subsequent study of this video and comparison with films taken at other sites, aided greatly in revealing the emulsification Process. It also greatly influenced the chemical Process design applied to the **MW-13** pilot demonstrations area.

Because the pyrolysis process used to produce coal gas in the manufactured gas process, produces large quantities of aldehydes and phenolic derivatives such as creosote

and some types of polyaromatic hydrocarbons (PAHs), the coal tar is generally found to be acetic at a pH of six or less. The reaction of the coal tar with the *Cool-Ox*™ reagents, tends to raise the pH of the mass to eight. In addition, polyols or alcohols or other types of wetting agents referred to as surfactants are produced. Both of these actions produce an environment that causes the coal tar to convert to a more water soluble entity. The reaction gas, generally carbon dioxide contributes two vital functions. These are first, improved mixing as the gas is produced thereby opening up the treatment matrix, and secondly, decreasing the specific gravity of the organic mass as it is trapped in the matrix. All of these phenomenon contribute to the transformation of a thick sticky coal tar mass to an emulsified material which can be readily pumped and transported. The expulsion of this converted product to the surface has been previously observed and was expected at this site.

Photo 11 shows the configuration of the emulsified coal tar (ECT) after the reaction has gone to completion and the surface is no longer impacted by subsurface activity. At this stage, the artifact is no longer coal tar but, instead a material that contains a large percentage of water (the transport medium) and reaction gasses. The material smears but, is not sticky or highly odorous like unreacted coal tar.

Photo 12 above shows TEAM Site Manager Rick Tolman collecting the ECT for drumming. At this stage, the ECT resembles "pudding" rather than the sticky, honey-like coal tar.

Question: John mentioned that the samples from the post-injection event were less viscous. It is unclear at this point if the reduction in viscosity is due to the Cool-Ox™ product or due to injection of large quantities of water.

No amount of water will facilitate dissolution or phase change of a material

Photo 13 depicts the ECT in a drum. Note the "rough" character of the surface indicative of the reagent reacting with contaminant and generating foam. At this point the physical characteristics of the original product are all but, gone.

that is insoluble in water at the normal groundwater temperatures encountered (see **Figure 7**). This can only be accomplished by actually changing the chemical characteristics of either the compound or the solution that is being used to dissolve or mobilize the compound. Chemically, this can be accomplished by several methods including the one used to emulsify the coal tar at this site. Other methods such as the use of surfactants can be used to increase the ability of the solvent (water) to carry the compound. The *Cool-Ox*™ Process has used a combination of both physical and chemical phenomenon to increase the solubility and lower the viscosity and in short, convert the insoluble recalcitrant coal tar to a manageable product.

The question was raised during one of the telephone conference calls regarding surfactant production, if it might be prudent to "measure the dipole moment" of reacted samples to monitor the production of surfactants. While this procedure certainly can be used and is valid under laboratory circumstances, the procedure adopted to monitor surfactant production in samples collected from sites where

Photo 14 above shows the method used to contain reflections of ECT after the first material had been cleaned up and containerized. This method consisted of placing a cut section of a 55 gallon drum around the active IP and sealing the bottom (inside and outside) with bentonite granules. This effectively allowed the IP (see arrow) to vent while protecting the holder from intrusion by surface water. A drum cover was placed over the top to protect against rain or snow.

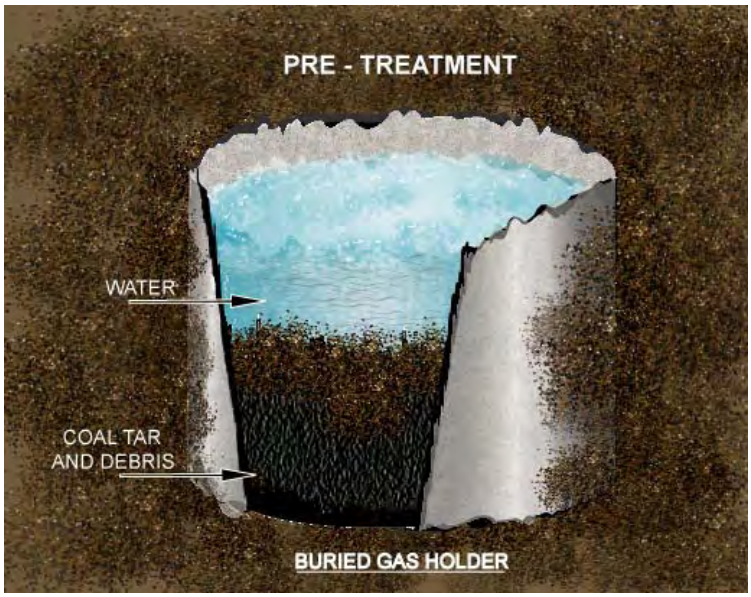


Illustration 1 depicts the suspected configuration of the coal tar/groundwater relationship prior to treatment with the *Cool-Ox*™ reagent. Note the water is phase separated from hydrophobic coal tar faction with the heavier tar collected near the lower portion of the vessel. During the injection activities as well as the sampling work, coal tar remnants were observed on the bottom eight (8) feet of the probe rods.

the groundwater may not be water-white, has been the measurement of surface tension. It has been shown that the surface tension of clean groundwater is approximately 70 dynes/cm. Laboratory experiments have revealed that pure water maintains this magnitude. However, the surface tension steadily decreases to a level of approximately 35 dynes/cm where the saturation point of the surfactants is it achieved. Groundwater samples collected from the site and submitted for analysis, maintained the 35 dynes/cm range consistently.

At this surface tension magnitude, the capacity of water to carry organic carbon contaminants (i.e., BTEX, PAHs, TPH, etc.) is greatly increased. As micells are formed or long chain carbon molecules are held in suspension, the water will take on a milky or translucent appearance indicating its ability to transport large concentrations of normally insoluble compounds. This characteristic is central to converting groundwater to an extraction media and would not be possible without a wetting agent to bridge the gap between the hydrophilic water and the hydrophobic organics. This agent is referred to as a surfactant.

Contaminant Concentrations

When interpreting the data concerning contaminant concentrations where the data is derived from free product environments (in this case, emulsified coal tar in the holder), several factors must be considered. If one reviews the post treatment data in comparison to pretreatment concentrations of groundwater in **MW-15**, it would appear that substantial decreases of approximately 50% were achieved. This may be true. However, to obtain a clear understanding of the effect of the treatment on the contaminant one must not only consider groundwater concentrations but, take into account concentrations in soil as well. In this case, the data indicates that a six-hundred percent (600%) increase in contaminant concentrations in the soil. How can that be? Where did the product come from? The Process cannot manufacture the contaminants therefore, the answer lies elsewhere. The answer lies in the ability of the Process to emulsify and desorbed contaminants.

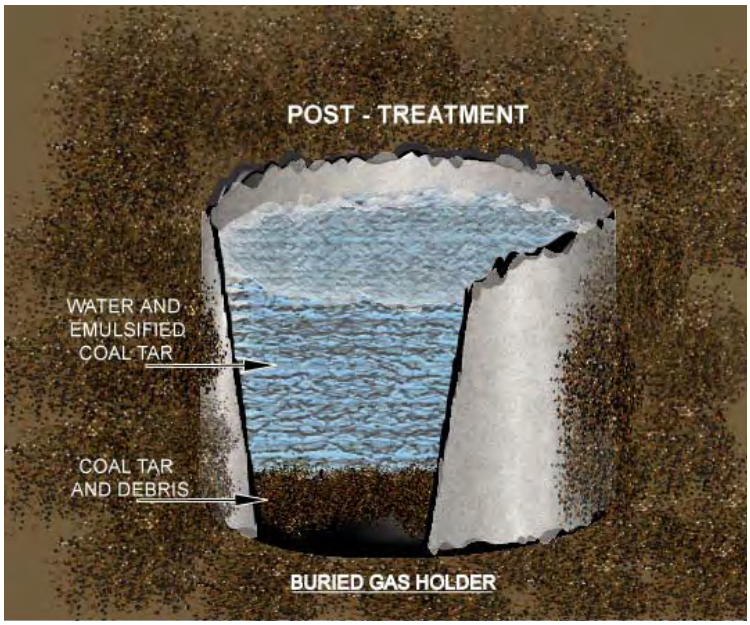


Illustration 2 shows the effect of the oxidation Process as it emulsified the coal tar thereby, increasing its solubility. This also causes the hydrophobic faction to separate and migrate to the heavier molecular weight asphaltene like contaminants in the bottom of the holder. This phenomenon occurs when the concentration or quantity of oxidizer is stoichiometricly insufficient to convert the mass of contaminant to an oxidized byproduct.

As the reagent reacts with the contaminants adsorbed to the soil or cinder particles in the holder, it begins desorbing them over the extent of the contaminated vertical interval. Because the quantity of oxidizer is less than the amount required to oxidize the entire mass, the heavier hydrocarbons, as they desorb, separate to the bottom of the holder, where the organics are more soluble in the hydrocarbon mass than they are in the aqueous phase. Thus, rather than being spread over a larger vertical interval as is the case prior to treatment, they are concentrated in the hydrophobic mass at the bottom of the holder. This action is known as agglomeration (the concentration of a hydrophobe with itself) and occurs when the quantity of surfactant is not sufficient to accomplish total emulsification (the breakup of a hydrophobe by surfactant action). In cases where the specific gravity of the organic hydrophobic constituent is greater than water, the material will desorb and sink. In cases where the specific gravity of the organic hydrophobic constituent is less than water, the material will desorb and float. This is not emulsification where the contaminants are finely divided into micells or molecular constituents. Instead, with agglomeration, the concentration of surfactant is just high enough to allow the contaminant to desorb and migrate as globules. When these globules meet, they combine to form a mass. This Technology is well understood by those schooled in the discipline.

Because this mass is more hydrophobic or oily in character, the hydrocarbon constituents such as BTEX or PAHs tend to be drawn into this hydrophobic environment. This action is no different than the simple laboratory exercise of using a separatory funnel to separate water soluble, components from oil soluble compounds. As the desorption occurs, the contaminants are concentrated in the hydrophobic mass at the bottom of the holder. Therefore, concentration of contaminants after treatment at the affected sampling elevation could be higher than before treatment if the reagent is not stoichiometricly matched to oxidize the target pollutants (converting them to hydroxylated organic

compounds wetting agents, i.e., surfactants) as well as the non-target heavier hydrocarbons. Based upon the soil samples collected from the bottom of the holder the target contaminants were concentrated in excess of six-hundred (600) times their pretreatment concentrations. However, investigation of the photos included in this report will reveal that, as expected, the integrity of the strata was disrupted by the treatment. Thus, accurate comparisons of pre-treatment contaminant concentrations drawn at certain depths against post-treatment sampling at the same depths may be impossible.

Question: The TIC data indicates absence of significant surfactant-type chemicals in the soil samples that can be observed above the hydrocarbon matrix. The presence of possible surfactant TICs (oxygenated and sulfonated organics) may have increased somewhat in the post-treatment groundwater samples. Are their any particular surfactants we should look for?

Photo 15 depicts a reflection of contaminant foam from **IP-SIB-16**. It should be noted that the reagent and a slight amount of contaminant foam can be seen surfacing at the building wall. This indicates that the reagent has reached the foundation and that contaminant was present at this location. This is the area west of the holder near the wall of the maintenance building where contaminant concentrations in the shallow soils were the greatest.

It may the have been appropriate to do EPA method 610 with GC/MS to identify the breakdown products from the large variety of baseline contaminants. More organic parameters are probably present than just those identified and listed on the spreadsheet. It has also been determined that when treating hydrocarbons of MGP sites it would be prudent to measure TOC and TRPH or TPH with fractionation. In this way, one could have documented the increases and decreases in TPH in specific contaminants. Thus, demonstrating that the contaminants are indeed being reduced to carbon based molecules with chains broken and very likely hydroxyl groups added thereby, generating compounds such as alcohols, polyols, organic acids, etc. Keeping this in mind, it must be clearly understood that coal tar contains thousands of different chemical compounds, all of which are subject to oxidation. Therefore, it is nearly impossible to collect data on the individual reaction products produced.

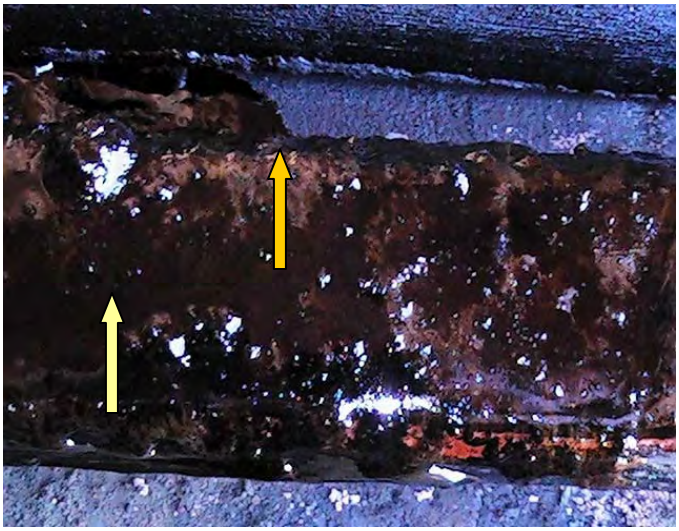


Photo 16 reveals the watery mass of ECT collected at the bottom of the holder during the January sampling event. Note the ECT (yellow arrow) and the soil and reagent mix (orange arrow). Samples collected at this interval prior to treatment were black with no phase separation

This challenge is greatly exacerbated by the dynamic nature of an on-going reaction where at one point in time, an analysis can reveal a broad spectrum of compounds. The problem is further confounded, if a second aliquot is collected from the same reaction vessel at a slightly later time. In this case, because the reaction is on-going, a completely different group of compounds may be present. Many of which may be daughter compounds of the reaction products found in the first analysis. This explanation is based upon laboratory experiments under controlled conditions. It is exponentially more complicated when the reactions are conducted under field conditions where it is nearly impossible to compend a complete list of all contaminants present.

Question: We have had difficulty in obtaining a sufficient volume of NAPL to conduct physical tests. The samples we have collected are black and oily, but appear to separate into thin layer of black material coating the sides and bottom of the sample bottles, with only a very thin layer of film at the top of the aqueous phase. Is this black granular NAPL (solidified NAPL) or soil particles coated with NAPL? Has Cool-Ox™ encountered any similar situations/sites where recovery of NAPL has been problematic?

Photo 17 above depicts the sampling interval use to collect the soil samples from the holder during the week of April 9th. The brown (clay) soil (see arrow) at the left of the photo is from the bottom of the holder.

It was also pointed out in one of the conference calls that when groundwater samples were received at the laboratory, the technicians were unable to conduct analysis because of the lack of sufficient product quantity.

The comment was made that the organic compounds were thin films that looked more like black dust adhered to the side of the sample vessels than what is normally seen in oily or hydrocarbon aliquots. This is not unusual and can be attribute to the fact that the solid oxidizers do not stop working as the samples are in transit. A measurement of the surface tension of such samples generally shows the surface tension to be somewhere in the mid to high thirty (30) dynes/cm range (seventy (70) is usual for groundwater not impacted with surfactants).

In many cases acid is used to "stabilize" the sample. This works by killing the microbes, where bio-samples are to be analyzed. However, when peroxygens are employed as hydrogen peroxide generators, the dissolution rate of these compounds is accelerated under acetic conditions. In the case of calcium peroxide, this reaction ($CaO_2 + H_2O \rightarrow H_2O_2 + Ca(OH)_2$) is well understood and it is easy to see that the calcium hydroxide formed by the reaction will quickly buffer the acid toward neutrality. A more subtle factor however, is the fact that the acid preservative, by increasing the solubility of the peroxygens, actually increases the availability of hydrogen peroxide over a much shorter timeframe thus, accelerating the oxidation of the organic contaminants in the sample. By the time the sample arrives at the laboratory, it does not represent the aliquot as it was collected and dispatched. One can argue that if this is the case, evolved gas should form a bubble in the container. This would be true only if the organics were mineralized to form carbon dioxide. However, since the bulk of the contaminants are hydroxylated rather than mineralized, any carbon dioxide formed could be of such low concentrations that they would reside at levels below their coefficient of solubility and thus, not be recognized as a gas phase in the sample container. The surfactants generated would also contribute to increasing the solubility. It should also be pointed out that all of the samples collected at the Ashland site contained soil or suspended soil. As such, the cation catalysts necessary for the formation of oxidizing radicals was inherent in the sample. Thus, the abiotic oxidation activity would proceed.

Question: If an un-sleeved injection point is used as a volunteer conduit to bring coal tar to the surface, isn't there a chance of contaminating more permeable layers (sand stringers, etc.) that might be present above the mass by intrusion of the coal tar into those areas?

Characterization vs. Remediation

The capability of the *Cool-Ox*™ Process to detect contaminant sources and reveal their locations by the reflection of "tell-tale" foam to the surface after the injection probe is withdrawn has raised questions concerning contaminant recovery issues.

Photo 18 above shows where a "soil" sample was collected during the January 2007 sampling event. This spill occurred when the soil sample collected from the bottom of the holder was so liquefied that the sampling tube was could not contain the soil sample. To retrieve soil samples, the probe was driven into the clay bottom of the holder to form a plug. The holder contents displayed the same watery characteristics during the April 2007 sampling event. This was evidence that the emulsion had not broken since the November treatment.

The primary question is, "if an un-sleeved injection point is used as a volunteer conduit to bring coal tar to the surface, isn't there a chance of contaminating more permeable layers (sand stringers, etc.) that might be present above the mass by intrusion of the coal tar into those areas?"

The possibility of that type of cross contamination is real and probably would occur. However, *one must remember that site characterization and subsequent remediation are two separate phases of the remedial program*. The *Cool-Ox*™ Process simply allows the work to progress from one phase to the other without the need to waste time and expense locating contaminant sources. This is the qualitative step. In some cases, where (as is perhaps the case of MGP sites) it is suspected that massive quantities of contaminants are present, it may be prudent to conduct quantitative analysis to develop the information needed to select or design the proper remedial solution. It should also be remembered that during remediation activities, contamination of so-called clean soil or groundwater will occur.

To answer the question directly, based upon information gained at Ashland and similar sites, the *Cool-Ox*™ Process appears to produce the desired results for economically remediating contaminants found in deeper strata. Under normal circumstances, encountering a holder whether a gas holder or relief holder, during remediation of an MGP site, can significantly increase the expense of the job particularly if it contains coal tar. However, for the purposes of this pilot demonstration project it could not have been more welcome. The holder provided the opportunity to demonstrate in a closed vessel, the ability of the Technology to transform a heavy viscous material into a low viscosity material that could quite easily be extracted and addressed under pro-forma pumping and materials handling techniques. If the mass of the contaminant can be extracted in this manner to the concentration level that will allow it to be a candidate for in-situ oxidation and combined bioremediation, the remedial costs can be greatly decreased. Other highly desirable qualities include eliminating the need to excavate thereby, eliminating the sensitive issue of odor emissions since all the work is completed without opening the earth.

Photo 19 above is additional evidence that of the accumulation of heavy coal tar artifacts at the bottom of the holder. It is expected that these samples will exhibit contaminant concentrations relative to those collected during the January 2007 event. Note the clay plug from the bottom of the holder to the right of the photograph (see arrow).

To implement a remedial program to address this problem, it is believed that a series of extraction wells would be placed at strategic locations and elevations to aspirate contaminants as they are being desorbed by the Technology. Once the concentrations are reduced to the point that the reagents can treat the remaining contaminants, extractions can cease. This procedure will assure that strata above the affected zone are protected from cross-contamination caused by any off gassing from the Process. A detailed discussion of this Process or remedial design is beyond the scope of this report. However, the TEAM welcomes any questions that may be helpful in understanding the concept.

Question: The groundwater samples from the thirty (30) day sampling event indicate that hydrogen peroxide was still present. Does Lundy have any idea what the initial concentrations should be? Mr. Lundy initially thought that the Cool-Ox™ would not be present after about sixty (60) days, does Mr. Lundy still think so? Should Tetra

Tech delay the second post-injection event in order to give ample time for the Cool-Ox™ product to work and to record adequate percent reduction to support the primary goal of the project?

Sampling of the few groundwater monitoring wells at sixty (60) days would allow another snapshot of the dynamic conditions that are taking place at these few wells. Again it is important to add TRPH/TPH to the sampling regimen. The peroxide concentration should continue to decrease with time as these oxidants readily react with iron present in the soil and the organic molecules that are present at very high concentration levels. The slow continued generation of hydrogen peroxide is beneficial as it improves the desorption of organic contaminants that were tightly bound to the soil and which had previously formed hydrophobic barriers to bacterial degradation.

Photo 20 shows a core sample taken outside the holder near **SBN**. Note the reddish color of the soil and the apparent absence of any coal tar artifacts. This core very different in appearance from those collected within the holder. It should be noted that the integrity of the soil allow meaningful samples to be collected from very defined vertical intervals. This was not possible in the holder where the heavy coal tar was desorbed from the soil, cinders (ash) and debris and settled to the bottom of the vessel.

The increased supply of oxygen will allow rapid aerobic degradation to occur until the amount of oxygen being generated and naturally diffused, decreases. Typically, it takes up to one-hundred (100) days for significant and sustained increases in biologic activity to be measurable. Many of the locations monitored showed acceptable levels of biologic growth after only a few weeks. This demonstrates that the *Cool-Ox*™ did increase biologic activity in many points and that continued degradation of the contaminants of concern is now taking place over a larger volume. In essence the treatment has made the site a larger bio-reactor.

The second sampling was delayed until the week of April 9, 2007. No samples were collected from the Copper Falls Aquifer. At the writing of this report, the sampling results were not completed.

During the injection work at the **MW-15** holder, the TEAM was faced with a wide variety of weather conditions, ranging from pleasant fall weather, to rain, to snow and freezing conditions. While the freezing weather made pumping and grouting difficult, these conditions were quickly overcome and subsequently the work proceeded without incident. The most troublesome condition, was rain which lasted for approximately two days with the water collecting in the low area atop the holder. Injection ports were grouted with bentonite to prevent casual water intrusion into the holder. Attempts were made to redirect the water from the roof downspout into the work area, however because water was also accumulating from the parking area, collecting the water using a drum vacuum prove to be the most efficient method of handling. The ground water was then tested and disposed of in an acceptable manner.

Photo 21 shows rain water that collected in the depression (see **Photo 1**) over the holder from the roof downspout and the parking lot. The water was contained in the treatment area by the boom (see yellow arrow) placed across the alley. The water was containerized with the drum vacuum (see orange arrow) and disposed of. The soil placed and compacted against the building wall to prohibit vapor intrusion into the men's lavatory in the building, where the foundation had settled can be seen (see blue arrow) at the right of the photo near the downspout.

Although when treating the holder, injection points were left open to vent any reaction gases, near the end of the injection work Photo Ionization Detection (PID) readings indicated that some intrusion was occurring in the men's lavatory inside the maintenance building. Prior to the initiation of injection work, it was noted that the foundation had settled over the holder area leaving a gap between the stud wall and the foundation. Being aware of this condition, the TEAM piled and tamped soil against the base of the maintenance building wall in an effort to seal off that area from the injection work. This strategy appeared to work well and it was not until near the end of the injection activities that higher PID readings were noted. Shortly thereafter, injection work in the holder was truncated.

Treating the Copper Falls Aquifer:

As previously noted, the injection work was initiated with Deep Injection Point (**DIB-1**) (see **Figure 4**). This IP location was selected because it was believed it was far enough west to include all three (3) geologic formations (Filled Ravine, Miller Creek Aquitard and Copper Falls Aquifer). However, from the surface, the injection was indicative of penetrating very hard clay. Although the forty (40) fbgs depth was achieved and the injection completed in the Copper Fall Aquifer, retrieval of injection tooling was extremely difficult with the bottom ten feet of rod being lost. The IP was grouted from twenty-five (25) feet to the surface with Portland cement. It was the opinion of the experienced TEAM Direct Push Technology (DPT) rig operators that there was no variation in the consistency of the upper twenty-five (25) feet and that the hard clay formation of the Miller Creek Aquitard was encountered at the surface.

Photo 22 depicts the reflection of coal tar from one of the deep injection points when the probe had been withdrawn. Because the pilot location was not impacted by the Filled Ravine, the threat of cross contamination between the Filled Ravine and Copper Falls Aquifer was greatly reduced. Thus, it was possible to observe contaminants reflected from the Aquifer. All IPs place into the Copper Falls formation were grouted to the surface with portland Cement.

As stated previously, Deep Injection Points (**DIB-2**) and (**DIB-3**) were completed in the manner stated above with coal tar artifacts observed when the injection head was disconnected. It was concluded that coal tar residuals were present in the Copper Falls Aquifer at these IPs. However, when **DIB-3** was injected, reagent was reflected to the surface through **MW-16** and deep sampling point **SBS** (see **Figure 4**) installed by OSE located in the lawn just off the asphalt driveway to the southwest of **DIB-3**. Because the depth of **MW-16** was approximately fifteen (15) feet, it was concluded that a transmissive seam served as the transport mechanism for the reagent. This elevation coincided with sand seam artifacts found in the core sample taken at sampling point **SBS** at the edge of the lawn where the reagent broke out to the surface.

As stated above, based upon the findings during the initial work stages of the pilot demonstration, the QAPP was modified to divide the injection work into two phases. These were treating the shallow (Miller Creek Aquitard) in one work task and treating the deep (Copper Falls Aquifer) in a second. Initially, twenty-four (24) injection points (IPs) arranged on an eight (8) foot matrix were to be completed in the MW-15 pilot demonstration area. As explained above, the vertical injection design for these IPs was to include injecting *Cool-Ox*™ reagents from the bottom-up, beginning at forty (40) fbgs (in the Copper Falls Aquifer) up to twenty-five (25) fbgs (the bottom of the Miller Creek Aquitard), then grouting up to fifteen (15) fbgs (the bottom of the Filled Ravine), then again injecting *Cool-Ox*™ reagents to the asphalt surface and grouting the upper two (2) feet with bentonite to seal the formation.

Modifying the QAPP necessitated the redistribution of the IPs and *Cool-Ox*™ reagent to attempt to retain the goals of the pilot demonstration. Because of the reactions observed in **DIBs-1, 2** and **3**, it was decided that the contamination in the Copper Falls Aquifer had intruded into the areas of these IPs. Therefore, it only remained to find out how much further to the south the plume extended. The TEAM concluded that this could be accomplished with the placement of fourteen (14) deep injection points. However, it was quite evident that the concentration of contaminants and their place in the shallow (Miller Creek Aquitard) posed a challenge that required a more concentrated effort.

Photo 23 depicts the foam caused by the reaction of the reagent with the contaminant, breaking out around monitoring well **MW-15B** as the reagent is injected at **IP-DIB-13**. Newfields had reported that they believed the integrity of the bentonite well seal had been compromised for some time by the corrosive activity of the coal tar. As the reaction occurred, the foam was contained by the cut drum. The monitoring well is protected by the PVC pipe extension. Expelled material outside the cut drum was collected for disposal and containerized in 17-H, 55 gallon drums.

Thus, it was decided to place twenty-five (25) IPs in a random pattern to treat the area where the baseline sampling event had located the majority of contaminants. The 11,110 gallons of reagent slated for the treatment of both zones was divided into approximately 7,500 gallons for the shallow zone and 3,600 gallons for the deeper

Photo 24 reveals the proximity of **MW-15B** to the holder. Monitoring well **MW-15A** is located in the foreground. **MW-15A** was unaffected during the treatment. **IP-SIB-3** (in the holder) can be seen just behind the person in the blue jeans. Injection point **DIB-13** can be seen in front of the Geoprobe®.

Copper Falls Aquifer. After the revision of the QAPP, the injection work began with the treatment of the shallow soil at IP-SIB-1.

Upon completion of the injection work in the shallow zone, injections into the Copper Falls Aquifer were initiated with resumption at **DIB-4**. The objective of the injections into the Copper Falls Aquifer was to attempt to locate the southerly extent of contaminants that were present in concentrations high enough to be defined as a source area (free product or smeared) based upon the reaction of the coal tar with the *Cool-Ox*™ reagent. It should be pointed out that under the original QAPP, this work was to be conducted to; a) locate the areal extent of the contaminant in the Filled Ravine; and, b) collect microbial samples to determine if the Technology did indeed contribute to the proliferation of intrinsic species. However, discovery that, in this area, the Miller Creek Aquitard extend from near surface to the Copper Falls Aquifer at circa twenty-five (25) feet, it was decided to investigate the contaminant range in the latter.

The results of the reactions coincide with the finding of Newfields as shown in **Figure 3**. Heavy reactions with foam and odors were noted to the west and southwest of the holder with milder reactions to the south and southeast. Only slight foam reactions

Photo 25 depicts the continuing reaction (note rising foam caused by the emission of carbon dioxide) after injection has ceased at monitoring well **MW-13B** just outside the holder. **IP-SIB-3** inside the holder can be seen at the top right of the photo.

were noted in **DIB-4** with no odor observed. To the south near **MW-16, DIB-7** exhibited a slight foam reaction with mild odor indicating the presence of low levels of contaminant. No reactions or odor was observed in **DIB-8** to the south however, communication with **DIB-7** exhibiting a slight amount of foam was noted during the injection at **DIB-8**. It was mutually decided by the TEAM and USEPA Group that further investigations to the south of **DIB-8** were not necessary.

During the injection at **DIB-13**, the bentonite seal at **MW-15B** was compromised. It is assumed that a combination of gases generated by reaction of the reagent with contaminant coupled with the hydraulic pressure of the injection caused this phenomenon. Under normal circumstances, if monitoring wells are properly installed, this does not occur. Upon observing that the bentonite seal been expelled by the reaction, Mr. McCollogh, New Fields Site Manager, indicated that Newfields had arrived at the conclusion sometime prior to the implementation of the pilot demonstration that bentonite around the base of the well had been compromised by the action of the coal tar residue. **MW-15B** is the deep well, screened from approximately forty-seven (47) to fifty-three (53) fbgs.

Although, **MW-15A** is a shallower well, screened from approximately thirty-five (35) to forty (40) fbgs, no appearance of well seal compromise was noted at that location. Because reaction gases tend to rise through the formation it would have been logical that **MW- 15A** should have been compromised rather than **MW-15B** if the latter had been in good repair. Since this did not happen, it can be assumed that the well seal around MW-A is intact and that Newfields assumptions concerning the previous problems with **MW-15B** are correct. It should be noted that although the well seal outside of the well casing failed, no indication of increased elevation of the groundwater inside the well casing was observed. Therefore, it can be assumed that the strata below the forty (40) fbgs injection interval, was not affected.

When it was observed that the bentonite seal of **MW-15** be was compromised, an extension was immediately placed on the monitoring well to avoid contamination of the Copper Falls Aquifer from the injection activity above. At the same time, a cut drum was placed around the monitoring well to contain expelled material. All material was containerized and segregated for proper disposal. Injection at **DIB-13** was ceased and the IP grouted with Portland cement as were all injection points.

A similar breakout at **MW-15B** be was again observed during injections at **DIB-14**. The same procedures were used to contain the reaction and collect the expelled material as before and injection of the Copper Falls Aquifer in the **MW-15** pilot demonstration zone was completed. The gas holder was a god-send field laboratory.

MW-15 Summary:

Findings during the injection work at the **MW-15** Pilot Demonstration Area that presented several unanticipated challenges, necessitated several modifications in the

Quality Assurance Project Plan (QAPP). These modifications began with discoveries made during the baseline sampling events and continued on through the finish of the injection work. The major findings and point of interest were as follows.

Filled Ravine: Although shown on the Sanborn Maps to be present in the **MW-15** pilot area, it was determined that this geological formation was in fact, located west of demonstration area. This presented significant problems because it was anticipated during project design that the Filled Ravine could contribute to the verification that the *Cool-Ox*™ Technology could locate contaminants, destroy them through in-situ chemical oxidation and initiate accelerated bioremediation. Fortunately, subsequent discoveries were made that supported these claims that did not rely on the Ravine.

Gas/Relief Holder: Although the historical records indicated that the holder had been removed, the injection work revealed that it was indeed, in place. When the south wall of the holder was located, it revealed that the majority of the holder was located under the maintenance building. Photographs taken during July 2006, indicate a depression of the pavement in the alley where the holder was located. Although unexpected, the presence of the holder provided a very positive opportunity to gather and verify characteristics of the Technology that would not have been possible had the holder not been present. Because the holder contained a significant volume of free product, the TEAM was able to demonstrate that the *Cool-Ox*™ Process could emulsify coal tar. Additional information was developed however, the ability to emulsified coal tar in large concentrations thus, breaking the viscosity and rendering it extractable by conventional means, opens the door to new remedial opportunities.

Bioremediation: Two locations where examined to determine the effect of the Technology on accelerating intrinsic bioactivity. One, from inside the holder and one located outside the holder. While the point inside the holder (**SIB-12**), demonstrated only moderate increases in microbial proliferation, it was concluded that because of the harsh environment, the fact that the bacteria survived and demonstrated some increase was significant. Conversely, the point outside the holder that was studied (**SBN**) revealed significant increases in microbial plate counts. The relationship between these two points demonstrated that in the presence of free product or highly elevated concentrations of contaminant, bioremediation will not make a significant contribution to site remediation. On the other hand, where contaminants reside primarily in groundwater or in concentrations below the toxic threshold of the microbes, bioremediation can be significantly accelerated by the Technology and provide the "finishing" (mitigation of contaminants subjected to abiotic chemical oxidation) step in cleaning up sites.

Contaminant Destruction Through Chemical Oxidation: As in bioremediation, the ability of the Technology to destroy contaminants by chemical oxidation must be investigated from two perspectives. Outside the holder where contaminant concentrations were low enough to be measured without the influence of free product, the reductions in target pollutants were very satisfactory and comparable to other sites treated where PAHs and BTEX were the subject of mitigation. However, in

the holder where free product was encountered the mass of contaminants was so concentrated that reductions, given the quantity of reagent injected, were impossible to measure. Therefore, an attempt was made to determine the effect of the reagent on contaminant destruction by analyzing for oxidation products. These were referred to as TICs. Unfortunately, at the writing of this report, the measurement of TICs is still under discussion. However, the coal tar in the holder underwent a change in physical character. This physiochemical change was a transition of the coal tar from a sticky, honey-like odorous material to an emulsified product that was to some degree water soluble or miscible. This transformation could not have occurred without the formation of surfactants. It has been shown that hydrocarbons are converted to surfactants by chemical oxidation. Thus, compounds comprising the make-up of coal tar were oxidized to form surfactants. In short, a portion of the mass of coal tar was oxidized. The question remains, what percent of the total mass was converted. Because the amount of contaminant was so great, the degree to which it can be measured remains to be determined.

Analytical results from samples taken within the holder show a fifty percent (50%) decrease in the concentration of target pollutants in the groundwater. While these analytical results are undisputed, one must remember that at the same time, concentrations of contaminants in the soil at the bottom of the holder increased by factor of six-hundred percent (600%). As explained in the text, these two phenomena are the result of a combination of chemical oxidation and surfactant production causing an agglomeration or concentrating of the contaminants at the bottom of the holder. While this was expected, it should be remembered that desorption of coal tar over the vertical treatment interval that may indicate a reduction in the concentration, may be misleading and may not be attributable to destruction under chemical oxidation. Rather, in this case where the reactions were occurring in free product, it is more likely that the agglomeration process concentrated the contaminant at the bottom of the holder where analysis indicated concentrations has increased. This is very different from the reactions observed in the **MW-13** treatment overwhere the lighter gravity material was “lifted’ by the action of the oxidizer.

Emulsification of Coal Tar: Although the ability of the *Cool-Ox*™ Process to emulsify coal tar has been demonstrated elsewhere, the usefulness of this phenomenon was graphically demonstrated by the conversion of large quantities of this material in a confined unit (the holder). By converting the insoluble sticky, viscous mass of coal tar to a material (emulsified coal tar ECT)that is pumpable or extractable using conventional remedial tools, it has been demonstrated that new, very economical methods of site remediation are possible. This is by far the most important finding of this site demonstration.

MW-13 Application and Findings:

The objective of the pilot demonstration in the **MW-13** monitoring well nest, was to determine if the *Cool-Ox*™ Process could improve the efficiency of the extraction wells by increasing the desorption of coal tar contaminants in the Copper Falls Aquifer. This was to be evaluated by the increased volume of contaminants (against time) recovered in the wastewater treatment plant.

The remedial design for the **MW-13** pilot area called for a forty (40) by sixty (60) foot area (2,400 sq. ft.) to be injected with the *Cool-Ox*™ reagent. A vertical injection interval from eighty (80) fbgs in the Copper Falls Aquifer (approximately seven (7) feet below the bottom of the contaminant plume), up to thirty (30) fbgs (where it interfaced with the bottom of the Miller Creek Aquitard), was designed. This interval was chosen to assure that the entire vertical extent of the plume would be contacted by the reagent. The injection points (twenty-seven (27) in all) were then to be grouted with Portland cement from thirty (30) fbgs to the surface to seal the Aquitard. This would prevent cross contamination of the Copper Falls Aquifer with the Filled Ravine. **Figure 1** depicts the areal locations of the pilot demonstration while **Figure 2** shows the cross sectional configuration of the vertical injection zones.

Photo 26 shows the **MW-13** pilot demonstration area prior to treatment in early July 2006. The telephone service near extraction well **E-1** is located to the left of the photo (see arrow).

While the spacing of the injection points was designed on a nine and one-half (9 ½) foot matrix, the discovery of structures and utilities in the injection zone during the actual application, necessitated the redeployment of the injection points such that, they would not impact of these interferences (see **Figure 6**). Note the green dots on the figure depict the location of the designed IPs, while the black numbers connote the location of the actual IPs as they were installed. Although the remedial design called for the injection of 33,633 gallons of reagent equally into the twenty-seven (27) IPs, the combination of utility interference, refusal from debris in the Filled Ravine and the encounters with the rock and hardpan in the Copper Falls Aquifer, rendered it impossible to adhere to the original design. **Table 3** contains a breakdown of each injection point including, the depth, the volume of reagent injected, obstructions encountered, and any reactions noted.

Although the entire volume of reagent was successfully injected, because of refusals encountered in the Copper Falls Aquifer due to the presence of cobbles and apparently hardpan seams, the average injection depth was sixty-three and one-half (63½) feet. **Figure 2** indicates that the depth of the contaminant plume is approximately seventy-three (73) feet. Therefore, if one calculates the vertical injection interval from thirty (30) to sixty-three and one-half (63½) feet, approximately seventy-eight percent (78%) of the volume of the plume in the treatment area was addressed.

Winter arrived prior to the start of work in the **MW-13** pilot area. **Photo 27** above depicts the area after the exclusion zone has been established. The red decontamination trailer is visible in the background.

At the onset of the injection work, it was noted that although the remedial design called for injection from the bottom of the Copper Falls Aquifer up to the Miller Creek Aquitard (a bottom up method), it was thought to be prudent to place the first injection point using a top down method. This change was incorporated with the consent of the EPA SITE team to assure that any reaction gases evolved from the reaction of the reagent with the contaminant would be vented to the shallow extraction well **E-1**. **IP-1** reached the entire eighty (80) foot vertical interval. Approximately three-hundred (300) gallons of the 1,200 gallons design for the injection point was placed in the top down injection method. The remaining nine-hundred (900) gallons were to be injected using the bottom up protocol. However, the pressure activated injection tip plugged and the rods had to be extracted and the injection tip freed. Upon extraction, it was discovered that the bottom fifteen (15) feet of tooling including the injection tip was lost. The rods were fixed with an expendable point and again driven into the **IP-1** injection port. However, refusal was encountered at the sixty-five (65) foot level. It was believed that the replacement rods might have contacted the fifteen (15) feet of rods lost in the prior activity. It is important to note at this point, that the depth to groundwater in **E-1** was of approximately nineteen (19) to twenty (20) fbgs. It was determined during the probing process that the bottom of the Filled Ravine in the **MW-13** pilot area was approximately fifteen (15) fbgs. Therefore, no upwelling of groundwater from the Copper Falls Aquifer was expected. During the entire application process, interference or refusal from contact with cobbles in the Copper Falls Aquifer was encountered at every injection point.

No reactions in **E-1** or any of the **MW-13** monitoring wells were observed during the injection of **IP-1**. However, a volunteer breakout was noted near the telephone service approximately ten (10) feet east of the injection point. Injection was halted and the expelled material contained and containerized for disposal. The breakout was plugged with bentonite and an additional two-hundred (200) gallons of reagent injected. **IP-1** was completed and grouted. **IP-2** was placed approximately three (3) feet north of **E-1**. After injecting approximately six-hundred (600) gallons, thick reaction foam again broke out by the telephone service. **IP-2** to was abandoned with the intention of moving to the south end of the treatment area. However, when the probe rods were withdrawn from **IP-2**, it was observed that Groundwater had risen to the top of casing in extraction well **E-3**.

Extraction well **E-3** is located approximately forty (40) feet across the treatment area to the south. This was an event that the TEAM had hoped to observe at extraction well **E-1**. Investigation of **Figure 2** will reveal a considerable upward gradient at the bottom of the Miller Creek Aquitard between extraction wells **E-1** and **E-3**. Reaction gases generated from the injection activities near **E-1** had evidently migrated upward to extraction well **E-3**. This type of communication within the Copper Falls Aquifer was very welcome. It demonstrated that reaction gases could be used to desorbed and lift contaminants in the deep strata.

Photo 28 above shows the green shelter housing the "*Deep-Shot Rig.*" *Cool-Ox*™ reagents are secured in the truck at right. This vehicle is locked at night, as a safety feature, to prohibit vandalism or access by only the curious. The crew can be seen readying the Geoprobe® and the Skid Steer for the days work.

When treating heavily contaminated service station sites, once a breakout occurs it is typical that most other injection points will communicate with the breakout point. It has been discovered that the process typically follows the contaminated strata (smear zone) where reaction gases create a migration path for the reagent. It has been demonstrated that if the application is applied in a doughnut pattern with concentric points being placed ever further way from the breakout point, a transmissive condition is set up in the subsurface and the distribution of the reagent is improved. With this in mind, the third injection point was placed near extraction well **E-3**.

It should be noted that extraction wells **E-1** and **E-3** were screened such that, the top of the screened intervals was near the bottom of the Miller Creek Aquitard. Because of the reaction gases, generated when the reagent contacts the contaminant, the process tends to lift contaminants. Because the Copper Falls Aquifer is composed of gravelly soils, it was believed that the upward direction of the process assisted by the artesian affect of the aquifer should lift any desorbed contaminants upward toward the extraction wells so that the freed contaminant could be captured by the extraction pumps.

As the injection work was implemented in the area of the **E-3** well, it was noted that the rolling action of the reaction gasses expelled oily debris from the well casing. pH readings were collected when the groundwater had reached the top of the casing and it was noted that these readings were acidic near pH 5.5 to six (6). This would indicate that the reagent had not yet reached the top of the casing. As the groundwater continued to be expelled from the **E-3** casing, the pH slowly increased to eight (8) and the color of the groundwater turned to a milky dark tan. This indicated that the *Cool-Ox*™ reagent had reached the well and that surfactants were being formed from the contaminants. This phenomenon aids in the desorption of contaminants from the soil.

The maintenance building sheltered the work in the **MW-15** pilot area from the fierce north winds off Lake Superior. However, the **MW-13** area was directly exposed to the numbing cold. The blue tarps shown in **Photo 29** above provided relief from the wind as well as privacy for the injection work.

The mechanism of surfactants aiding in the dissolution of hydrophobic materials and in the formation of aqueous emulsions is well understood and will not be discussed further in this section of the report. Rather, the question here is; does the *Cool-Ox*™ Process oxidize hydrocarbon contaminants to produce surfactants from these types of pollutants? If the process can produce wetting agents (surfactants), it will contribute significantly to the efficiency of the pump and treat system in place at this site.

Unlike the phenomenon occurring in the **MW-15** holder (where free product is being desorbed from the soil and agglomerated at the bottom of the holder), the contaminants present in the Copper Falls Aquifer appeared to be much more dilute and of

a lighter specific gravity. This would be normal, considering the high concentrations of benzene in the contaminant mix (benzene will act as a solvent in coal tar hydrophobes in the same manner that gasoline acts as a diluent in oil, this lowers the viscosity and the specific gravity of the resultant solution).

The torpedo heater in **Photo 30** above helps keep pump lines thawed and personnel to cope with the cold as they work in the vault at extraction well **E-1**.

The oxidation affect on these compounds (that are important to this pilot demonstration) can cause the physical characteristics to manifest themselves as a moiety in an aqueous media in at least three ways. These are as:

1. wholly dissolved hydroxylated (surfactants) molecules that are present as individual entities suspended in the water;

2. micells, minute particles of unreacted contaminants held together by the action of produced surfactants (micells give a milky appearance to the groundwater) and;

3. globules of product much larger than micells that are suspended in the groundwater because of their low (or near water) specific gravity.

Prior to treatment of the Copper Falls Aquifer, all contaminants extracted by the wastewater treatment system were in the form of globules. Therefore, the pilot demonstration evaluation criteria was based upon the increase in coal tar (in the form of globules) that could be separated and measured in the water treatment facility. Unfortunately, no protocol was developed to measure the presence of dissolved contaminants or micells which would pass through the skimmer tank undetected. The volume of these undetected contaminants could easily be much greater than those collected as free product. Because of this phenomenon, the condition of the skimmer tank in the water treatment plant was checked periodically for variations in pH and the appearance of the water as well as the contaminant.

Because no reactions were observed in extraction well **E-1** during injections in that area, it believed that the well screen may be occluded to the passage of all but, small volumes of water. Because of the low pump rate of the extraction pump, this fact

would not have been detected under normal operating conditions. Because the top of the well screen in **E-2** was least twenty (20) feet below the bottom of the Miller Creek Aquitard and since the reaction gas had caused the groundwater level in **E-3** to elevate to the top of the well casing, it was concluded that the majority of the groundwater affected by the process, would be collected from extraction well **E-3**. Therefore, when the reactions in **E-3** were observed, the pH of the water as well as visual observations of the water conditions in the water treatment plant separator were conducted. As the pH of the groundwater in **E-3** rose to eight (the optimum for the process) and the milky appearance (indicative of contaminant presence) was noted, the TEAM was alarmed that no similar changes were observed in the skimmer. This gave rise to the question of whether the **E-3** well was operable. Isolation of the well by service personnel indicated that it was not. Injection work was halted and the well pulled for inspection.

Photo 31 depicts the interior of the green shelter, employed to protect the *Deep-Shot Rig*™ from the freezing conditions outside. Propane heaters kept pumps and hoses from freezing. The ramp to truck storing the Cool-Ox™ reagents can be see at the left of the photo.

Investigation indicated that the pump mechanism in the well had been lost. A new pump was installed, tested, and when satisfactorily operating, the injection work was resumed. Shortly after the new pump was installed in **E-3**, the appearance of the groundwater in the separator became milky, the pH rose to eight (8), and the appearance of the contaminant on the surface of the water had changed from a smooth oily shine to a mottled, dull form similar to that of the contaminant material seen in the photos of the **E-3** vault.

Because the primary interest in the groundwater in the **MW-13** pilot area, was in contaminant mass extracted rather than analysis of contaminant species, no groundwater samples were collected for chemical analysis. Therefore, the effect of the technology on oxidation of individual chemical species was not investigated. This was a very unfortunate circumstance because such analysis might shed light on the effect of the application on oxidation of BTEX and PAH concentrations. Samples were however, collected by the TEAM to determine surface tension. As in similar MGP applications, it was found that the surface tension of groundwater collected from extraction well **E-3** had

Photo 32 above depicts only a few of the confrontations between the injection probes and the rocks in the Copper Falls Aquifer. The item in the middle is a new, undamaged expendable point. This provides a driving tip for the probe rods. When the probe reaches the desired depth, it is withdrawn two (2) to six (6) inches and the point pushed out by the pressure of the reagent. This initiates the injection process. Expendable points are used when the injection protocol calls for injections to start at the bottom of the vertical injection interval (VII) and distributes the reagent to the top as the probe is withdrawn. This is referred to as bottom-up (BU) delivery. The two items on each end are solid drive points that provide a drive point for retrievable tooling such as the Pressure Activated Valve (PAV), employed when the reagent is distributed from the top of the VI downward. This is called top-down (TD) delivery. All four (4) of the used point exhibit evidence of striking rocks.

dropped from approximately seventy (70) to thirty-five (35) dynes/cm. This would indicate that during the application, surfactants were produced and the ability of the groundwater to carry and transport dissolve phase contaminants was greatly enhanced. It should be noted, that although it has been demonstrated that surfactants are produced from organic compounds, including coal tar constituents, only relative terms rather than precise quantities or concentrations have been used (in this report) to attempt to describe the quantity or load of contaminants that can be transported by a given volume of water. This is because prior to the implementation of the site work, no methodology was developed or had been adopted, for the project to measure the precise contaminant or surfactant concentrations in terms of weight per unit volume (i.e., grams/Liter). Instead, the change in surface tension was employed to determine if surfactants were being produced.

A point should be made about the quality or type of surfactants produce by the *Cool-O*x™ oxidation reaction. The term surfactant is an acronym for the phrase "surface acting agent." The term is also used interchangeably in the chemical industry, with the phrase "wetting agent." For the purposes of this report, this group of molecules are generally composed of an organic hydrocarbon (hydrophobic) molecule with a hydroxyl (hydrophilic) group added by the oxidation reaction. In their primary state, these molecules align themselves between groundwater (hydrophilic) and the coal tar

(hydrophobic) contaminant thus, "breaking up" the coal tar mass and allowing groundwater to transport significant quantities of the unreacted coal tar.

During the injection work, a breakout occurred outside the casing in the **E-3** vault. The appearance of this effluent was substantially different than the contaminant material expelled from inside the casing. Instead of the much darker frothy ECT, the material from outside the casing appeared as a thick brown foam. This was collected and containerized in drums. Photos of the material in the vaults as well as in drums are included in this report. This effluent closely resembled the foam ejected from the breakout point near the telephone service near **E-1**. It should be noted that as the material was collected by the vacuum equipment and containerized, the oxidation reactions continued to proceed. When the effluent was collected from the **E-3** vault, a large void was discovered containing wooden debris and ash. It was assumed that this material was part of the fill in the Filled Ravine. Approximately one and one half (1½) cubic yards of sand was required to fill the void. This event prompted the TEAM to review the coal tar extraction options that it had evaluated prior to implementing the injection work in the **MW-13** pilot demonstration area.

Photo 33 above shows a close-up of an expendable point on the right that has been driven into the point holder with such force that the two parts appear to be welded together. This point was retrieved from **IP-7** near extraction well **E-2**. It can be seen that the point was "peened" on all sides by striking rock. Pump pressure applied at 1,200 psi could not dislodge the point. Prior to the initiation of the injection work, it was believed that the hard clay structure of the Miller Creek Aquitard would provide the greatest test for the driller. It turned out that the cobbles in the Copper Falls Aquifer provided the real challenge. Refusal proved to be so severe that the average depth of penetration was 63.5 feet.

As the injection work proceeded in the south part of the treatment area, approximately 6,000 gallons of reagent had been injected with no observations in any of the wells or any breakout point. However, while injecting at **IP-18,** breakout occurred near the foundation at the north side of the maintenance building. Photographs of this event are included in the report. This breakout was approximately eighty (80) feet from the injection point. The effluent was quickly collected and containerized and the area

Photo 34 above depicts the volunteer breakout (see orange arrow) near the telephone service (see yellow arrow) where the contaminant reacting with the *Cool-Ox*™ reagent was expelled to the surface through a previous sampling point. This occurred during injection in **IP-1** near extraction well **E-1**. Note, the reaction was contained using the cut drum method that proved successful during the injection work in the **MW-15** pilot area.

washed down with clean water. The clean up water was also containerized for proper disposal. During the cleanup work it was noted that the foundation had apparently settled in the area of the breakout. The sidewalk had also settled at the side near the building and separation of the bricks in the wall had previously been tuck-pointed. Noting that a similar settling of the soil in the **MW-15** pilot area had occurred over that holder prior to the pilot demonstration project, the question arose, could the large holder shown on the Sanborn Maps as being located in this area, be present? If so, like the **MW-15** holder, it could contain large quantities of coal tar which could continue to be an on-going contaminant source.

The question of artifacts from the old MGP operation remaining in place, was raised by other events that occurred during the injection operation. While injecting at **IP-10**, a clear liquid with a specific gravity lighter than water, was reflected to the surface during the grouting operation. The material had the odor and appearance of diesel fuel or kerosene. The TEAM believes its source is the old naphtha tank, shown on the Sanborn Maps as being located in that area. This event, coupled with the observations made during the entire **MW-13** injection program, gives rise to the supposition that, in the immediate area of the old MGP operations, the Miller Creek Aquitard may not be as impermeable as previously believed. How did the deep aquifer get contaminated?

A critical point concerning the integrity of the Aquitard is based on the premise, that all studies and data collected at the site prior to the *Cool-Ox*™ application, were based upon the supposition that (with the exception of the artesian affect of the Copper Falls Aquifer), the pressures exerted by the surface water or shallow groundwater in the Filled Ravine; were downward. The generation of reaction gases from the Technology, would reverse the direction of the pressure gradient so that the pressure would be upward from the injections in the Copper Falls Aquifer. It should also be noted that gases are more intrusive at negotiating strata than liquids particularly, viscous liquids such as those

produced by MGP operations. Because of it's weight and settling properties, the TEAM selected Portland cement rather than bentonite as a grouting material. Although the possibility exists that some of the injection points may have been compromised, the volume of reagent and groundwater reflected up into the Filled Ravine would indicate other pathways to be present also.

Photo 35 shows the drum vacuum employed to capture reacted contaminants and reagents that were expelled to the surface during the application process. Extraction well **E-1** can be seen in the background (see arrow).

To access the area under St. Claire Street, it was necessary to probe at an angle. This method was employed because the city preferred not to have the street breached. The angle probing did not present a problem and delivery of the reagent was accomplished. During the injection process contaminated groundwater and reagent was reflected to the surface through monitoring well **MW-13**. This was an important event from several perspectives. Most importantly, the initial expulsion of effluent contained very high concentrations of emulsified coal tar. This material had no doubt, collected in the well screen around the PVC casing of the well itself. The contaminant was aspirated from the well and contained for disposal. However, during the expulsion of the contaminant, globules could be seen breaking the surface and then very rapidly dissipating in a manner indicative of the effect of surfactants breaking up oily compounds. Again, this was an excellent example of coal tar emulsification. A video addendum has been included in this report as a CD to provide a graphic example of the points that have been discussed regarding emulsification activities in the **MW-15** holder and injection area as well as the events that unfolded during the treatment of the **MW-13** pilot demonstration area.

The objective of the demonstration project in the **MW-13** area was to assess the potential of the technology to increase the efficiency of the extraction wells. Therefore, as was the case with the work in the **MW-15** area, comments on this aspect of the work could not be presented until sufficient time had elapsed for the data to be gathered and a rationale developed.

At the time of the April sampling event, it was reported that the production of coal tar from the extraction wells had been increased by six (6) fold over the average historical production prior to treatment. Although this was very welcome news, it did not tell the

whole story based upon observations made during the injection work. Of primary importance, is the fact that no provision was made to measure the volume of soluble or emulsified contaminants that were produced coincidental with the measurable free product globules. Therefore, a significant volume of ECT was no doubt extracted but, passed through the system undetected. It is paramount that a field testing methodology be developed or adopted to close this loop. It was graphically pointed out that groundwater samples collected and transported to an analytical laboratory unfortunately, do not "keep" in transit. Thus, they are not representative of the aliquot at the time of collection. Therefore, field testing is necessary to develop data representative of actual real time conditions.

Photo 36 reveals the communication between **IP-2** (near **E-1**) and extraction well **E-3** across the site. The force of the reaction gasses raised the water level in **E-3** from the Copper Falls Aquifer to above the well casing into the vault. An industrial vacuum is used to aspirate the groundwater and contain it in a tank. The bubbling from the well casing can be seen in the top center of the photo (see orange arrow). Coal tar can be seen floating on the surface (see yellow arrow). At this time, the pH of the groundwater was still at ~6. However, with in one hour of the expulsion, the pH had risen to ~7. Communication from **E-1** across the site to **E-3** demonstrated that conditions in the Copper Falls Aquifer were conducive to contaminant extraction.

Overall, application work in the **MW-13** area provided several challenges. Freezing weather required the protection of all machines and hoses to avoid damage from the cold. Debris in the Filled Ravine and the unexpected high concentration of cobbles in the Copper Falls Aquifer, were responsible for an extraordinary number of refusals. Though expulsion of oxidation reagents were greater than expected, the TEAM did a very good job of containing the problems and preventing off-site releases to the environment.

MW-13 Summary:

The objective of the pilot demonstration located in the **MW-13** monitoring well nest was to determine if the *Cool-Ox*™ Process could improve the efficiency of the current pump and treat system to extract coal tar artifacts from the Copper Falls Aquifer.

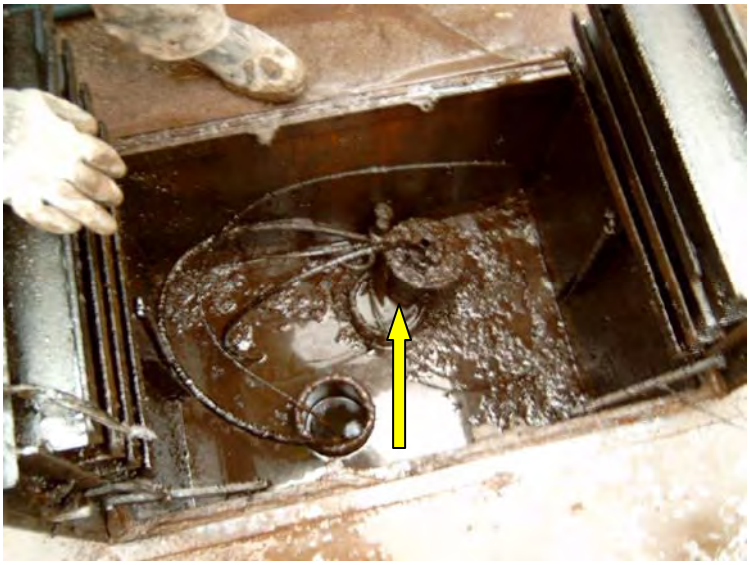


Photo 37 reveals that the color of the groundwater in extraction well **E-3** is changing from a semi-clear appearance to a dark tan, translucent liquid interspersed with globules of coal tar. Note the groundwater has been raised to the top of the casing (see arrow) and the pH is now approximately 7.5.

To implement this demonstration program, the Quality Assurance Project Plan (QAPP) and Scope of Work (SOW) called for the placement of twenty-seven (27) injection points (IPs) on a nine and one-half (9½) foot matrix within a forty (40) by sixth (60) foot (2,400 square feet), pilot demonstration area. The designed included, injecting 33,633 gallons of *Cool-Ox*™ reagent over a vertical injection interval from eighty (80) to thirty (30) feet below ground surface (fbgs), then grouting the IP to the surface with Portland cement. A total of 34,450 gallons was injected.

Because of interferences from utilities, building placements and the decision not to breach St. Claire Street with IPs, the injection matrix was abandoned in favor of strategically placing the IPs where they would, in the opinion of the TEAM, accomplish the stated objective. Because of the unanticipated concentration of cobbles in the Copper Falls Aquifer, only one IP (**IP-1**) reached the design depth of eighty (80) feet. The average depth, accounting for refusals, was sixty-three and one-half (63½) feet; approximately ten (10) feet above the bottom of the contaminant mass (see **Figure 2**). In spite of this problem, the TEAM was able to treat approximately seventy-eight percent (78%) of the targeted volume of contaminated soil (groundwater).

In spite of several breakouts occurring during the site work, all reagents and accompanying contaminants were contained with no off-site releases to the environment. However, there was evidence that the presumed integrity of the Miller Creek Aquitard may be in question. Because of the location and pattern of the breakout near the north side of the maintenance building coupled with the information developed with the discovery of a holder in the **MW-15** pilot area, there is speculation that the large holder shown under the maintenance building on the Sanborn Map, may in

fact, be in place. The settling of the sidewalk and the building wall prior to the pilot demonstration, would support this supposition.

Communication between **IP-2**, in the area of extraction well **E-1**, and extraction well **E-3**, provided evidence that communication and penetration of reagent throughout the Copper Falls Aquifer was apparent. This was major finding, lending credibility to the premise that the Aquifer could be treated with the Technology. The observations that a significant mass of contaminants was expelled to the top of the casing in extraction well **E-3**, and the emulsification of the coal tar contaminants, suggests that successful treatment of the Aquifer employing the *Cool-Ox*™ Process is quite possible.

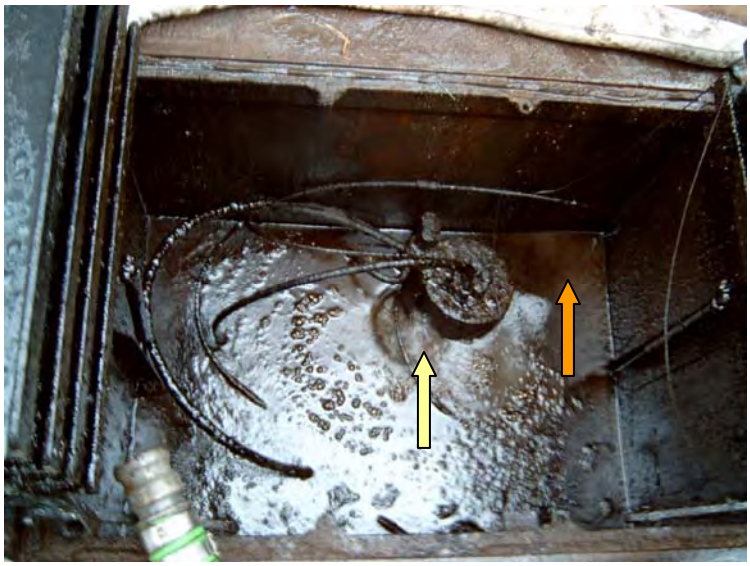


Photo 38 The pH of the groundwater in well vault **E-3** has reached 8, the optimum for the oxidation reaction of the *Cool-Ox*™ process to proceed. The color of the water is now a milky tan (see orange arrow) indicating the presence of emulsified coal tar (ECT). Note the coal tar has broken up to finer globules and foam (see yellow arrow) is now being generated from inside the well casing. The amount of ECT expelled from the well is increasing.

One significant factor, not investigated during the pilot demonstration, was the lack of an attempt to apply remediation scale vacuum to the extraction wells. Instead, the Technology was depended upon to transport contaminants to the extraction wells (employing the Technology's physiochemical phenomenon) and the in-place extraction system to extract the treated moiety. Because of the differences in the larger capacity of the injection system to deliver reagents and the limited capacity of the current pump and treat system to extract the reacted contaminants, a significant dynamic imbalance existed. Although not a component of the demonstration, it is the conclusion of the TEAM that if a vacuum system were employed to pull contaminated groundwater from the Aquifer in balance with the injection rates, an efficient cost effective remedial system could be implemented. The TEAM has given considerable consideration to design parameters of such systems, both for the remediation of the deep Aquifer as well as mitigation of holders and the filled Ravine.

The TEAM was gratified to learn that, subsequent to treatment, the productivity of the extraction of coal tar, by the current system, had increased by a factor of six (6). While this is certainly significant and very welcome news, the quantitative determination

As the groundwater level in **E-3** casing drops, **Photo 39** reveals the ECT left in the vault. Note the foam (see arrow) generated as the oxidation reaction proceeds.

of the mass of soluble or emulsified contaminant extracted, although believed to be considerable, is unknown and graphically points up the need to develop and employ field analytical methods of accountability. Similarly, since no baseline samples were collected to ascertain the chemical species distribution or concentrations in the groundwater, the effect of the application on the hydroxylation of target pollutants in that media is undetermined. However, if the effect at this site is consistent with the destruction of BTEX and PAHs under similar conditions at other sites, the reduction can be quite significant. This factor would also contribute to the remediation of the Aquifer without the oxidized faction being extracted.

During the application process at the **MW-13** area, the question was asked by Mr. Winslow if "the TEAM believes that the site was in better shape after the injections than before?" The TEAM believes that the site is in better shape and that the knowledge gained will allow remediation to go forward with far greater cost savings than predicted.

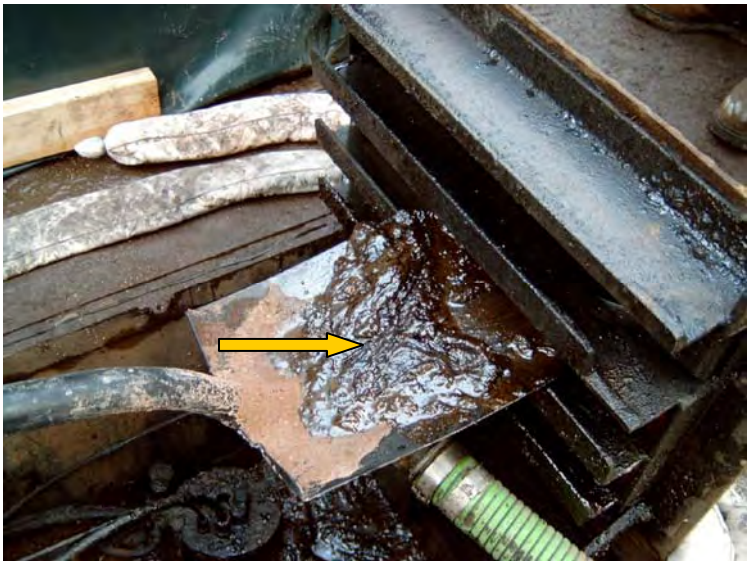


Photo 40 reveals the ECT grease-like material (see arrow) that was expelled from **E-3** by the reaction occurring in the Copper Falls Aquifer. As the globules of ETC were ejected into the vault, they settled to the bottom and congealed into the gelatinous material shown on the shovel. The material was containerized for disposal.

Photo 41 above shows the collector (see arrow) in the water treatment plant that is employed to separate the coal tar from the groundwater pumped here from the four extraction wells installed in the Copper Falls Aquifer. Although significant reactions were occurring in extraction well **E-3,** the expected changes in the appearance and chemical characteristics of the water in the collector, either in color or the pH, did not occur. Upon investigation, it was determined that the extraction pump in **E-3** was faulty. This discovery was critical to the project since fluctuations in the amount of coal tar captured in the collector was one of the parameters designed to measure the success or failure of the pilot demonstration.

Figure 1

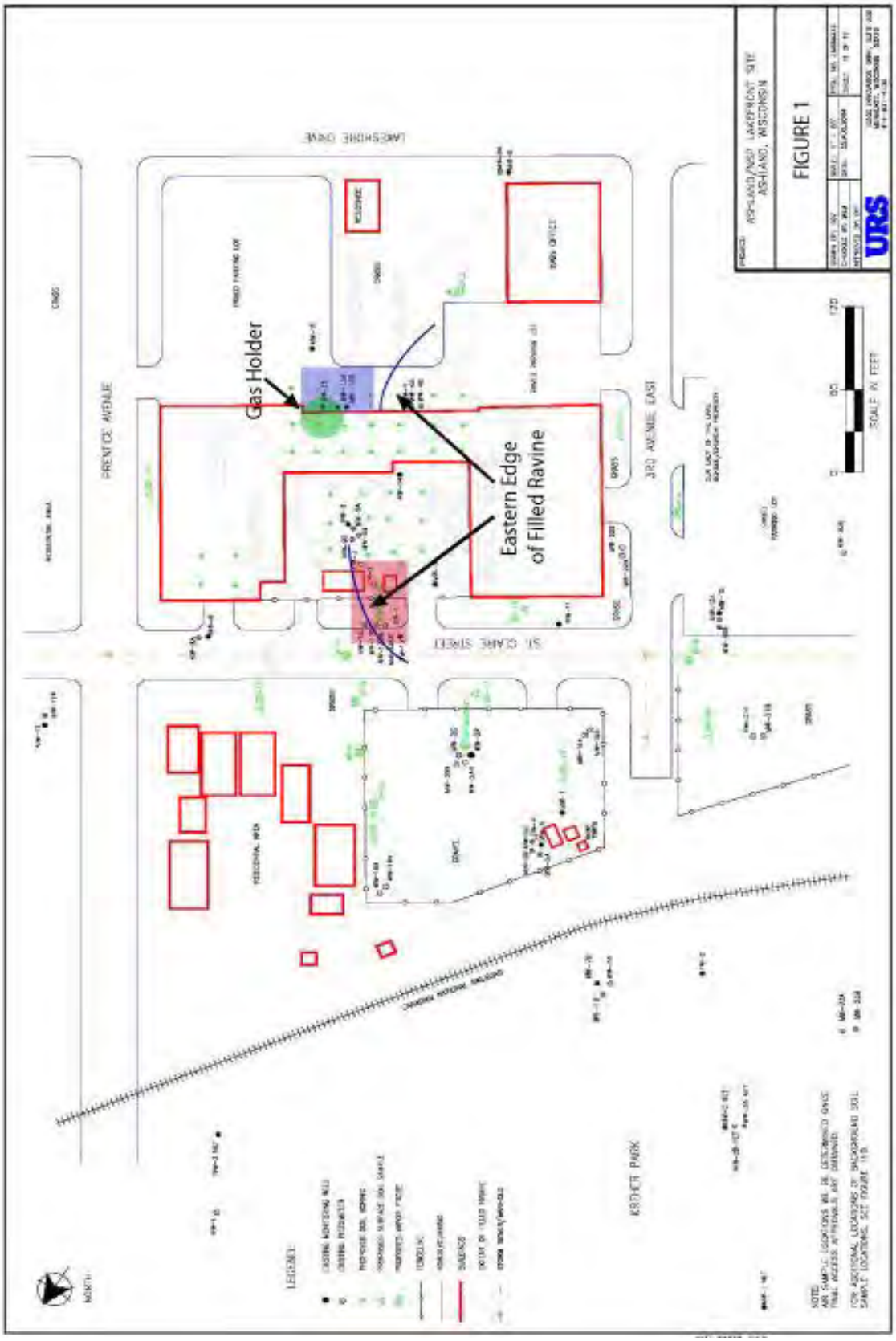

Gas Holder
Eastern Edge
of Filled Ravine
PRENTICE AVENUE
3RD AVENUE EAST
ST. CLAIRE STREET
LAKESHORE DRIVE
ASHLAND/ASP LANDFILL SITE
ASHLAND, WISCONSIN
FIGURE 1
URS
SCALE IN FEET
NORTH
LEGEND
NOTE:
ROBERT PARK

Figure 2

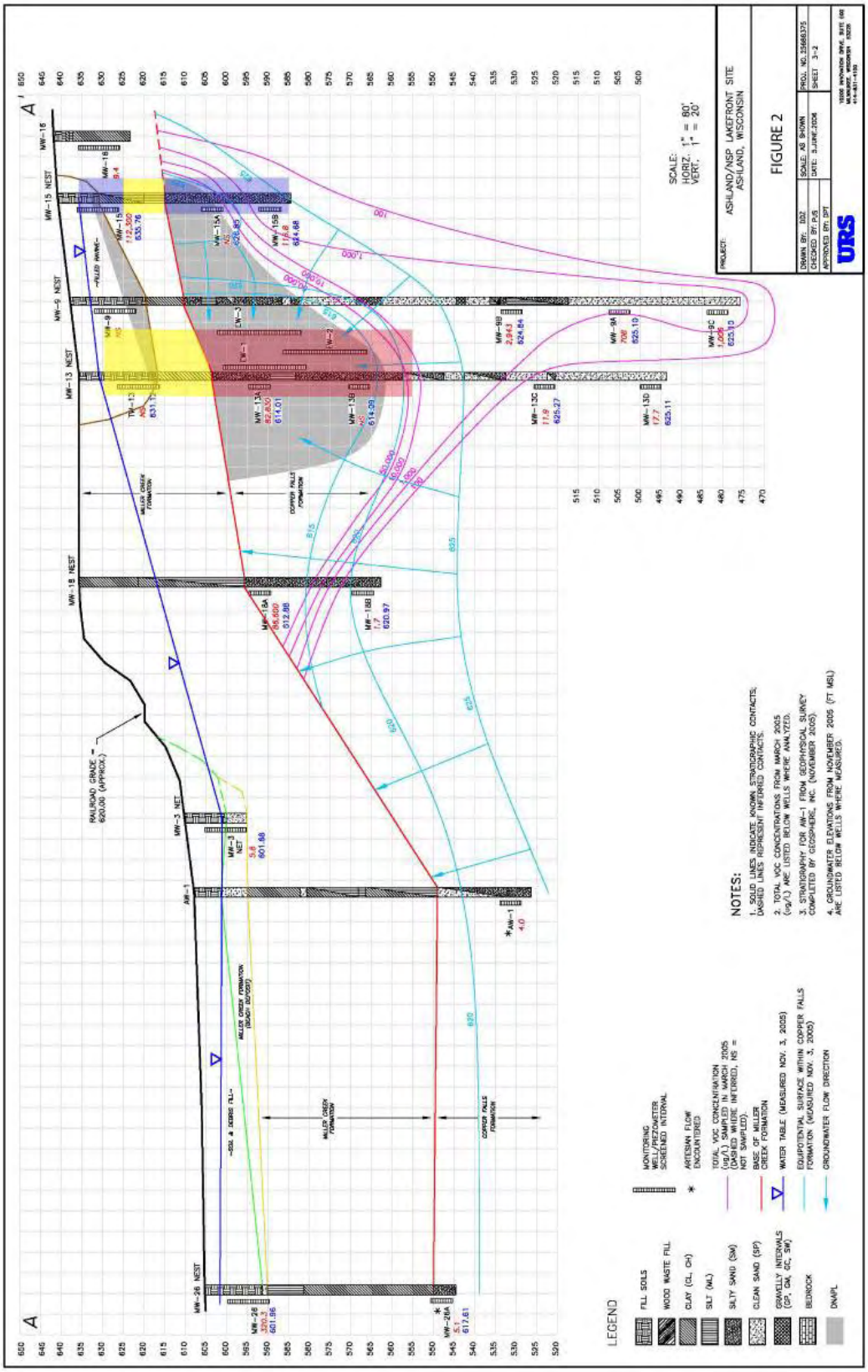

A
A'
MW-26 NEST
MW-3 NEST
MW-18 NEST
MW-13 NEST
MW-9 NEST
MW-15 NEST
MW-16
RAILROAD GRADE ~ 620.00 (APPROX.)
MILLER CREEK FORMATION
COPPER FALLS FORMATION
LEGEND
FILL SOILS
WOOD WASTE FILL
CLAY (CL, CH)
SILT (ML)
SILTY SAND (SM)
CLEAN SAND (SP)
GRAVELLY INTERVALS (GP, GM, GC, SW)
BEDROCK
DNAPL
MONITORING WELL (WITH SCREEN INTERVAL)
ARTESIAN FLOW ENCOUNTERED
TOTAL VOC CONCENTRATION (ug/L) SAMPLED MARCH 2005 (DASHED WHERE INFERRED, NS = NOT SAMPLED).
BASE OF MILLER CREEK FORMATION
WATER TABLE (MEASURED NOV. 3, 2005)
EQUIPOTENTIAL SURFACE WITHIN COPPER FALLS FORMATION (MEASURED NOV. 3, 2005)
GROUNDWATER FLOW DIRECTION
NOTES:
1. SOLID LINES INDICATE KNOWN STRATIGRAPHIC CONTACTS; DASHED LINES REPRESENT INFERRED CONTACTS.
2. TOTAL VOC CONCENTRATIONS FROM MARCH 2005 (ug/L) ARE LISTED BELOW WELLS WHERE ANALYZED.
3. STRATIGRAPHY FOR MW-1 FROM GEOPHYSICAL SURVEY COMPLETED BY GEOSPHERE, INC. (NOVEMBER 2005).
4. GROUNDWATER ELEVATIONS FROM NOVEMBER 2005 (FT MSL) ARE LISTED BELOW WELLS WHERE MEASURED.
SCALE: HORIZ. 1" = 80' VERT. 1" = 20'
PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN
FIGURE 2
DRAWN BY: DDZ
CHECKED BY: PJS
APPROVED BY: DPT
SCALE: AS SHOWN
DATE: 3-JUNE-2006
PROJ. NO. 25868375
SHEET 3-2
URS

Figure 3

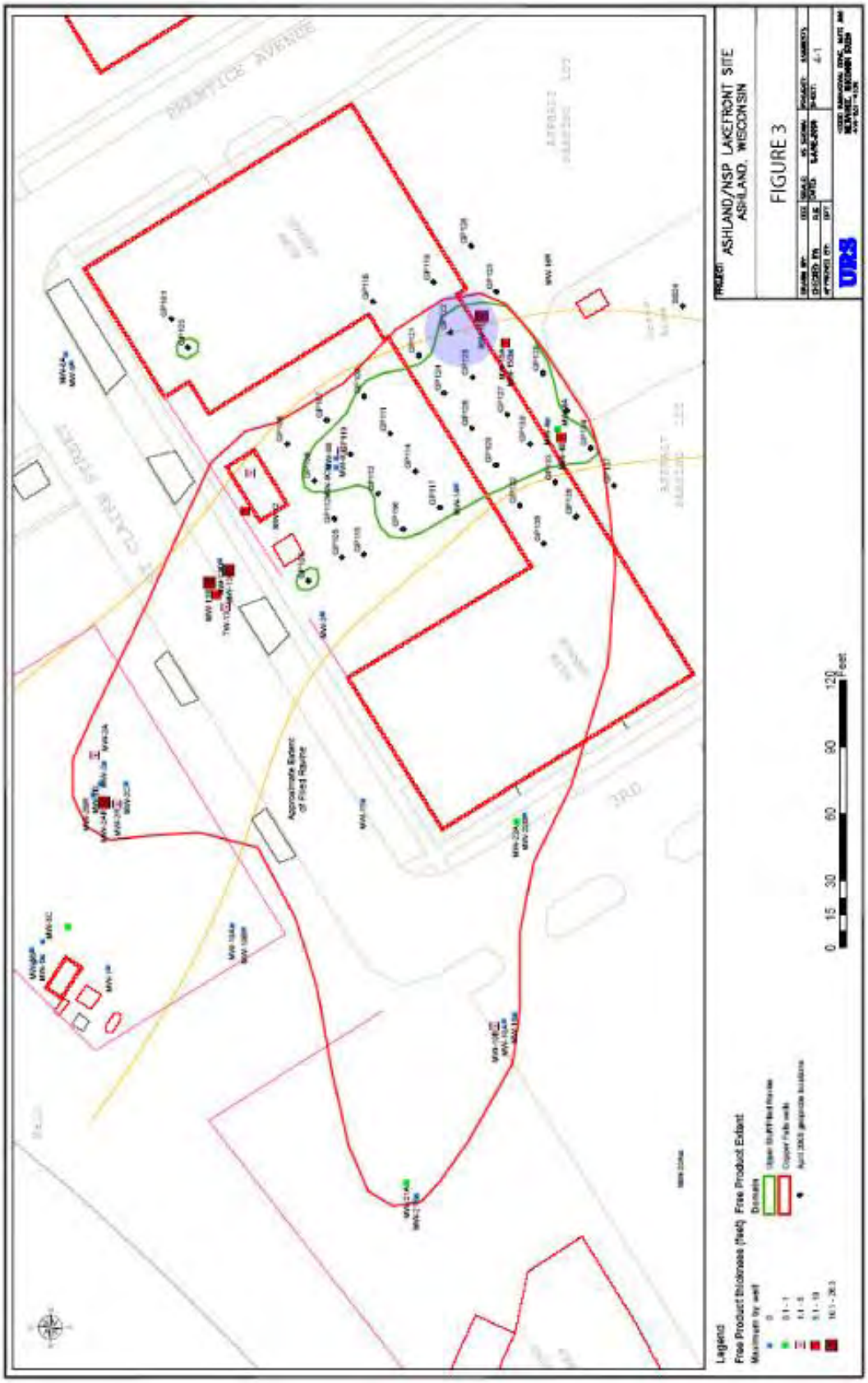

ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN
FIGURE 3
Legend
Free Product Thickness (feet)
Free Product Extent
Approximate Extent of Fixed Plume
0 15 30 60 90 120 Feet

Figure 4

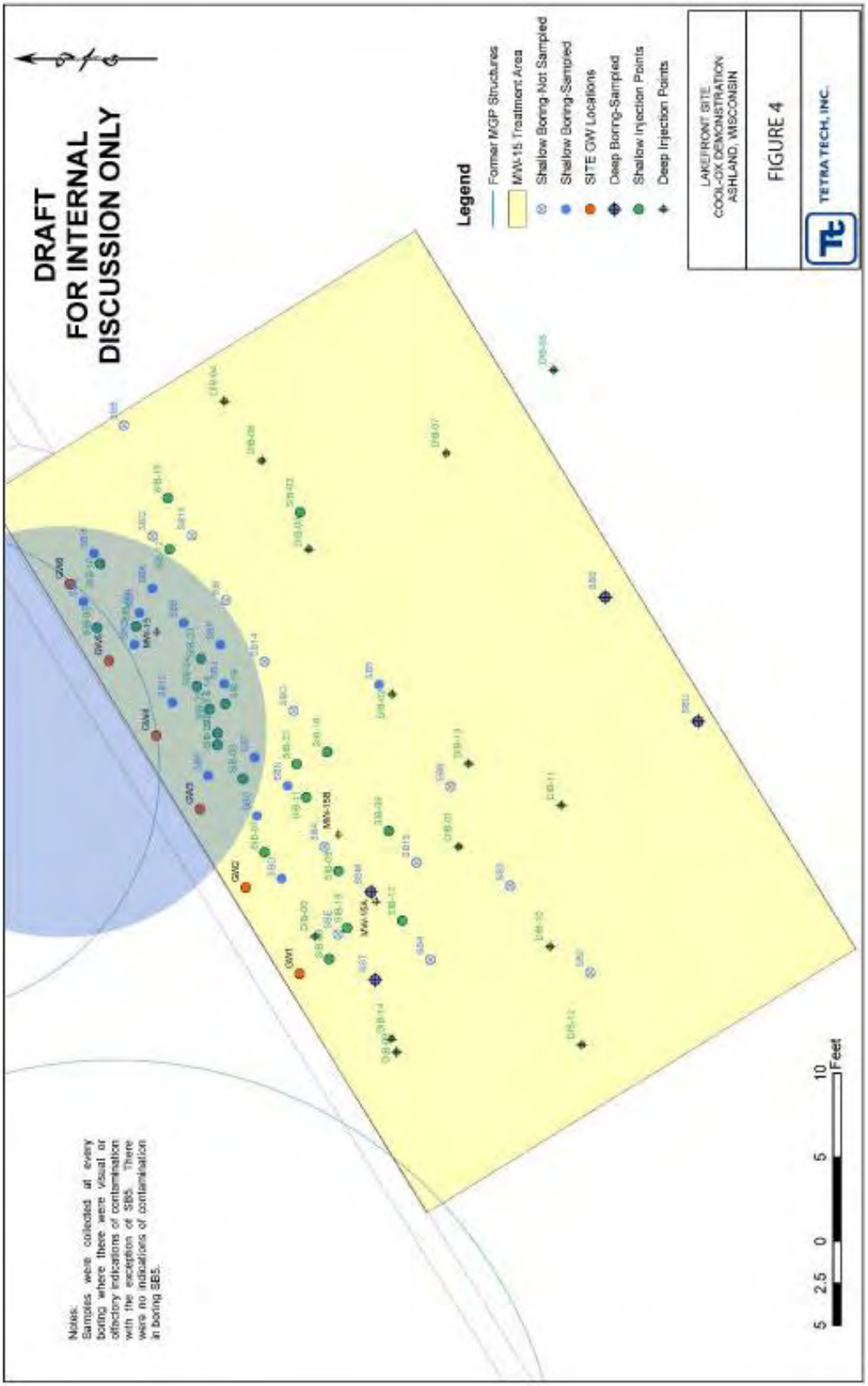

DRAFT
FOR INTERNAL
DISCUSSION ONLY
Legend
Former MGP Structures
MW-15 Treatment Area
Shallow Boring-Not Sampled
Shallow Boring-Sampled
SITE GW Locations
Deep Boring-Sampled
Shallow Injection Points
Deep Injection Points
LAKEFRONT SITE
COOL-OX DEMONSTRATION
ASHLAND, WISCONSIN
FIGURE 4
TETRA TECH, INC.
Notes:
Samples were collected at every boring where there were visual or olfactory indications of contamination with the exception of SB5. There were no indications of contamination in boring SB5.
5 2.5 0 5 10
Feet

Figure 5

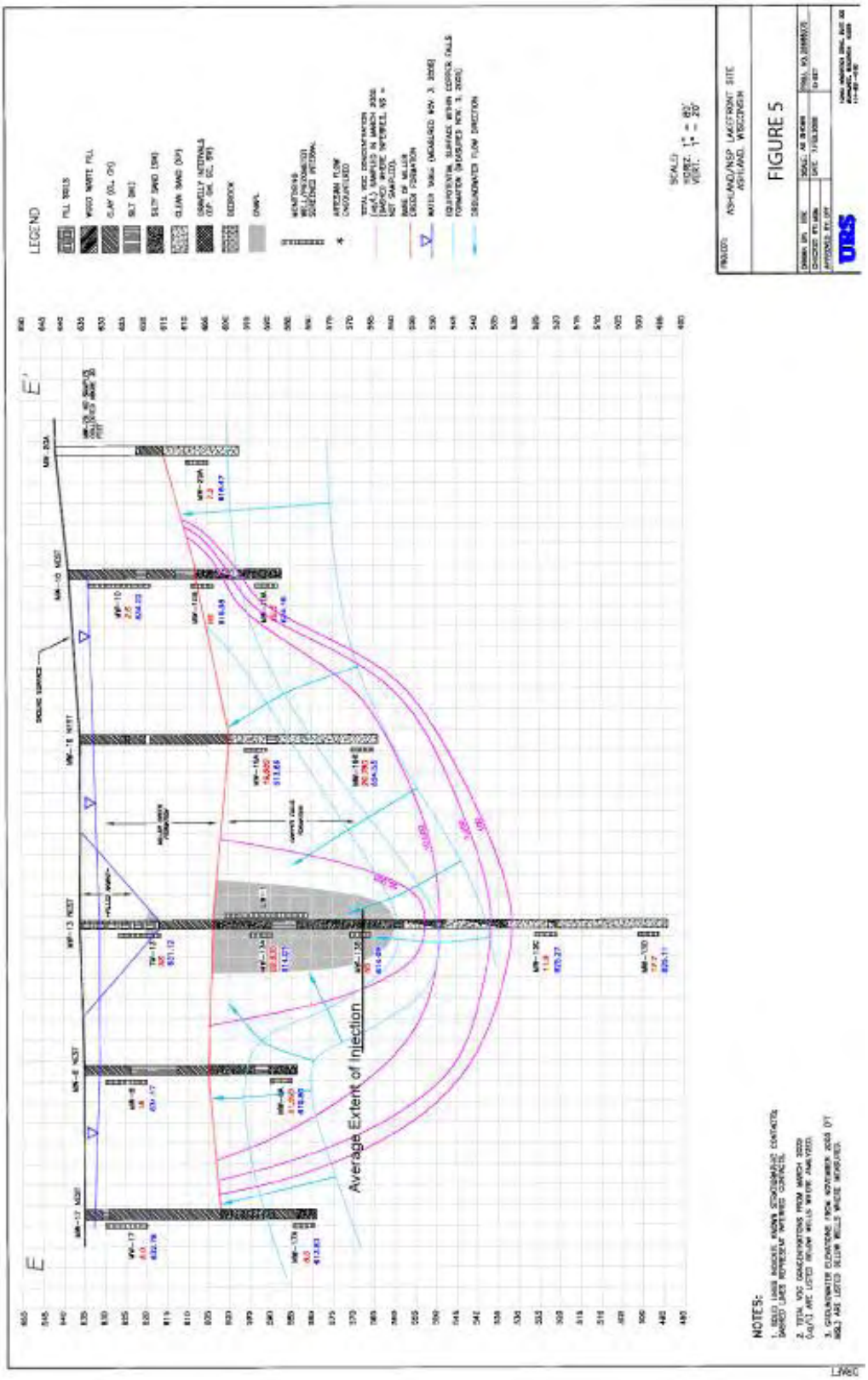

LEGEND
FILL SOILS
WOOD WASTE FILL
CLAY (CL, CH)
SILT (ML)
SILTY SAND (SM)
CLEAN SAND (SP)
GRAVELLY MATERIALS (GP, GM, GC, GW)
BEDROCK
CHAPL
MONITORING WELL (SCREENED) SCREENED INTERVAL
ARTESIAN FLOW (NOT MEASURED)
TOTAL VOC CONCENTRATION (ug/L) SAMPLED IN MARCH 2020 (MISSED WHERE INTERVAL, NS = NOT SAMPLED)
BASE OF WELLS (BEDROCK FORMATION)
WATER TABLE (MEASURED MAY 3, 2020)
ESTIMATED WATER SURFACE BETWEEN COPPER FALLS FORMATION (MEASURED NOV. 3, 2020)
DISCHARGING FLOW DIRECTION
SCALE:
HORIZ. 1" = 40'
VERT. 1" = 20'
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN
FIGURE 5
DRAWN BY: DSC
CHECKED BY: MRA
APPROVED BY: JPF
SCALE: AS SHOWN
DATE: 7/15/2020
DRAWING NO. 20446570
DRAFT
URS
Average Extent of Injection
NOTES:
1. FIELD DATA INCLUDE KNOWN STRATIGRAPHIC CONTACTS BASED LARGE REPRESENT INTERVAL CONTACTS.
2. TOTAL VOC CONCENTRATIONS FROM MARCH 2020 (ug/L) ARE LISTED BELOW WELLS WHERE SAMPLED.
3. GROUNDWATER ELEVATIONS FROM NOVEMBER 2020 DT WELLS ARE LISTED BELOW WELLS WHERE MEASURED.

Figure 6

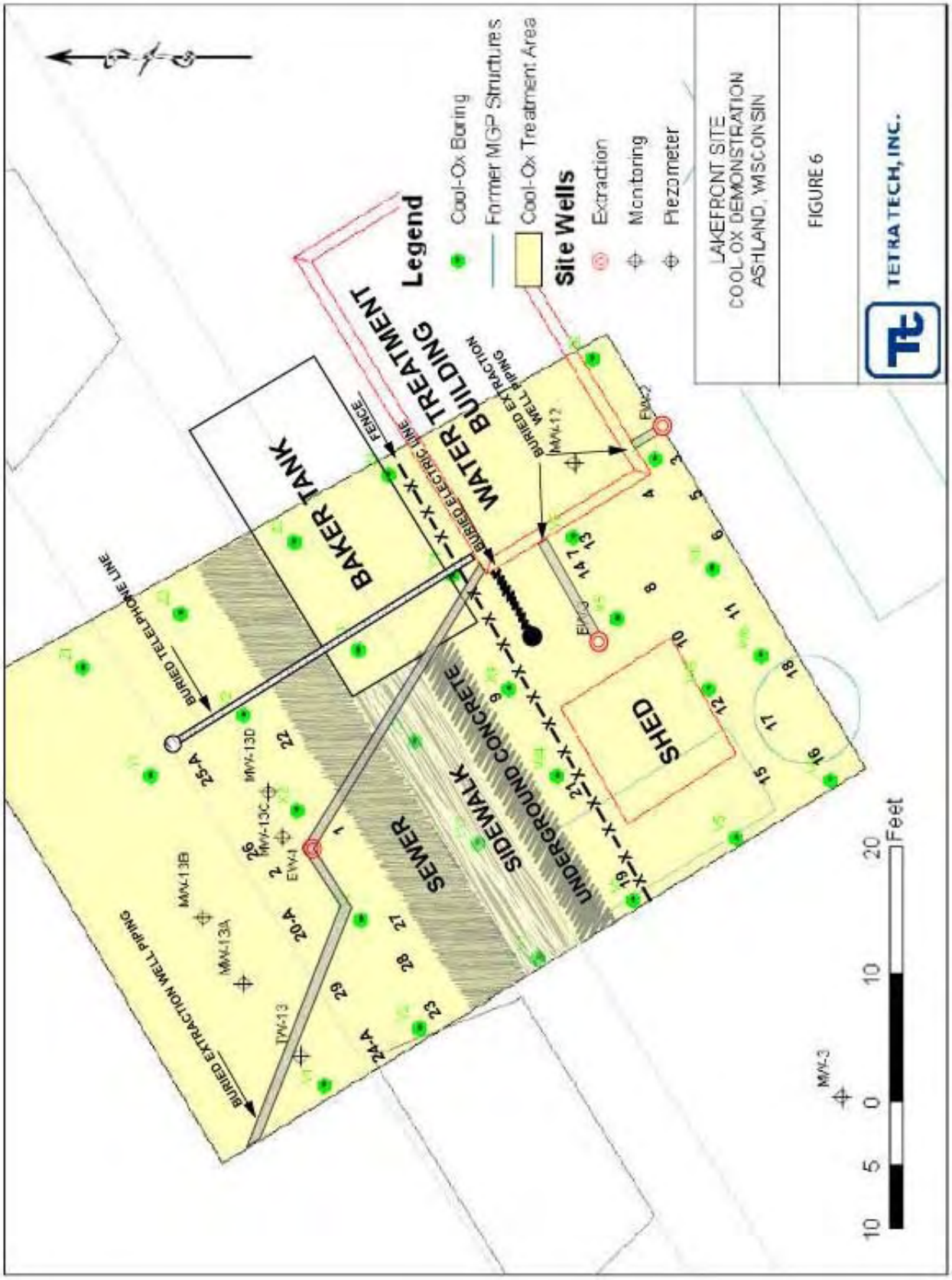

Legend
Cool-Ox Boring
Former MGP Structures
Cool-Ox Treatment Area
Site Wells
Extraction
Monitoring
Piezometer
LAKEFRONT SITE
COOL-OX DEMONSTRATION
ASHLAND, WISCONSIN
FIGURE 6
TETRA TECH, INC.
WATER TREATMENT BUILDING
BAKER TANK
SHED
SEWER
SIDEWALK
UNDERGROUND CONCRETE
FENCE
BURIED ELECTRIC LINE
BURIED TELEPHONE LINE
BURIED EXTRACTION WELL PIPING
MW-12
MW-13
MW-13A
MW-13B
MW-13C
MW-13D
MW-3
EW-1
EW-2
25-A
20-A
24-A
Feet
10
5
0
10
20

Figure 7

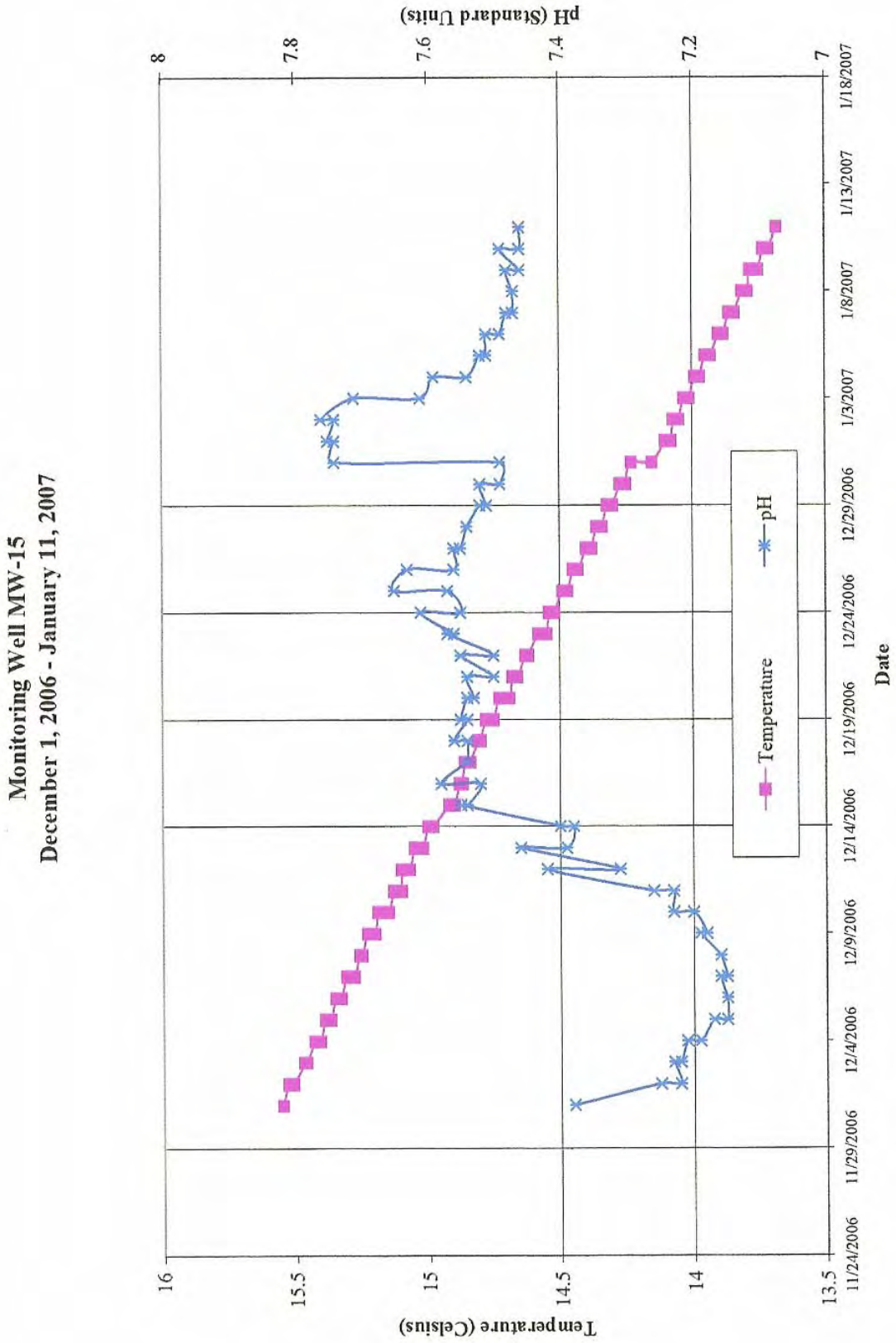

Monitoring Well MW-15
December 1, 2006 - January 11, 2007
Temperature (Celsius)
16
15.5
15
14.5
14
13.5
pH (Standard Units)
8
7.8
7.6
7.4
7.2
7
11/24/2006
11/29/2006
12/4/2006
12/9/2006
12/14/2006
12/19/2006
12/24/2006
12/29/2006
1/3/2007
1/8/2007
1/13/2007
1/18/2007
Date
Temperature
pH

Chart 1

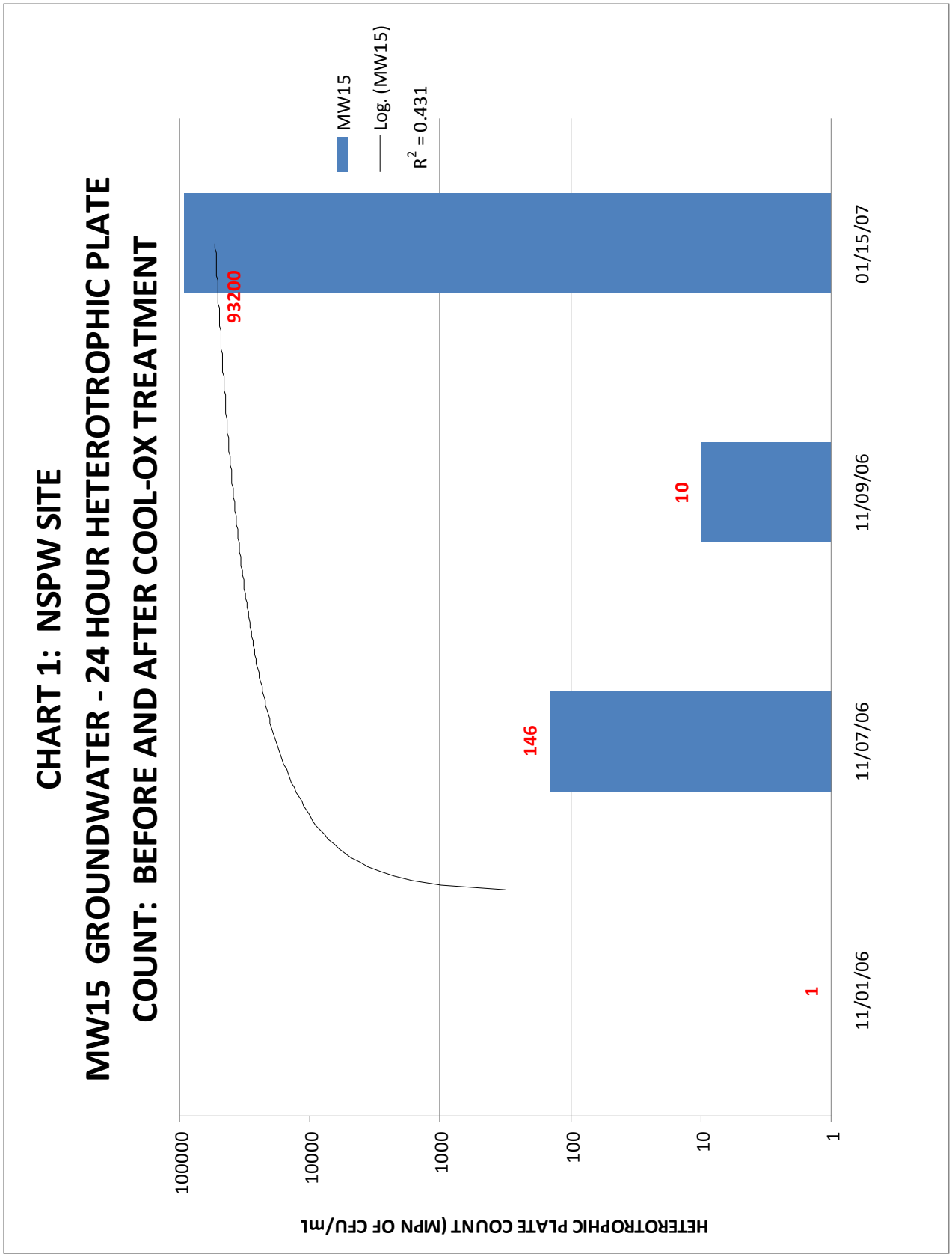


CHART 1: NSPW SITE
MW15 GROUNDWATER - 24 HOUR HETEROTROPHIC PLATE COUNT: BEFORE AND AFTER COOL-OX TREATMENT
HETEROTROPHIC PLATE COUNT (MPN OF CFU/ml
100000
10000
1000
100
10
1
93200
146
10
1
11/01/06
11/07/06
11/09/06
01/15/07
MW15
Log. (MW15)
R2 = 0.431

Chart 2

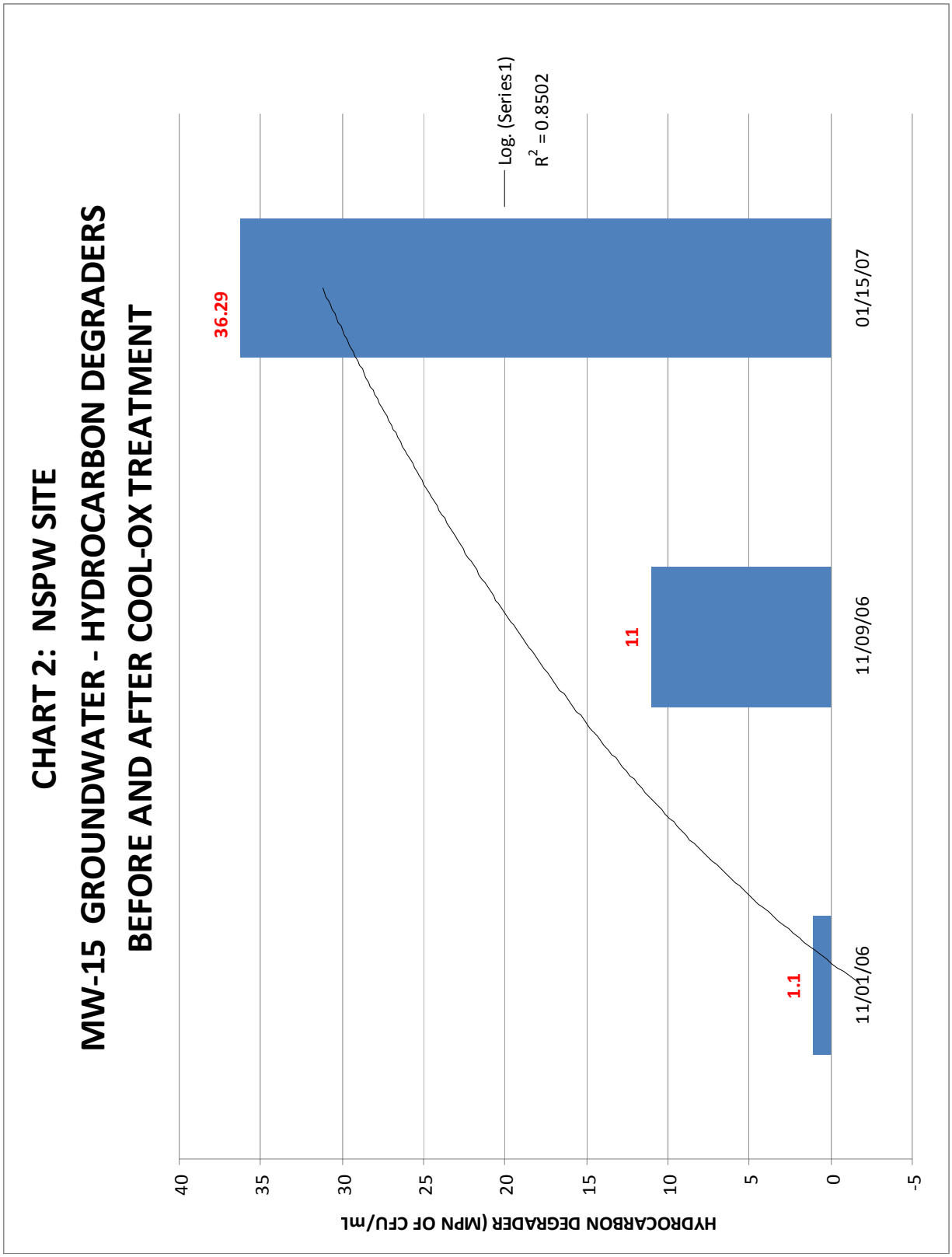


CHART 2: NSPW SITE
MW-15 GROUNDWATER - HYDROCARBON DEGRADERS
BEFORE AND AFTER COOL-OX TREATMENT
HYDROCARBON DEGRADER (MPN OF CFU/mL
40
35
30
25
20
15
10
5
0
-5
1.1
11
36.29
11/01/06
11/09/06
01/15/07
Log. (Series1)
$R^2 = 0.8502$

Chart 3

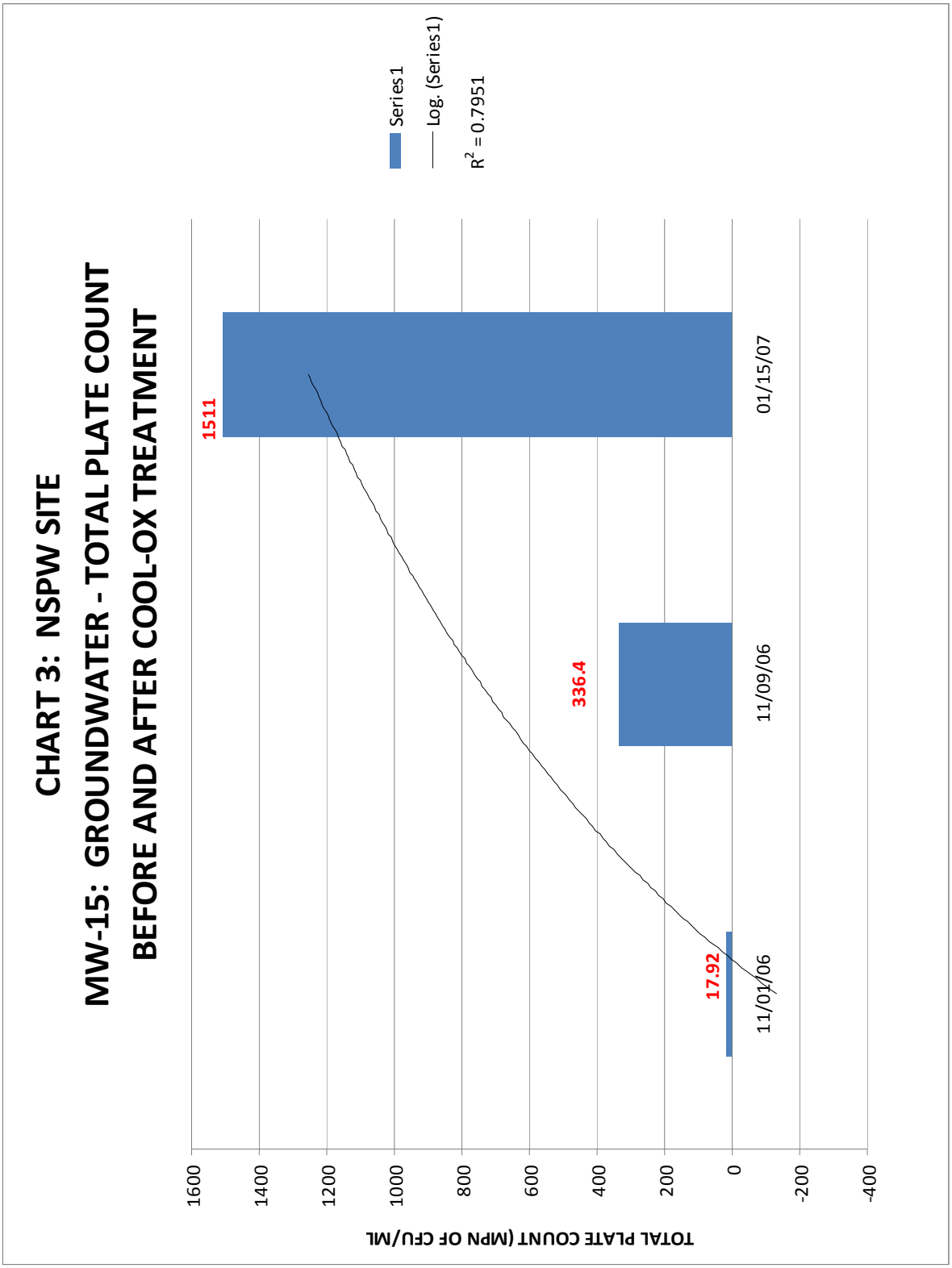


CHART 3: NSPW SITE
MW-15: GROUNDWATER - TOTAL PLATE COUNT
BEFORE AND AFTER COOL-OX TREATMENT
TOTAL PLATE COUNT (MPN OF CFU/ML
1600
1400
1200
1000
800
600
400
200
0
-200
-400
17.92
336.4
1511
11/01/06
11/09/06
01/15/07
Series1
Log. (Series1)
R2 = 0.7951

Chart 4

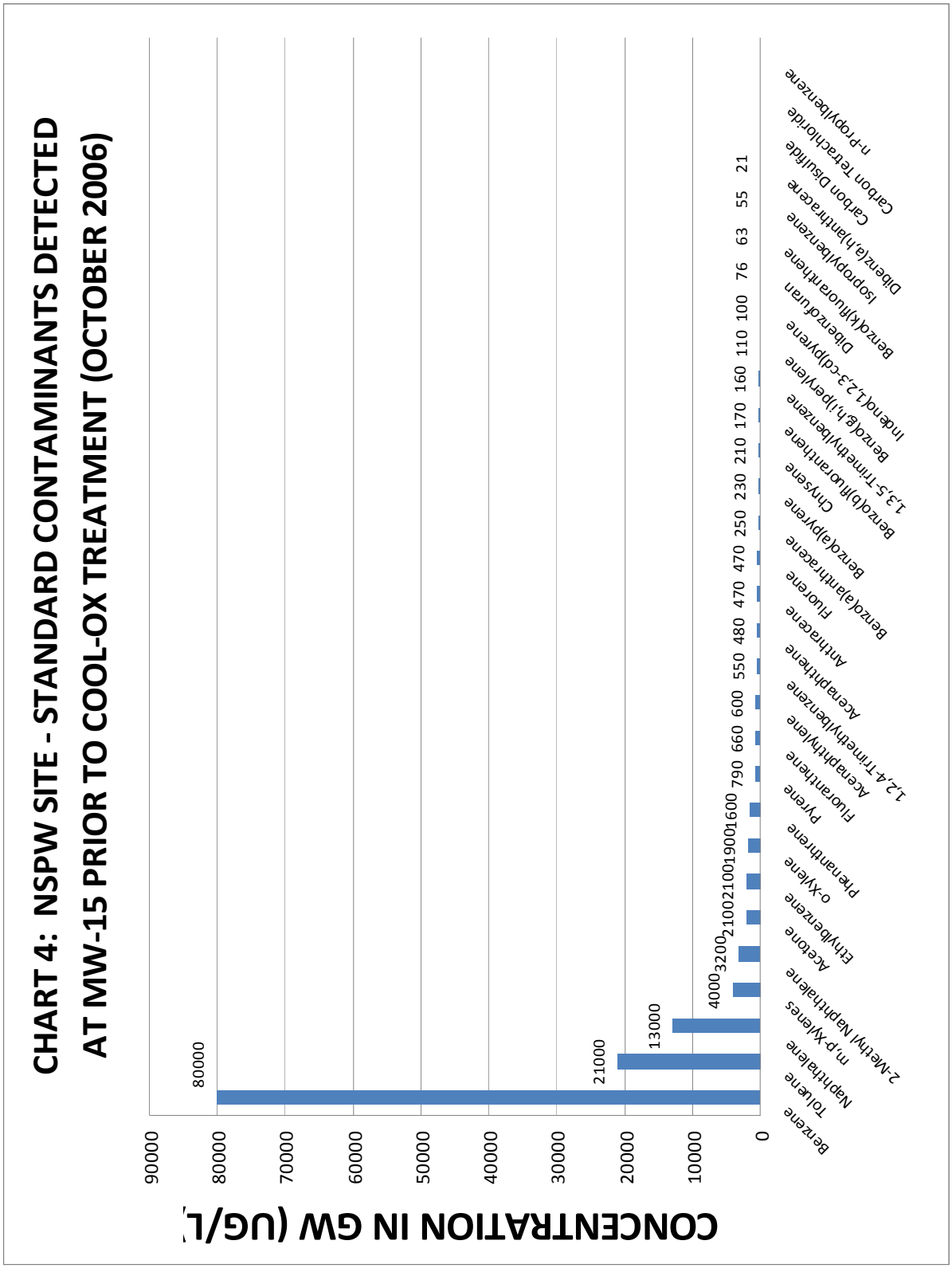


CHART 4: NSPW SITE - STANDARD CONTAMINANTS DETECTED
AT MW-15 PRIOR TO COOL-OX TREATMENT (OCTOBER 2006)
CONCENTRATION IN GW (UG/L)
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
80000
21000
13000
4000
3200
2100
2100
1900
1600
790
660
600
550
480
470
470
250
230
210
170
160
110
100
76
63
55
21
Benzene
Toluene
Naphthalene
m,p-Xylenes
2-Methyl Naphthalene
Acetone
Ethylbenzene
o-Xylene
Phenanthrene
Pyrene
Fluoranthene
Acenaphthylene
1,2,4-Trimethylbenzene
Acenaphthene
Anthracene
Fluorene
Benzo(a)anthracene
Benzo(a)pyrene
Chrysene
Benzo(b)fluoranthene
1,3,5-Trimethylbenzene
Benzo(g,h,i)perylene
Indeno(1,2,3-cd)pyrene
Dibenzofuran
Benzo(k)fluoranthene
Isopropylbenzene
Dibenz(a,h)anthracene
Carbon Disulfide
Carbon Tetrachloride
n-Propylbenzene

Chart 5

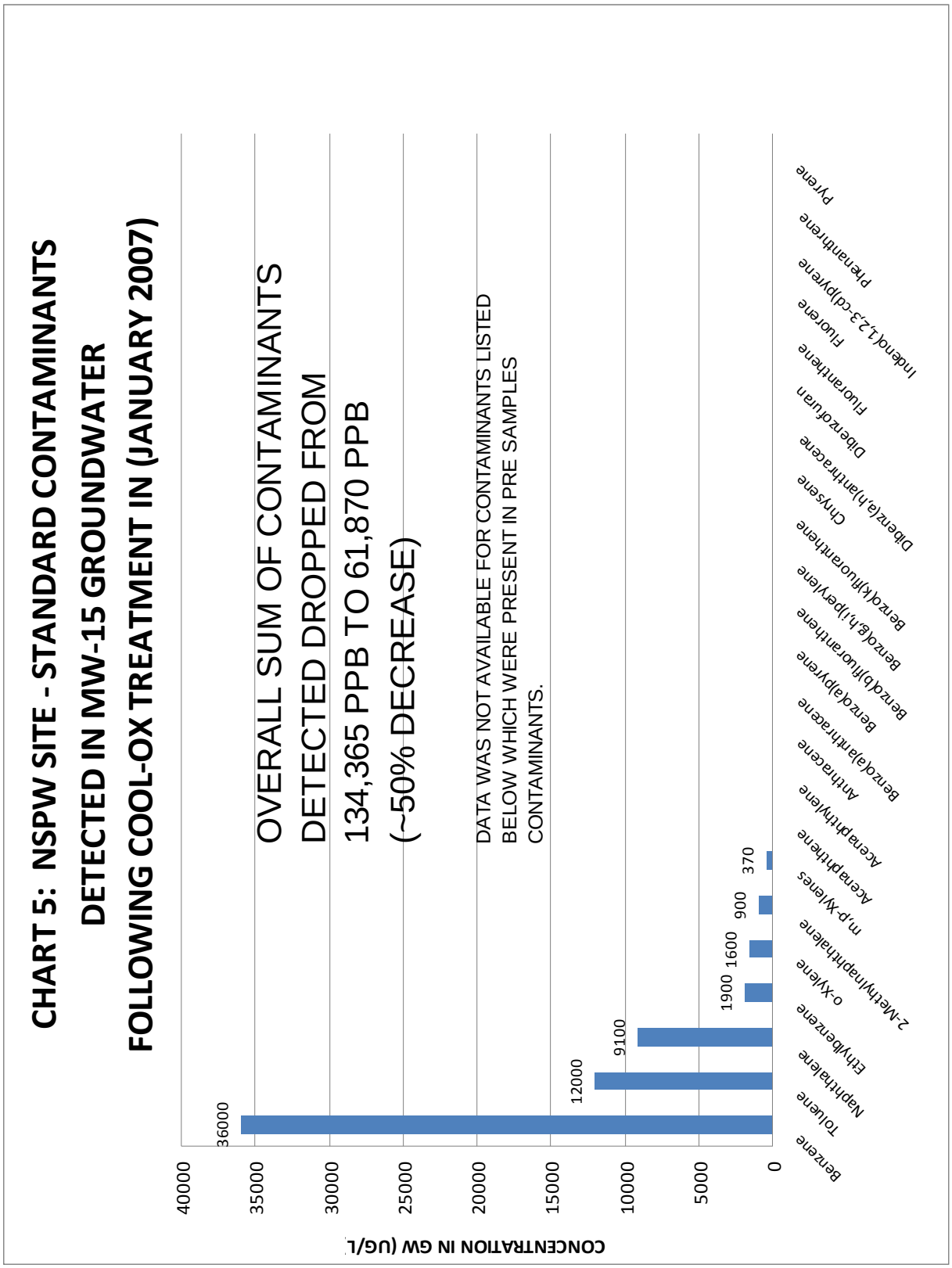


CHART 5: NSPW SITE - STANDARD CONTAMINANTS
DETECTED IN MW-15 GROUNDWATER
FOLLOWING COOL-OX TREATMENT IN (JANUARY 2007)
OVERALL SUM OF CONTAMINANTS
DETECTED DROPPED FROM
134,365 PPB TO 61,870 PPB
(~50% DECREASE)
DATA WAS NOT AVAILABLE FOR CONTAMINANTS LISTED
BELOW WHICH WERE PRESENT IN PRE SAMPLES
CONTAMINANTS.
CONCENTRATION IN GW (UG/L)
40000
35000
30000
25000
20000
15000
10000
5000
0
36000
12000
9100
1900
1600
900
370
Benzene
Toluene
Naphthalene
Ethylbenzene
o-Xylene
2-Methylnaphthalene
m,p-Xylenes
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Chrysene
Dibenz(a,h)anthracene
Dibenzofuran
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Phenanthrene
Pyrene

Chart 6

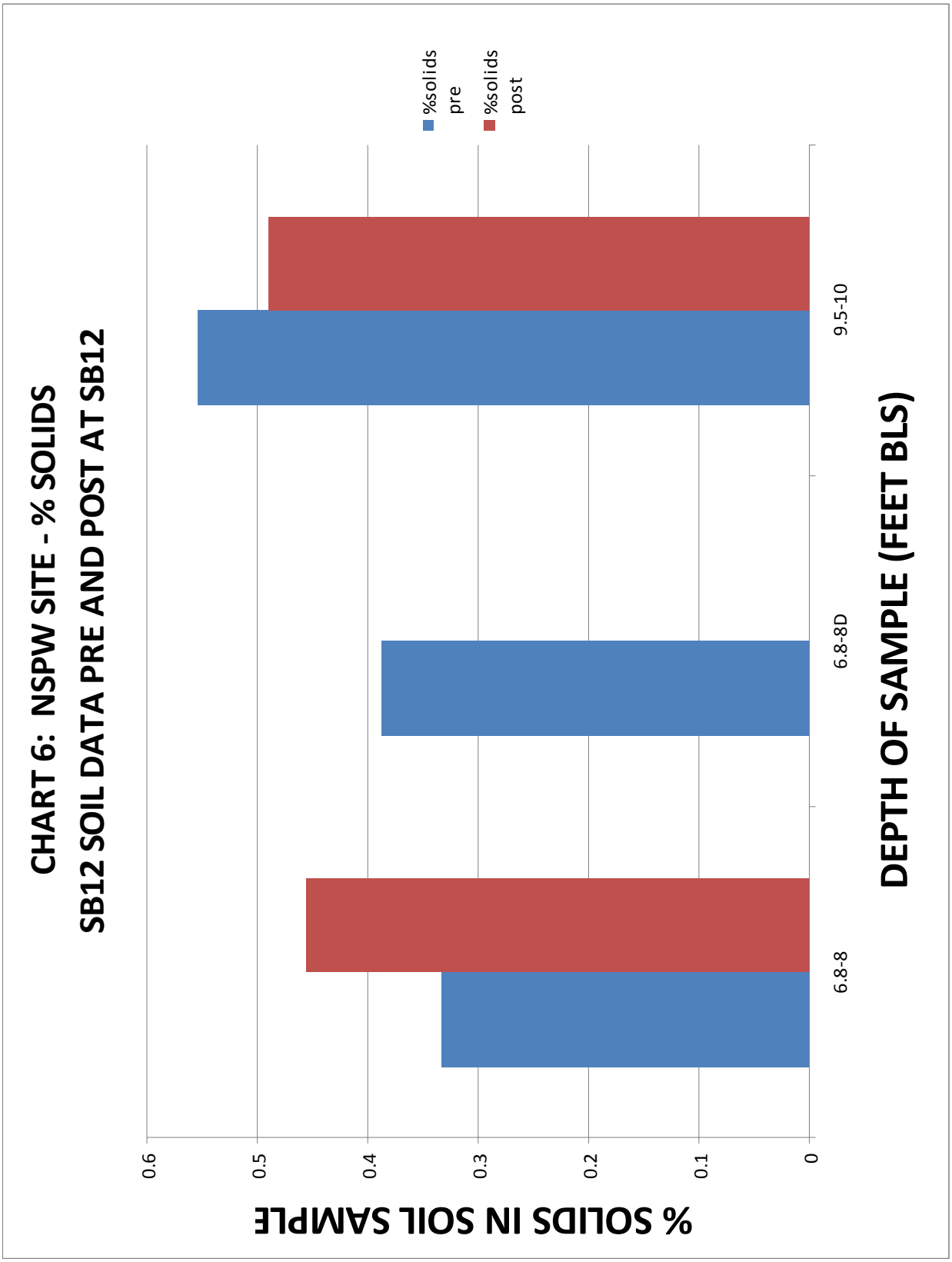
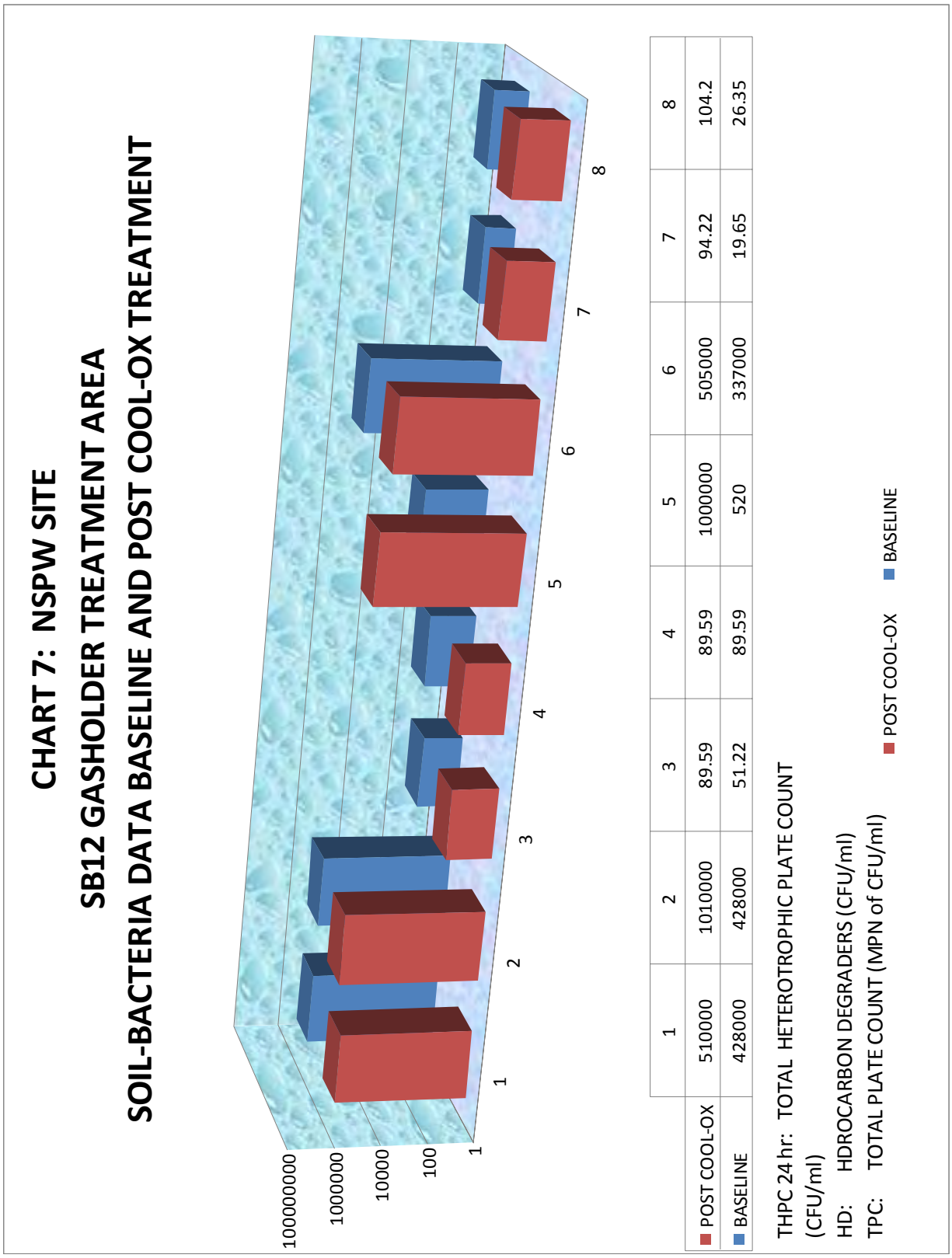


CHART 6: NSPW SITE - % SOLIDS
SB12 SOIL DATA PRE AND POST AT SB12
%solids pre
%solids post
% SOLIDS IN SOIL SAMPLE
0.6
0.5
0.4
0.3
0.2
0.1
0
6.8-8
6.8-8D
9.5-10
DEPTH OF SAMPLE (FEET BLS)

Chart 7



	1	2	3	4	5	6	7	8
POST COOL-OX	510000	1010000	89.59	89.59	1000000	505000	94.22	104.2
BASELINE	428000	428000	51.22	89.59	520	337000	19.65	26.35

Chart 8

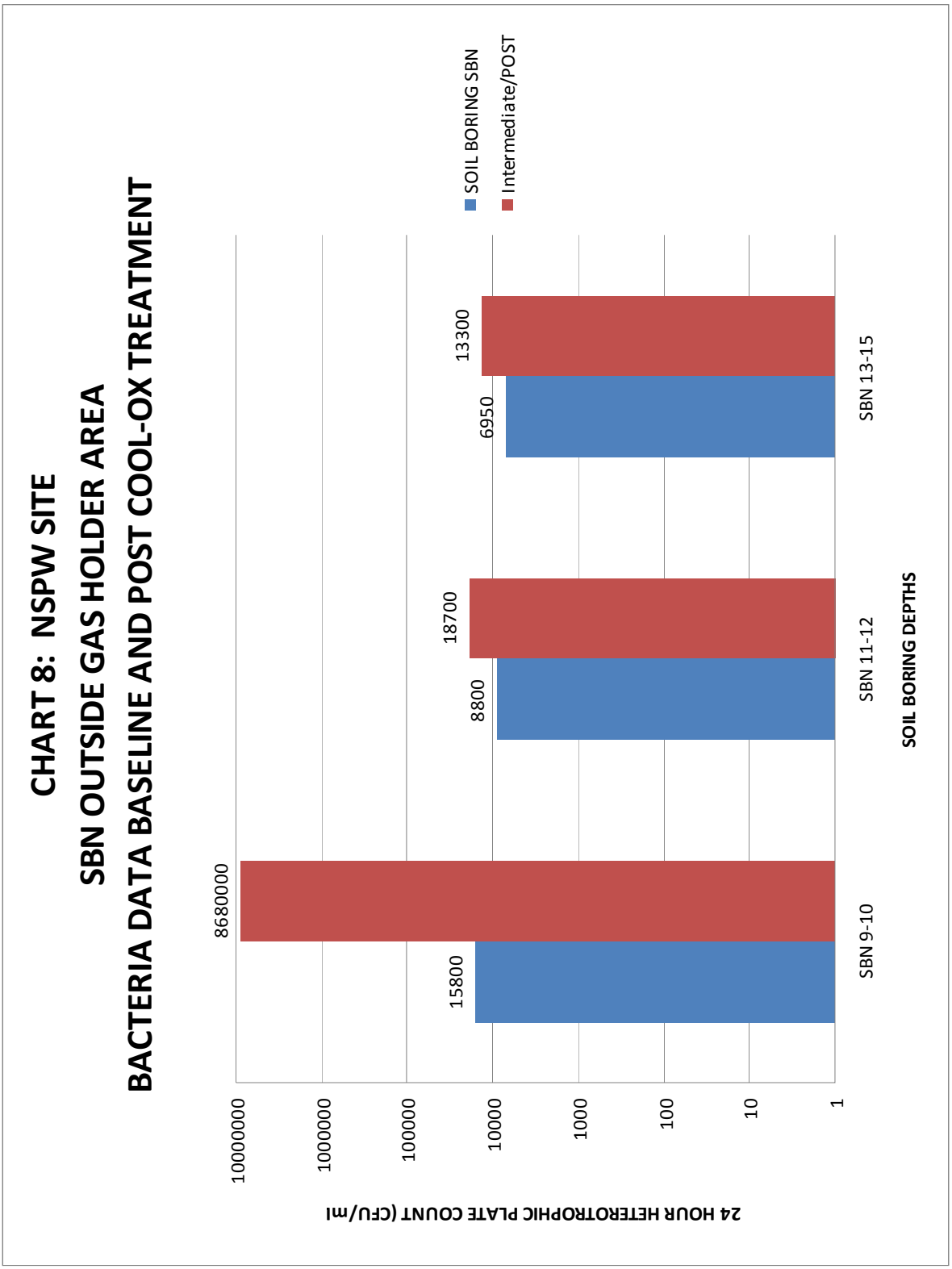


CHART 8: NSPW SITE
SBN OUTSIDE GAS HOLDER AREA
BACTERIA DATA BASELINE AND POST COOL-OX TREATMENT
24 HOUR HETEROTROPHIC PLATE COUNT (CFU/ml)
10000000
1000000
100000
10000
1000
100
10
1
8680000
15800
18700
8800
13300
6950
SOIL BORING SBN
Intermediate/POST
SBN 9-10
SBN 11-12
SBN 13-15
SOIL BORING DEPTHS

Chart 9

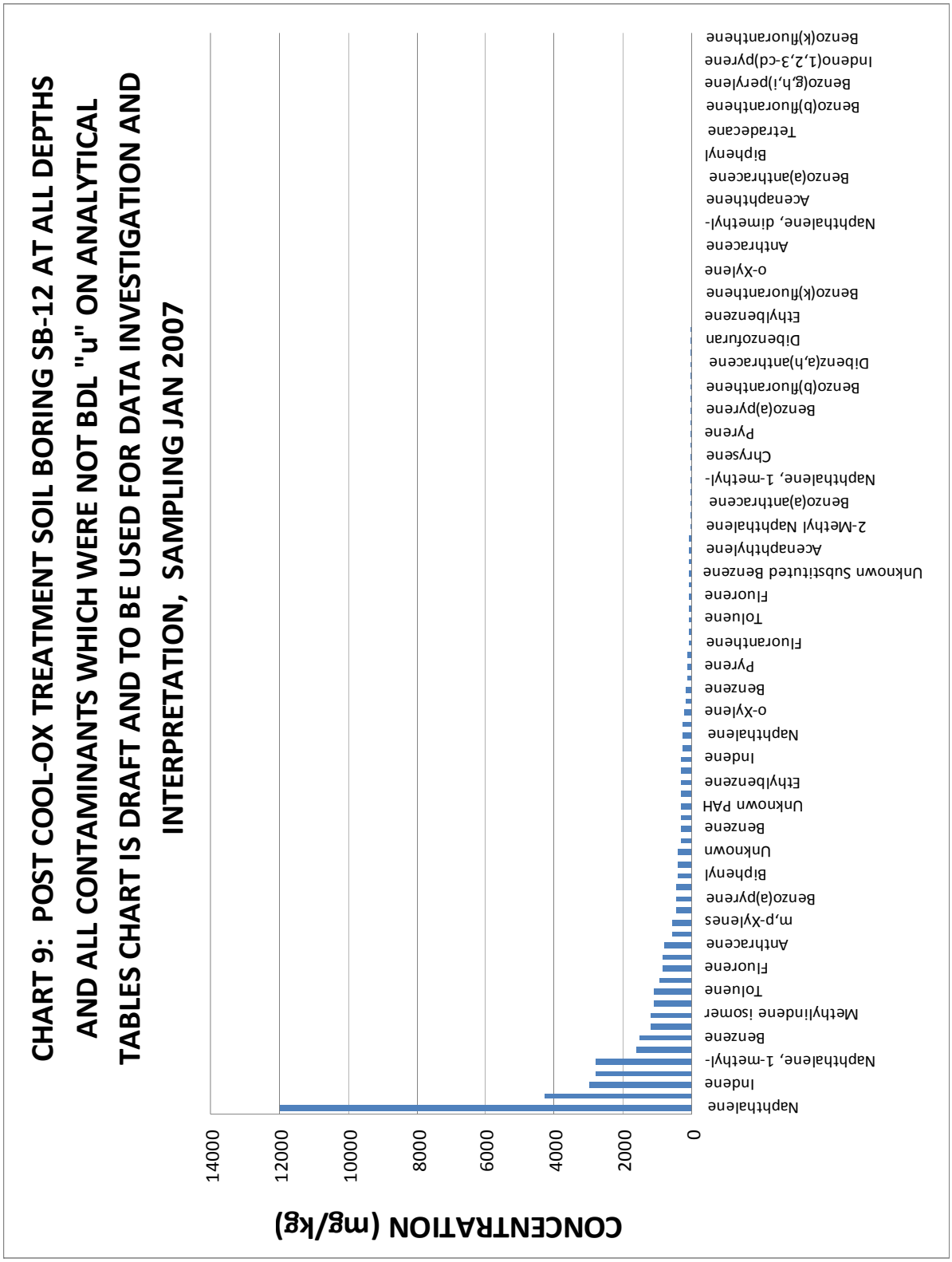


CHART 9: POST COOL-OX TREATMENT SOIL BORING SB-12 AT ALL DEPTHS AND ALL CONTAMINANTS WHICH WERE NOT BDL "u" ON ANALYTICAL TABLES CHART IS DRAFT AND TO BE USED FOR DATA INVESTIGATION AND INTERPRETATION, SAMPLING JAN 2007
CONCENTRATION (mg/kg)
14000
12000
10000
8000
6000
4000
2000
0
Naphthalene
Indene
Naphthalene, 1-methyl-
Benzene
Methylindene isomer
Toluene
Fluorene
Anthracene
m,p-Xylenes
Benzo(a)pyrene
Biphenyl
Unknown
Benzene
Unknown PAH
Ethylbenzene
Indene
Naphthalene
o-Xylene
Benzene
Pyrene
Fluoranthene
Toluene
Fluorene
Unknown Substituted Benzene
Acenaphthylene
2-Methyl Naphthalene
Benzo(a)anthracene
Naphthalene, 1-methyl-
Chrysene
Pyrene
Benzo(a)pyrene
Benzo(b)fluoranthene
Dibenz(a,h)anthracene
Dibenzofuran
Ethylbenzene
Benzo(k)fluoranthene
o-Xylene
Anthracene
Naphthalene, dimethyl-
Acenaphthene
Benzo(a)anthracene
Biphenyl
Tetradecane
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Indeno(1,2,3-cd)pyrene
Benzo(k)fluoranthene

Chart 10

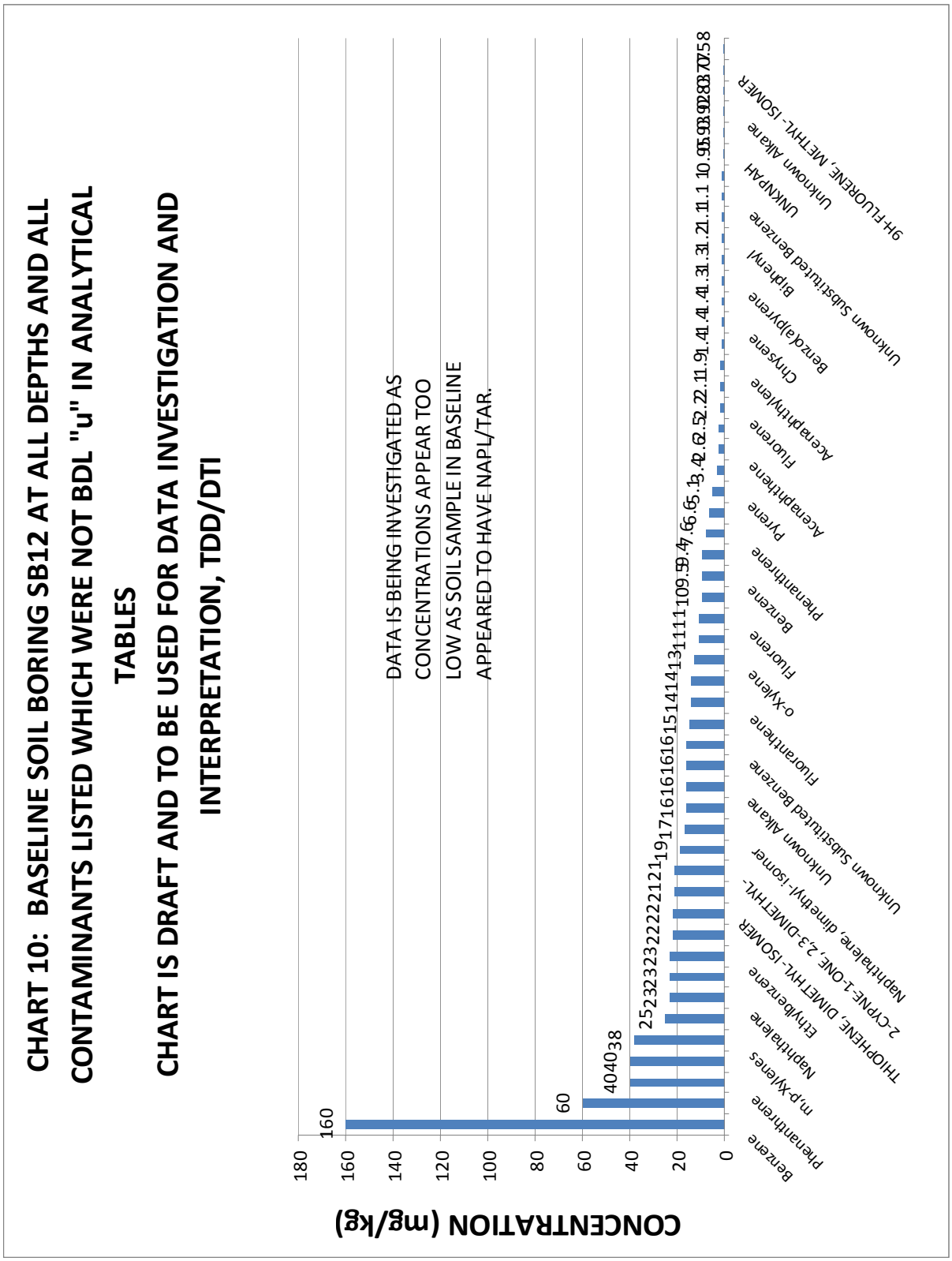


CHART 10: BASELINE SOIL BORING SB12 AT ALL DEPTHS AND ALL CONTAMINANTS LISTED WHICH WERE NOT BDL "u" IN ANALYTICAL TABLES
CHART IS DRAFT AND TO BE USED FOR DATA INVESTIGATION AND INTERPRETATION, TDD/DTI
DATA IS BEING INVESTIGATED AS CONCENTRATIONS APPEAR TOO LOW AS SOIL SAMPLE IN BASELINE APPEARED TO HAVE NAPL/TAR.
CONCENTRATION (mg/kg)
180
160
140
120
100
80
60
40
20
0
160
60
40
40
38
25
23
23
23
22
22
22
21
21
19
17
16
16
16
16
15
14
14
14
13
11
11
11
10
9.9
9.4
7.6
6.6
5.1
3.4
2.6
2.5
2.2
2.1
1.9
1.4
1.4
1.4
1.3
1.3
1.2
1.1
1.1
1.1
1.0
0.95
0.93
0.92
0.88
0.83
0.70
0.58
Benzene
Phenanthrene
m,p-Xylenes
Naphthalene
Ethylbenzene
TMIOPHENE, DIMETHYL-ISOMER
2-CYPNE-1-ONE, 2,3-DIMETHYL-
Naphthalene, dimethyl-isomer
Unknown Alkane
Unknown Substituted Benzene
Fluoranthene
o-Xylene
Fluorene
Benzene
Phenanthrene
Pyrene
Acenaphthene
Fluorene
Acenaphthylene
Chrysene
Benzo(a)pyrene
Biphenyl
Unknown Substituted Benzene
UNKNPAH
Unknown Alkane
9H-FLUORENE, METHYL-ISOMER

Chart 11

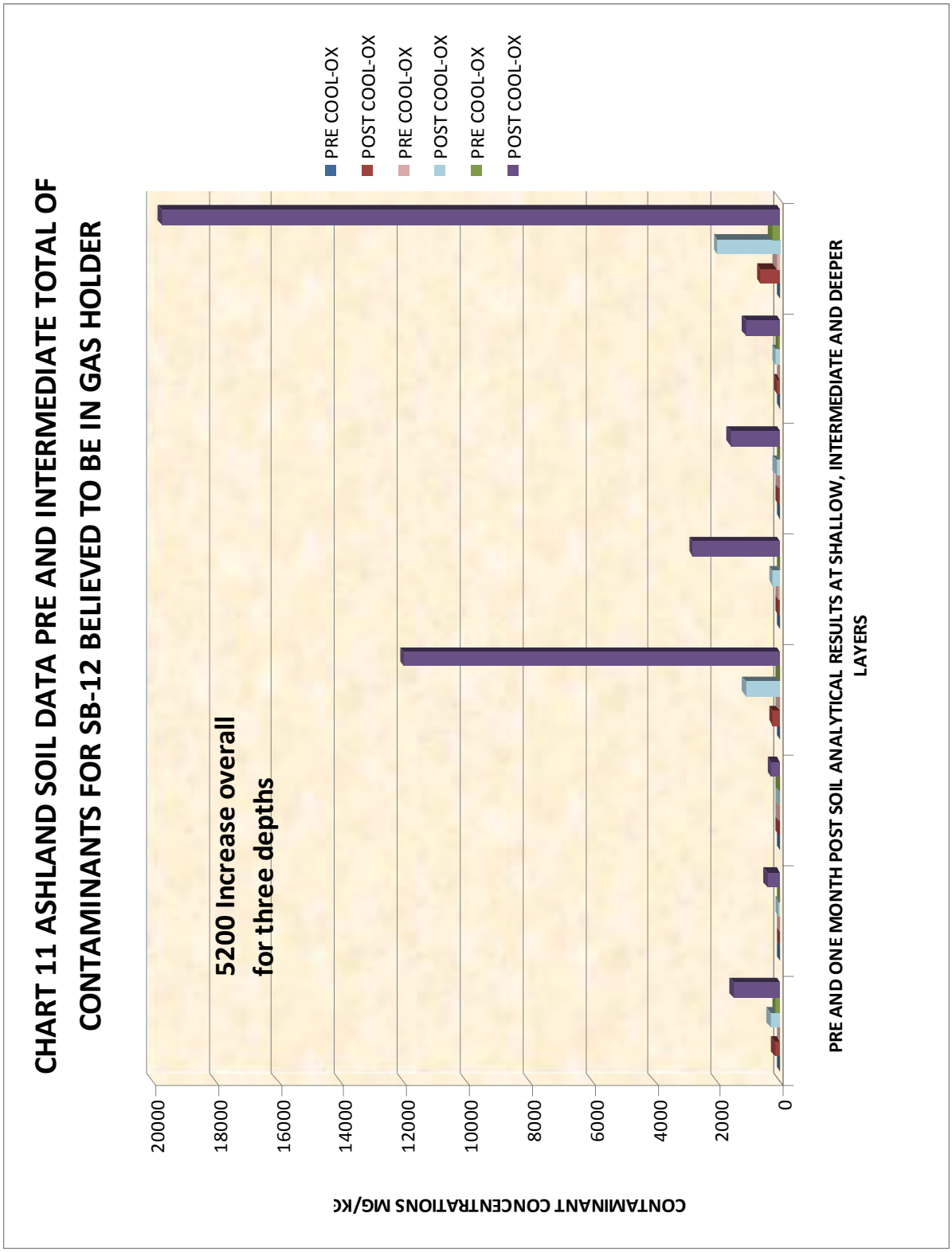


CHART 11 ASHLAND SOIL DATA PRE AND INTERMEDIATE TOTAL OF CONTAMINANTS FOR SB-12 BELIEVED TO BE IN GAS HOLDER
5200 Increase overall for three depths
PRE COOL-OX
POST COOL-OX
PRE COOL-OX
POST COOL-OX
PRE COOL-OX
POST COOL-OX
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
CONTAMINANT CONCENTRATIONS MG/KG
PRE AND ONE MONTH POST SOIL ANALYTICAL RESULTS AT SHALLOW, INTERMEDIATE AND DEEPER LAYERS

Chart 12

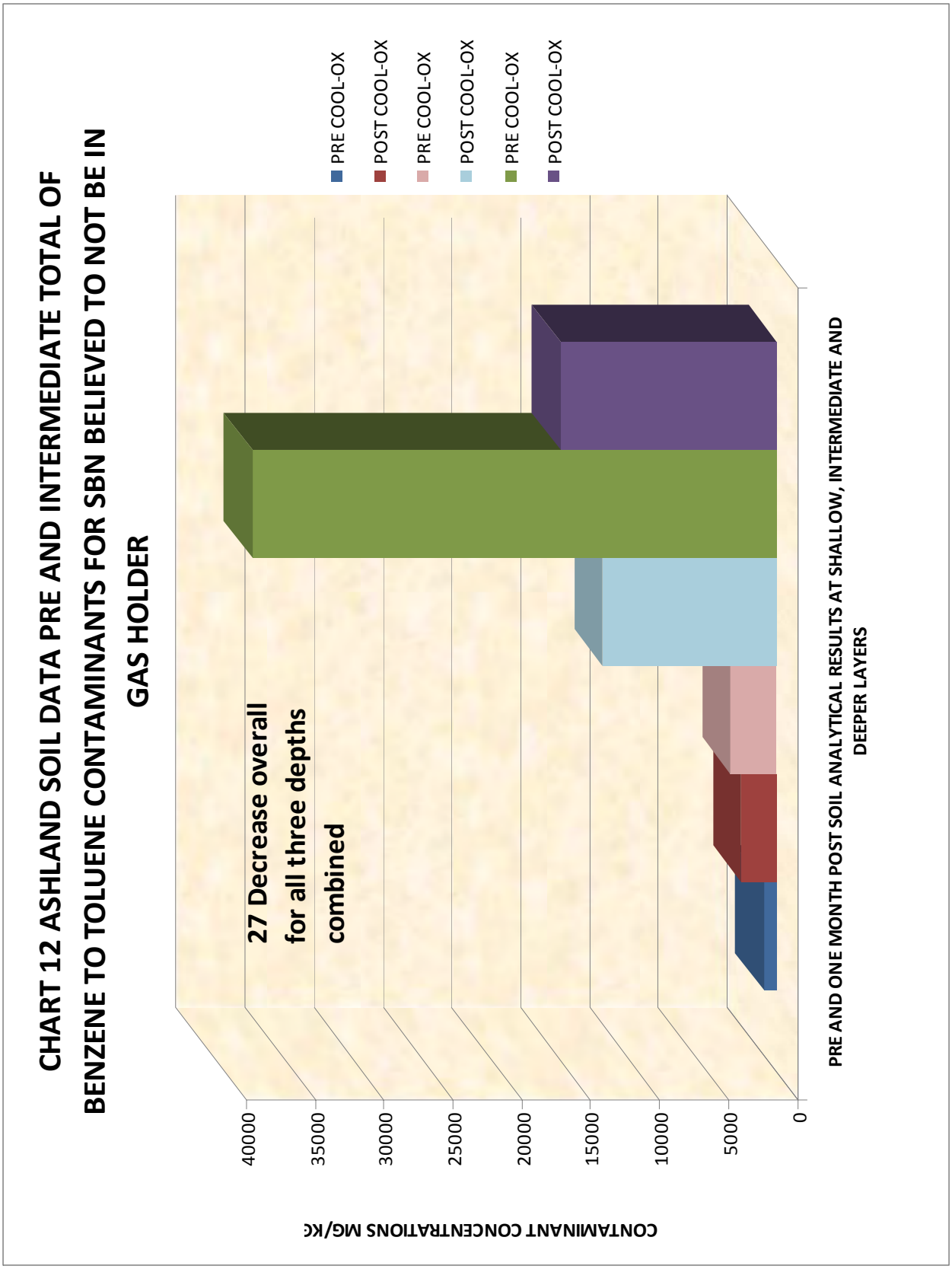


CHART 12 ASHLAND SOIL DATA PRE AND INTERMEDIATE TOTAL OF BENZENE TO TOLUENE CONTAMINANTS FOR SBN BELIEVED TO NOT BE IN GAS HOLDER
27 Decrease overall for all three depths combined
PRE COOL-OX
POST COOL-OX
PRE COOL-OX
POST COOL-OX
PRE COOL-OX
POST COOL-OX
40000
35000
30000
25000
20000
15000
10000
5000
0
CONTAMINANT CONCENTRATIONS MG/KG
PRE AND ONE MONTH POST SOIL ANALYTICAL RESULTS AT SHALLOW, INTERMEDIATE AND DEEPER LAYERS

Table 1

Table 1
MW-15 Pilot Demonstration Area
Shallow Application in Miller Creek Formation - Four (2) to Eighteen (18) fbgs

Date	IP (SIB)[1]	Depth[2]	Holder[3,4] Inside	Holder[3,4] Outside	Observations
14-Nov	1	18'	300		Odor - No Foam (ONF)
	2	18'		200	Influenced MW-16 & Sampling Point SBS (NONF)
	3	18'	300		ONF
	4	18'	300		ONF
	5R	8'			Refusal on Holder Wall
	5	18	300		ONF
	6	18		300	Odor and Foam (OF)
	7R	8			Refusal on Holder Wall
	7	18		300	Odor - Heavy Foam
	8	18		300	Odor - Heavy Foam - Product
	9	18		300	Odor and Foam - Mild
	10R	6.5			Refusal - Holder Wall or Debris
	10	18	300		ONF
15-Nov	11	18		300	Odor and Foam - Mild
	12	18	300		Odor - No Foam (ONF)
	13	18	300		Odor - Heavy Foam - Product
	14	18	300		Coal Tar Residue Expelled
	15	18		300	No Reaction
	16	18		300	Odor and Foam - Mild
	17	18		200	Influenced MW-16 & Sampling Point SBS (NONF)
	18	18		300	Odor - Heavy Foam
	19	18	300		Coal Tar Residue Expelled
	20	18	300		Coal Tar Residue Expelled from SIB-19
16-Nov	21R	10			Refusal - Probably Debris
	21	18	300		No Reaction very Mild Odor
	22	18	600		No Reaction very Mild Odor
	23	18	200		No Reaction very Mild Odor
	24	18	300		Coal Tar Residue Expelled from SIB-19
	25	18	300		Coal Tar Residue Expelled from SIB-19
			4700	**2800**	**7500** Total gal MW-15 Area

Notes:
[1] Injection Point - Shallow Injection Boring (SIB)
[2] Maximum Depth - Feet Below Ground Surface (fbgs)
[3]Gallons of Reagent Injected per IP
[4]Injection Point Location Relative to Holder

Table 2

Table 2
MW-15 Pilot Demonstration Area
Deep Application in Copper Falls Formation - Twenty-five (25) to Forty (40) fbgs

17-Nov Collected Samples from MW-15A & B - resumed work after Thanksgiving Holiday

Date	IP (DIB)[1]	Depth[2]	Gal[3]	Observations
14-Nov	1	40	200	[4]Heavy Sheen - Odor - Foaming, lost bottom 10' of rods
	2	36R	250	Refusal - Heavy Sheen - Foaming - Odor- MW-15B bentonite seal pushed up
15-Nov	3	40	250	Contaminant observed outside MW-15B casing - strong reaction
27-Nov	4	40	200	Slight foaming - no odor
28-Nov	5	40	250	Foaming - Heavy Sheen - More reaction at MW-15B
	6	40	200	Discontinued 10' spacing - Sheen - Mild reaction - communicate with DIB-4
	7	32R	200	Start south to Delineate GW plume - very silght reaction - slight odor
	8	36R	200	Slight reaction with DIB-7 - no reaction - concentrations very low - bio only
29-Nov	9	40	300	Heavy "Cow Pie" no reaction @ MW-15B - Breakout by bldg. foundation
	9-A	36	190	190 in DIB-9 - demo for State DNR visitors
	9-B	36	200	Additional Demo for State DNR visitors - Cow Pie after they left
	10	37R	200	"Cow Pie" heavy foam - odor
30-Nov	11	35R	300	"Cow Pie" heavy foam - odor
	12	33R	300	No Reaction
	13	35R	300	Strong Reaction - heavy foam
	14	37R	300	"Cow Pie" heavy foam - odor
			3840	Total Gal. MW-15 Deep

Notes:
[1] Injection Point - Deep Injection Boring (DIB)
[2] Maximum Depth - Feet Below Ground Surface (fbgs)
[3]Gallons of Reagent Injected per IP
[4]Encountered difficulty below 25 feet - Lost 10 feet of tooling (35 to 45 feet)

Table 3

Table 3
MW-13 Pilot Demonstration Area
Deep Application in Copper Falls Formation - Thirty (30) to Eighty (80) fbgs

Date	IP[1]	Depth[2]	Gal[3]	[4]Observations
7-Dec	1	80	300	Drove to 80' (TD) - PAV plugged, pulled rods, lost bottom 15', DTW-20', pH 5.5-6
	1	65'R	900	broke out at phone service, betonited point, old probe hole (NR-E1)(BU), pH of foam 8
8-Dec	1	65'	200	broke out at phone service, betonited point, old probe hole (NR-E1)(BU)
	2	30'C	0	rods caped and left, no injection - continue Monday
11-Dec	2	70'R	600	break out at phone service again, abandoned boring grouted, discovered communication with E3 water rose to top of casing, communication in E-3 across site in CFA, great news E-3 pH 5.5 to 6
12-Dec	3	68R	2,200	E-3, DTW-18.5', pH6, water to top of casing, CT stringy, pH changing to 6-7, water turning from clear to translucent, CT breaking up into globules & appearing more soluble, no change in pH (5.5-6) or CT appearance (black/oily) in WTP
13-Dec	3		1,700	E3 water milky to amber, pH 8, CT globules breaking up on surface of E3 casing indicating emulisification, micells forming (?) from surfactant from CT & PAHs, odor down, pH in collector in WTP 5.5-6, no change in CT or appearance, water still clear, #3 grouted, E3 pump suspected inoperable, no way to measure success, Kellog/Lundy stop work pending testing of E3 pump
14-Nov				telecon Kellog/Lundy/Trainor/Winslow halt work pending pulling pump.
15-Nov				E3 pump replaced - mechanism gone, down until Monday
18-Nov	4	35'C		E3 pump OK by 3PM, drove to 35' & capped until Tue.
19-Nov	4	68'R	1,400	At 600 gal water to top of casing, pH 8, CT breaking up, after 1,300 gal water in collector in WTP turning cloudy, pH @7-8, CT now has wrinkled appearance, no doubt that WTP is now getting water from E3, Breakout outside of casing in E3, heavy CT material in vault, apparent cinders, wood blocks in vault, large void opened up in west side of vault, sand was used to fill opening, ~1.5 cy needed, IP grouted after 1,400 gal
20-Nov	5	45'R	450	pumped 450 gal, breakout into E3 vault, point grouted, pH 8 in WTP, water reddish translucent, CT rough
21-Nov	6	55'R	600	At 600 gal, breakout again in E3 vault, decided to grout and let site equilibrate until after holidays
3-Jan	7	78'R	400	Tooling stuck, pumped 400 gal @ 1,200 psi, rods are plugged, left in place until later date.
4-Jan	8	45'R	450	no effect on #7 rods, still stuck, grouted IP
5-Jan	9	73, R	100	pumped 100 gal @ 900 psi, rods stuck and plugged, left in place over weekend, no affect at wells
8-Jan	10	3'R	0	worked on freeing rods in IP#9, rewired Probe for greater lift
9-Jan	9	73'R	1,950	pumped 1,250, no communication with any wells, pumped 750 gal, breakout at St. Claire St., entire crew worked quickly to contain effluent, no release to storm sewers
10-Jan	11	64'R	1,400	mild activity (bubbling) in E2 & ~4' raise in GW in well, foaming outside of casing in E3
11-Jan	7	78'	2,500	injected 2,500 gal, slight reaction in E3 vault, foam, grouted IP and moved
12-Jan				worked stopped to check integrety of E3 well casing
15-Jan	12	67'R	1,700	rod clogged, pulled to free, lost bottom 20' of rod, reinserted, grouted
	13	45'R	650	pumped 650, grouted
16-Jan	14	70-R	1,350	slight activity in E2, bubbling, ~4' raise in GW, grouted
			18850	

Table 3 Continued

Table 3

MW-13 Pilot Demonstration Area

Deep Application in Copper Falls Formation - Thirty (30) to Eighty (80) fbgs

Page 2

17-Jan	15	75'R	1,200		no noticable reactions, grouted
18-Jan	16	60'R	2,000		no noticable reactions, grouted
19-Jan	17	60'R	1,600		no noticable reactions, grouted
22-Jan	18	58'R	1,400		breakout by building foundation in are of large holder, team all worked to contain release, no effluent escaped off-site, parking lot was cleaned and swept, then washed down with clean water, all material was contained
23-Jan	19	67'R	800		slight reaction in E1 vault, injection stopped, grouted
24-Jan	20	75'R	1,400		angle probe under street, reaction in MW-13, ECT bubbling out, captured with drum vacuum, large volume of emulsified CT coming out of MW-13, globules would immediately break up at surface indicating action by surfactant, effluent was milky
25-Jan	21	63'R	1,800		no noticable reactions, grouted
26-Jan	22	45'R	200		rods plugged, grouted
29-Jan	23	67'R	800		rods plugged, grouted
30-Jan	24	60'R	800		angle probe under street, reaction in probe rod ECT foam expelled
31-Jan	24		2,000		
1-Feb	25	67'R	1,600		angle probe under street, reaction in probe rod ECT foam expelled
			15,600	18850	**34,450** Total gallons Injected MW-13 Area

Notes:

[1] Injection Point

[2] Maximum Depth - Feet Below Ground Surface (fbgs)

[3] Gallons of Reagent Injected per IP

[4] Observations

TD-

APPENDIX B2

CAP FLUX TESTING REPORT

ADDENDUM 1
CAP FLUX TEST -
EXTENDED DURATION COLUMN

ASHLAND/NORTHERN STATES POWER LAKEFRONT SUPERFUND SITE

Prepared for

Northern States Power Company - WI
1414 West Hamilton Avenue
Eau Claire, WI 54701

January 2008

URS

6737 W. Washington Street, Suite 2265
Milwaukee, WI 53214

25688375.70000

EXECUTIVE SUMMARY

This report presents additional results of the Cap Flux treatability study for the Ashland/Northern States Power Lakefront Superfund Site (Site) described in a previously submitted report, *Cap Flux Test. Ashland/Northern States Power Lakefront Superfund Site* (URS 2007). As part of the test protocol, a sediment column capped with three feet of sand was allowed to run an additional three months (six months total) to compare to the results of a similar column which only ran for three months.

The primary differences observed in the six month test included the following:

1) The rate of gas generation increased substantially after three months;
2) More gas was generated in the last three months than in the first three months; and
3) At the termination of the six month test, somewhat higher levels of PAHs and VOCs were measured in both the bottom and top of the sand cap compared to what was measured after three months.

The fact that the six month test resulted in the generation of more gas than the three month test was likely due to the longer time that methanogenesis (production of methane by anaerobic bacteria) occurred in the column. It should also be noted that the test was operated at warmer temperatures (generally over 20 degrees C) than normally would be experienced at the Site. It is unlikely that the Site would experience temperatures this high for more than 1-2 months per year. It is likely that the continuation of these warmer temperatures over a six month period resulted in an increased rate of methanogenesis.

Overall, the continuation of this cap flux test indicates that even under conditions more favorable to transport than what would be found at the Site, (i.e. significant groundwater upwelling and higher temperatures than would typically be experienced in Site sediments), the three foot sand cap was effective in substantially reducing the transport of contaminants and NAPL to the surface of the cap. Levels of PAHs measured in the top layer of the cap after six months were still less than sediment quality guidelines or the Preliminary Remediation Goal.

TABLE OF CONTENTS

Executive Summary ES-1

1.0 Introduction 1

2.0 Methods and Materials 2
- 2.1 Test Termination 2
- 2.2 Sample Analysis Protocol 3
- 2.3 Other Observations 3

3.0 Results 4
- 3.1 Test Temperature 4
- 3.2 Water and Gas Generation 4
- 3.3 Analytical Results 4
  - 3.3.1 Sediment 4
  - 3.3.2 Water 4
  - 3.3.3 Gas 4
  - 3.3.4 Glass Wool 5
- 3.4 Consolidation Results 5
- 3.5 Other Observations 5

4.0 Discussion 6

5.0 References 8

TABLE OF CONTENTS

Tables

Table 1: Gradients throughout the Flux Test
Table 2: Summary of PAHs and VOCs in Columns 2E at Six Months and 2G at Three Months
Table 3: Summary of PAHs in Water in Column 2E Compared to Column 2G
Table 4: Summary of Gas VOC Results Column 2E
Table 5: Summary of Gas Composition Results in Column 2E Compared to Columns 2C and 2F
Table 6: Summary of PAHs and VOCs in Column 2E Glass Wool after Six Months

Figures

Figure 1: Column Temperatures
Figure 2: Cumulative Water Production
Figure 3: Cumulative Gas Production
Figure 4: Consolidation Results Column 2E and 2G
Figure 5: Column 2E Cap Surface (July, 2007)
Figure 6 Column 2G Cap Surface (June, 2007)
Figure 7 Column 2E Layers

Appendices

Appendix A: Braun Intertec and Test America Laboratory Reports
Appendix B: Column 2E Visual Log
Appendix C: Grain Size Analysis of Lower Sediment Layer

1.0 Introduction

This addendum to the Cap Flux Test report (URS 2007) which was submitted to USEPA on September 18, 2007 presents the results for the sixth column tested in the Cap Flux treatability study for the Ashland/Northern States Power Lakefront Superfund Site (Site). The original columns used in the Cap Flux study were tested over a period of approximately three months; the test with the sixth column, Column 2E, continued for an additional three months resulting in a total test duration of approximately six months. Like the column test conducted with Column 2G, Column 2E was tested with a three foot sand cap and at approximately room temperature. The purpose of this extended test was to compare results observed in the shorter term tests to those from the six month test.

The Cap Flux Test report previously submitted to USEPA (URS 2007) should be consulted for details on the development and approval of this treatability study as well as for the results observed in the other columns. This addendum will focus primarily on how results from the extended duration column test with a three foot sand cap (Column 2E) compared to the shorter term results for the column with a three foot sand cap (Column 2G).

2.0 Methods and Materials

Testing apparatus, methods and materials for the Cap Flux treatability test were described in the original Cap Flux Test report (URS 2007). The primary difference in procedures was that this column test was continued for an additional three months. During the additional three months of testing the following procedures continued:

Measurement of consolidation – the column height was initially measured two to three times a week to start and then less frequently later as the rate of consolidation decreased. Measurements were made with a ruler calibrated in 1/100 foot increments

Collection of gas and water – Gas and water continued to be collected periodically based upon visual observations of the Kynar collection bag at the top of the column. When sufficient water and gas were observed in the bag, based upon the degree to which the bag had visually expanded, the gas and/or water were collected. Since water was delivered under constant upward head at a relatively constant flow rate into the columns, samples of water were collected from the bags on a fairly regular basis and composited for analysis. When a Kynar collection bag was sufficiently filled, a calibrated syringe was attached to the top valve, and the gas and water extracted. The volumes of extracted gas and water were recorded. Two composite water samples were submitted for analysis, one from July 18, 2007, the other a composite sample composed of water collected on August 22, August 30, and September 4, 2007. One gas sample, composited from gas collected from the column bag on July 18, August 31 and September 5, 2007 was submitted for VOC analysis. Gas extracted on each date was immediately pushed though the same adsorbent tubes on the date extracted and refrigerated until shipment. Composite sampling was used to increase sample volume and lower the resulting detection limits for VOC analysis. A second gas sample was also collected on August 2, 2007 and immediately shipped to TestAmerica Laboratories (formerly Severn-Trent) for gas composition analysis. Water samples for PAH and VOC analysis and adsorbent tubes for VOC analysis were shipped to Braun Intertec (Braun). During the first three months the water was also analyzed for VOCs; however during the last three months to collect sufficient volume for PAH analysis, VOC analysis was not conducted.

2.1 Test Termination

The test with Column 2E was terminated on September 5, 2007 and the column was partially drained and the funnels removed. Glass wool was placed in tared jars for shipment to Braun for chemical and gravimetric analysis. Hexane saturated filter paper wipes (glass fiber with no binders) were used to wipe any sediment/NAPL residue on the capture funnel. The paper wipes were placed in the same jar as the glass wool and the paper wipes combined with the glass wool sample contents for extraction and analysis.

In the next step of takedown, the column was sectioned for analysis as described in the Cap Flux Test report (URS 2007). The samples included six inch intervals collected from the top and the bottom of the original core and six inch intervals collected from the bottom and the top of the sand cap.

2.2 Sample Analysis Protocol

As with the shorter term test, all samples (except gas bags) were kept cool after collection and shipped on ice using next day air courier service to the laboratory. Gases collected in the Kynar bags were analyzed by Braun for VOC analysis and by TestAmerica for gas composition analysis. Water collected from the Kynar bags were placed in glass jars and analyzed for PAHs by Braun.

At the end of the test, column sediment and the sand capping materials were sampled and analyzed for PAHs, VOCs, and organic carbon at the following intervals:

- Base six inches of the cap;
- Top six inches of the cap;
- Visibly contaminated upper sediment layer from the original core (with a substantial amount of wood debris); and
- Visibly contaminated lower sediment layer from the original core.

In addition, NAPL and other organics were extracted from the glass wool and paper wipes as described in the Cap Flux Test report (URS 2007) and analyzed for VOCs, PAHs and methylene chloride extractable matter (MEM). Also, a grain size analysis was conducted on the lower sediment layer from the original core sample. Laboratory data are provided in Appendix A.

2.3 Other Observations

Observations of the column were made during the testing period and at termination. A visual log was prepared (Appendix B).

3.0 Results

3.1 Test Temperature

The continuation of the Cap Flux Test (the last three months) was conducted under approximately room temperature which during the test period ranged from approximately 23°C to 26°C (Figure 1).

3.2 Water and Gas Generation

Upward water gradients continued to range from 0.01-0.03 ft/ft (Table 1). The cumulative water and gas collected from the Kynar bags on all columns including extended period of testing for Column 2E are depicted on Figures 2 and 3, respectively.

3.3 Analytical Results

Analytical results are provided in appendices:

- Appendix A: Braun and TestAmerica laboratory reports;
- Appendix B: Column 2E Visual log; and
- Appendix C: Grain size analysis results.

3.3.1 Sediment

The analytical results are summarized for the sediments in columns 2E (six month) and 2G (three month) in Table 2. Based on the laboratory results, the upper sediment layers in both columns (mostly wood debris) were more contaminated than the lower sediment layers.

Total PAHs and total VOCs at the end of three months testing were consistently less than 1 mg/kg in the base of both caps (URS 2007). At the end of the six month test period, total PAHs in the base of the cap in Column 2E were approximately 2.1 mg/kg (Table 2). Of this, naphthalene, 1-methynaphthalene and 2-methylnaphthalene totaled 1.6 mg/kg or about 76% of the total PAHs (Table 2). Total PAHs in the top of the Column 2E cap were approximately 1.1 mg/kg; naphthalene compounds comprised 98% of that.

Total VOCs were 0.34 mg/kg in the base of the cap and were not detected in the top of the cap (Table 2).

3.3.2 Water

Only three PAHs were detected (estimated concentration-'J' qualified) in either of the composite water samples at the end of six months (Table 3). Naphthalene, phenanthrene and pyrene were detected at levels below the method reporting limit (MRL). The highest estimated concentration for any PAH measured at the conclusion of the test was 0.015 µg/L for phenanthrene. VOCs were not analyzed in the water samples.

3.3.3 Gas

No VOCs in gas were detected in gas samples from either Column 2E or 2G after three months, however, 10,395 $\mu g/m^3$ of carbon tetrachloride were detected in the gas collected from Column 2E in the 7/18/07, 8/31/07 and 9/5/07 composite sample (Table 4). Detection limits were

substantially lower in the six month column than in the three month column and the carbon tetrachloride was likely a laboratory contaminant.

Gas composition laboratory reports are also contained in Appendix A. A summary of the analysis is shown in Table 5. Only the two uncapped columns (at three months) and Column 2E (at six months) had sufficient gas volume for this analysis. The major components in Column 2E were methane and nitrogen which together made up 88% of the gas collected. The presence of methane confirms anaerobic bacteria were metabolizing in the columns including in Column 2E.

3.3.4 Glass Wool

Total PAHs in the glass wool in Column 2G at the end of three months were 8.8 µg/sample and total VOCs were 430 µg/sample (URS 2007). The glass wool in Column 2E (six month) was not measured at three months. After six months total PAHs in Column 2E were 8.96 µg/sample and no VOCs were detected (Table 6).

In addition to the chemical analysis, organic material extracted with methylene chloride (MEM) was determined as described in Section 2.2 (Table 6). The MEM in Column 2E was about three times higher (15,540 µg) than Column 2G at three months (5926 µg), but in the range of the other capped columns (URS 2007).

3.4 Consolidation Results

The consolidation measurements are summarized in Figure 4. Most of the consolidation occurred within about the first 70 hours. There was little further settlement of Column 2E during the second three months.

3.5 Other Observations

During set up of the columns it was observed that the upper surface in Column 2E had brown and black wood fiber. On April 9, 2007 water was removed from the overhead collection bag and a 1 inch air pocket was visible. A 1.5 inch pocket was also observed on April 18, 2007 confirming the start of gas generation. A number of gas pockets were visible though the sidewalls of this column in the upper 9 cm of the sediment on May 2, 2007 in Column 2E and also in Column 2G. Beginning May 20, 2007 gas was measured during the water extraction procedure.

As shown in Figure 5 in early July, 2007, based upon the presence of small craters in the cap surface gas ebullition was occurring. This observation is consistent with the increase in gas extraction volumes as shown in Figure 3. These craters were also noted after draining Column 2E during the takedown and were also visible for Column 2G during takedown in June, 2007 as shown in Figure 6.

The layers of sediment shown in Figure 7 for Column 2E were similar to the other test columns. The sediment column includes a dark brown soft sediment layer overlain with a brown and black wood debris layer that contained small pockets of black NAPL. A log of this column is shown in Appendix B.

4.0 Discussion

The Cap Flux Test was designed to simulate conditions under caps of different configurations and evaluate whether PAHs, VOCs and NAPL in underlying sediments are likely to be transported through these caps if placed on contaminated sediments either subaqueously or in a Confined Disposal Facility (CDF).

The results of the Cap Flux Test at the end of three months indicated that low levels of both VOCs and PAHs were transported through all the caps in the bubble phase and were collected in the Kynar bags; however, levels of these constituents passing through the caps were one to two orders of magnitude less than in the uncapped column and two to three orders of magnitude less than in the heated, uncapped column.

After three months, only very low levels of the more water-soluble compounds such as 2-methylnaphthalene and naphthalene were able to pass though the caps in the dissolved phase under a significantly greater upward flow than is expected at the Site. The amount of the more water soluble compounds passing through the caps between the third and sixth months were less than through caps on Column 2G or 2E in the first three months. After six months none of the compounds measured in the water collected in the Kynar bag were detected above the MRL (Table 3).

Visual evidence indicated that NAPL in the form of black drops was transported to the glass wool in the uncapped columns after three months; however, this NAPL was not visible in the glass wool of the capped columns and the presence of substantially lower PAHs and VOCs in the glass wool confirms that NAPL was not transported through the cap. After six months the amount of PAHs trapped by the glass wool (8.96 µg) was approximately the same as what was collected in Column 2G after three months (8.8 µg).

Based upon analysis of sediment, with one exception, no PAHs or VOCs above 1 mg/kg were transported to even the base of the cap in any column during the first three months of testing. The bottom of the cap in the column with a 1.5 ft cap and a carbon mat (Column 2H) had 1 mg/kg total PAHs. After six months the levels of PAHs and VOCs in the cap base and cap top in Column 2E were somewhat greater than in Column 2G after three months. However, the concentration of PAHs in the top of the cap still was only approximately 1 mg/kg (Table 2).

As shown in Figure 3 most of the gas was generated during the last three months of operation in Column 2E. The volume of gas exceeded that in the standard column and was about 2/3 the amount of gas generated in the accelerated (heated) column. It is likely that gas bubbles resulting from ebullition facilitated transport of NAPL and contaminants from the sediments in Column 2E. Only a minor amount of gas was generated in Column 2G during the three months it was tested.

Based upon comparison of the three foot sand cap to the uncapped columns the sand cap still effectively attenuates contaminant transport from the underlying sediments after six months. While there was some measurable increase in PAHs and VOCs in the top layer of the cap, within the sediment to which ecological receptors would be exposed, levels were still considerably less

than sediment quality guidelines or the Preliminary Remediation Goal for the Ashland/Northern States Power Lakefront Superfund Site.

Overall, the continuation of this cap flux test indicates that even under conditions more favorable to transport than what would be found at the Site, (i.e., significant groundwater upwelling and higher temperatures), the three foot sand cap was still effective in substantially reducing the transport of contaminants and NAPL to the surface of the cap.

This six month test generated much more gas in Column 2E than likely would be experienced in Site sediments were they to be capped since the test was operated at warm temperatures (generally over 20°C). The Site would not experience temperatures this high for more than 1-2 months per year due to local climate conditions. At the lower temperatures expected at the Site less gas from anaerobic bacteria would be available to facilitate transport of contaminants from buried sediments. After six months of testing, the three foot cap was effective in substantially reducing contaminant transport even with the relatively high gas ebullition rates observed during this test.

5.0 References

URS. 2007. Cap Flux Test. Ashland/Northern States Power Lakefront Superfund Site.

Tables

Table 1
Gradients [1] Throughout the Flux Test
Ashland/NSP Lakefront Site
Ashland WI

Date	Column 2F Standard, No cap	Column 2C, Accelerated, No Cap	Column 2H 1.5-ft sand cap with carbon mat	Column 2E 3-ft sand cap at 6 Months	Column 2G 3-ft sand cap at 3 Months	Column 2D 5-ft sand cap	Result
3/20/07	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	No Flow
3/29/07	0.1	0.1	0.1	0.1	0.1	0.1 to 0.15 [3]	Flow too high
4/2/07	0.01	0.01	0.01	0.01	0.01	0.01	Flow too low
4/4/07 [2]	.01	.025	.025	.03	.02	.07	Minimal allowable flow

[1] Gradients were calculated as: head cm / length of sediment sample cm

[2] By 4/4/07 the gradients set were the minimum gradient that was found to produce flow into the column from the constant head groundwater reservoir. The gradient remained at these gradients throughout the test.

[3] For Column 2D, the gradient was set to 0.1 for on 3/29/07, which caused the water to flow faster. The water in the reservoir flowed too fast and thus to a level lower than the Marriott tube overnight. When the water level is lower than the Marriott tube, the gradient changed from a constant head to a falling head. By the morning when the column was assessed, the gradient was at approximately 0.15. Flow appeared to have stopped from the reservoir because equilibrium was reached in the water level in the reservoir versus the water level in the column.

Table 2
Summary of PAHs and VOCs in Columns 2E at Six Months and 2G at Three Months
Ashland/NSPLakefront Site
Ashland WI

Test Column		2E - 3 Foot Cap Extended Time at Six Months										2G - 3 Foot Sand Cap at Three Months											
Compound	**Units**	**Upper Sediment Layer**	**flag**	**Lower Sediment Layer**	**flag**	**Cap Base**	**flag**	**Cap Top**	**flag**	**Cap Base Dup.**	**flag**	**Upper Sediment Layer**	**flag**	**Lower Sediment Layer**	**flag**	**Cap Base**	**flag**	**Cap Top**	**flag**	**Upper Charred Sediment Layer**	**flag**	**Cap Base Dup.**	**flag**
PAHs																							
% Solids	% Wt	**85.0**		**85.0**		**89.0**		**86.0**		**86.0**		**88.0**		**80.0**		**86.0**		**40.0**		**31.0**		**84.0**	
1-Methylnaphthalene	mg/kg dry	**470**		**180**		**0.3**		**0.17**		**0.18**		**360**		**160**		**7.20E-03**		**4.00E-03**		**880**		**1.10E-02**	
1-Methylphenanthrene	mg/kg dry	**92**		**38**		ND		ND		**0.019**		**42.0**		**24.0**		**2.40E-03**		7.68E-04	U	**100**		1.20E-03	J
2,3,5-Trimethylnaphthalene	mg/kg dry	**50**		**31**		**0.019**		ND		ND		**26.0**		**14.0**		**1.70E-03**		6.80E-04	J	**64.0**		1.20E-03	J
2,6-Dimethylnaphthalene	mg/kg dry	**230**		**93**		**0.1**		**0.051**		**0.061**		**1.69**		**72**		**5.70E-03**		2.90E-03	J	**410**		**5.00E-03**	
2-Methylnaphthalene	mg/kg dry	**880**		**340**		**0.46**		**0.26**		**0.28**		**660**		**250**		**9.70E-03**		**6.00E-03**		**1400**		**1.30E-02**	
Acenaphthene	mg/kg dry	**350**		**140**		**0.15**		**0.067**		**0.092**		**280**		**120**		**1.30E-02**		**4.90E-03**		**730**		**1.30E-02**	
Acenaphthylene	mg/kg dry	**21**		**12**		0.021		ND		**0.016**		**19.0**		**13.0**		1.50E-03	J	8.80E-04	J	**41.0**		8.40E-04	J
Anthracene	mg/kg dry	**170**		**69**		**0.038**		ND		**0.032**		**120**		**52.0**		**8.30E-03**		2.20E-03	J	**290**		**4.50E-03**	
Benz(a)anthracene	mg/kg dry	**60**		**27**		ND		ND		**0.017**		**46.0**		**24.0**		**3.60E-03**		8.30E-04	U	**110**		1.70E-03	J
Benzo(a)pyrene	mg/kg dry	**37**		**21**		ND		ND		ND		**36.0**		**20.0**		**2.80E-03**		8.60E-04	U	**94.0**		1.20E-03	J
Benzo(b)fluoranthene	mg/kg dry	**28**		**14**		ND		ND		ND		**17.0**		**12.0**		1.40E-03	J	4.50E-04	J	**48.0**		5.90E-04	J
Benzo(e)pyrene	mg/kg dry	**21**		**11**		ND		ND		ND		**19.0**		**10.0**		1.40E-03	J	1.10E-03	U	**47.0**		7.20E-04	J
Benzo(g,h,i)perylene	mg/kg dry	**4**		**1.9**		ND		ND		ND		**19.0**		**11.0**		1.40E-03	J	9.80E-04	U	**50.0**		7.50E-04	J
Benzo(k)fluoranthene	mg/kg dry	**29**		**15**		ND		ND		ND		**25.0**		**11.0**		**2.00E-03**		5.00E-04	J	**59.0**		9.70E-04	J
Biphenyl	mg/kg dry	**51**		**29**		**0.028**		ND		**0.018**		**52.0**		**25.0**		**1.80E-03**		1.10E-03	J	**130**		**1.80E-03**	
Chrysene	mg/kg dry	**45**		**24**		**0.028**		ND		**0.016**		**44.0**		**24.0**		**3.10E-03**		1.10E-03	U	**110**		1.50E-03	J
Dibenz(a,h)anthracene	mg/kg dry	**0.7**		**0.33**		ND		ND		ND		**5.90**		**4.60**		5.40E-04	J	1.10E-03	U	**21.0**		5.00E-04	U
Fluoranthene	mg/kg dry	**140**		**57**		**0.027**		ND		**0.04**		**99.0**		**44.0**		**8.90E-03**		1.60E-03	J	**280**		**4.00E-03**	
Fluorene	mg/kg dry	**160**		**71**		**ND**		0.02		**0.045**		**110**		**47.0**		**8.60E-03**		4.10E-03	J	**280**		**7.20E-03**	
Indeno(1,2,3-cd)pyrene	mg/kg dry	**4.7**		**2.3**		ND		ND		ND		**14.0**		**8.10**		1.20E-03	J	1.20E-03	U	**37.0**		5.70E-04	J
Naphthalene	mg/kg dry	**1100**		**420**		**0.84**		**0.5**		**0.51**		**1.62**		**310**		**1.10E-02**		**7.20E-03**		**1400**		**2.30E-02**	
Perylene	mg/kg dry	**5.3**		**3**		ND		ND		ND		**6.20**		**4.20**		6.00E-04	J	1.10E-03	U	**17.0**		5.10E-04	U
Phenanthrene	mg/kg dry	**380**		**150**		**0.091**		**0.021**		**0.084**		**350**		**150**		**2.60E-02**		**8.70E-03**		**940**		**1.50E-02**	
Pyrene	mg/kg dry	**190**		**78**		**0.037**		ND		**0.048**		**150**		**64.0**		**1.20E-02**		1.90E-03	J	**410**		**5.50E-03**	
PAHs, Total[1]	mg/kg dry	4,519		1,828		2.14		1.09		1.46		2,503		1,474		0.136		0.047		7,948		0.114	
Total Organic Carbon																							
TOC	mg/kg dry	**360,000**		**3050**		ND		ND		ND		**206,000**		1,000	U	**4,820**		1,000	U	370,000		4,820	
VOCs																							
1,2,3-Trimethylbenzene	mg/kg dry	**14**		**5.5**		ND		ND		ND		**2.70**		**1.00**		0.001	U	0.002	U	**1.80**		0.000	U
1,2,4-Trimethylbenzene	mg/kg dry	**31**		**12**		**0.027**		ND		ND		**7.80**		**2.80**		0.002	U	0.003	U	**5.40**		0.001	U
1,3,5-Trimethylbenzene	mg/kg dry	**8.5**		**3.2**		ND		ND		ND		**2.00**		**0.660**		0.002	U	0.005	U	0.160	U	0.001	U
1,4-Dichlorobenzene	mg/kg dry	ND		ND		ND		ND		ND		0.140	U	0.017	U	0.003	U	0.006	U	0.190	U	0.002	U
Benzene	mg/kg dry	**4.1**		**1.3**		**0.13**		ND		**0.094**		0.050	U	**0.360**		0.001	U	0.002	U	0.070	U	**0.044**	
Carbon Tetrachloride	mg/kg dry	ND		ND		ND		ND		ND		0.064	U	8.10E-03	U	0.001	U	0.003	U	0.089	U	0.001	U
Ethylbenzene	mg/kg dry	**52**		**22**		**0.091**		ND		**0.071**		**9.30**		**5.90**		0.002	U	0.005	U	**6.10**		**0.016**	
m,p-Xylenes	mg/kg dry	**40**		**17**		**0.035**		ND		ND		**7.10**		**4.00**		0.003	U	0.006	U	**5.50**		0.002	U
o-Xylene	mg/kg dry	**21**		**9**		**0.056**		ND		**0.045**		**3.60**		**2.10**		0.003	U	0.006	U	**2.80**		0.002	U
sec-Butylbenzene	mg/kg dry	ND		ND		ND		ND		ND		0.048	U	6.10E-03	U	0.001	U	0.002	U	0.067	U	0.001	U
Styrene	mg/kg dry	ND		ND		ND		ND		ND		0.052	U	6.70E-03	U	0.001	U	0.002	U	0.073	U	0.001	U
Toluene	mg/kg dry	**18**		**10**		ND		ND		ND		**2.40**		**2.30**		0.004	U	0.008	U	**2.00**		0.003	U
Trichloroethene	mg/kg dry	ND		ND		ND		ND		ND		0.084	U	0.011	U	0.002	U	0.003	U	0.120	U	0.001	U
VOCs, Total[1]	mg/kg dry	188.6		80		0.34		0		0.21		34.9		19.1		0		0		23.6		0.060	

Flag:
U=Analyte not detected
J=Detected but below Method Reporting Limit; therefore result is an estimated concentration

Footnote:
[1]Totals do not include analytes not detected

Note:
Results in bold above Method Reporting Limit

Table 3
Summary of PAHs in Water in
Column 2E Compared to Column 2G
Ashland/NSP Lakefront Site
Ashland, WI

Compound	Units	Column 2E 5/23/2007	Column 2E 6/15/2007	Column 2E 7/18/2007	Column 2E Composite 8/31, 8/22, 9/4/2007	Column 2G 6/1/2007
PAHs						
1-Methylnaphthalene	µg/L	ND	ND	ND	ND	ND
1-Methylphenanthrene	µg/L	ND	ND	ND	ND	ND
2,3,5-Trimethylnaphthalene	µg/L	ND	ND	ND	ND	ND
2,6-Dimethylnaphthalene	µg/L	ND	ND	ND	ND	ND
2-Methylnaphthalene	µg/L	ND	0.019	ND	ND	0.034
Acenaphthene	µg/L	0.017	**0.037**	ND	ND	0.039
Acenaphthylene	µg/L	0.018	ND	ND	ND	ND
Anthracene	µg/L	ND	ND	ND	ND	ND
Benz(a)anthracene	µg/L	ND	ND	ND	ND	ND
Benzo(a)pyrene	µg/L	0.015	ND	ND	ND	ND
Benzo(b)fluoranthene	µg/L	0.0096	ND	ND	ND	ND
Benzo(e)pyrene	µg/L	0.0093	ND	ND	ND	ND
Benzo(g,h,i)perylene	µg/L	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	µg/L	0.0096	ND	ND	ND	ND
Biphenyl	µg/L	ND	ND	ND	ND	ND
Chrysene	µg/L	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	µg/L	ND	ND	ND	ND	ND
Fluoranthene	µg/L	ND	ND	ND	ND	ND
Fluorene	µg/L	0.0059	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	µg/L	0.0097	ND	ND	ND	ND
Naphthalene	µg/L	0.0048	0.035	0.027	0.004	0.19
Perylene	µg/L	ND	ND	ND	ND	ND
Phenanthrene	µg/L	**0.023**	ND	0.013	0.015	ND
Pyrene	µg/L	0.01	ND	0.008	0.006	ND
PAHs, Total[1]	µg/L	0.122	0.091	0.048	0.025	0.263

Flag:
ND=Analyte not detected

Footnote:
[1]Totals do not include analytes not detected

Note:
Results below the MRL are shown without bold and bold is shown for above the MRL.

Table 4
Summary of Gas VOC Results Column 2E
Ashland/NSP Lakefront Site
Ashland WI

Compound	Units	Column 2E (0703573-03) 6/11/07	flag		Column 2E (0703573-02) 6/15/07	flag	Column 2E (0705565-07) 7/18/07,8/31/07 & 9/5/07 Composite	flag
VOCs								
1,2,3-Trimethylbenzene	ug/m^3	30,300	U		38,800	U	5,760	U
1,2,4-Trimethylbenzene	ug/m^3	29,700	U		38,000	U	5,646	U
1,3,5-Trimethylbenzene	ug/m^3	28,800	U		37,000	U	5,475	U
1,4-Dichlorobenzene	ug/m^3	34,700	U		44,500	U	6,596	U
Benzene	ug/m^3	29,700	U		38,100	U	5,646	U
Carbon Tetrachloride	ug/m^3	324,000	U		416,000	U	**10,395**	
Ethylbenzene	ug/m^3	29,400	U		37,700	U	5,589	U
sec-Butylbenzene	ug/m^3	29,400	U		37,700	U	5,722	U
Styrene	ug/m^3	39,200	U		50,300	U	7,452	U
Toluene	ug/m^3	30,200	U		38,700	U	5,741	U
Trichloroethene	ug/m^3	29,900	U		37,400	U	5,684	U
Xylenes, Total	ug/m^3	29,900	U		37,400	U	5,684	U
VOCs, Total[1]	ug/m^3	0	U		0	U	10,395	

Flag:
U=Analyte not detected

Footnote:
[1]Totals do not include analytes not detected

Note:
Results in bold above Method Reporting Limit
No MDL reported. Non Detects represent MRL

Table 5
Summary of Gas Composition Results
Column 2E Compared to Columns 2C and 2F
Ashland/NSP Lakefront Site
Ashland WI

Compound	Units	Column 2C Accelerated No Cap 5/09/07	flag	Column 2C Accelerated No Cap 5/21/07	flag	Column 2C Accelerated No Cap 6/05/07	flag	Column 2F Standard No Cap 5/21/07	flag	Column 2F Standard No Cap 6/05/07	flag	Column 2E 3-FT Cap Extended Time 8/2/07	flag
Gases													
Carbon Dioxide	% V/V	3.6		3.8		3.7		1.2		2.4		0.4	
Oxygen	% V/V	3.6		4.7		5.6		8.3		7.8		9.9	
Nitrogen	% V/V	34		25		29		45		37		48	
Methane	% V/V	59		66		61		45		51		40	

Flag:
U=Analyte not detected
J=Detected but below Method Reporting Limit; therefore result is an estimated concentration

Table 6
Summary of PAHs and VOCs in
Column 2E Glass Wool after Six Months
Ashland/NSP Lakefront Site
Ashland, WI

PAHs		
1-Methylnaphthalene	ug/sample	0.2
1-Methylphenanthrene	ug/sample	ND
2,3,5-Trimethylnaphthalene	ug/sample	ND
2,6-Dimethylnaphthalene	ug/sample	ND
2-Methylnaphthalene	ug/sample	ND
Acenaphthene	ug/sample	0.27
Acenaphthylene	ug/sample	0.48
Anthracene	ug/sample	0.14
Benz(a)anthracene	ug/sample	**0.66**
Benzo(a)pyrene	ug/sample	**0.91**
Benzo(b)fluoranthene	ug/sample	**0.6**
Benzo(e)pyrene	ug/sample	**0.52**
Benzo(g,h,i)perylene	ug/sample	**0.59**
Benzo(k)fluoranthene	ug/sample	**0.63**
Biphenyl	ug/sample	ND
Chrysene	ug/sample	**0.61**
Dibenz(a,h)anthracene	ug/sample	0.13
Fluoranthene	ug/sample	0.21
Fluorene	ug/sample	ND
Indeno(1,2,3-cd)pyrene	ug/sample	0.45
Naphthalene	ug/sample	**2.00**
Perylene	ug/sample	0.14
Phenanthrene	ug/sample	ND
Pyrene	ug/sample	0.42
PAHs, Total	*ug/sample*	*8.96*
VOCs		
1,2,3-Trimethylbenzene	ug/sample	ND
1,2,4-Trimethylbenzene	ug/sample	ND
1,3,5-Trimethylbenzene	ug/sample	ND
1,4-Dichlorobenzene	ug/sample	ND
Benzene	ug/sample	ND
Carbon Tetrachloride	ug/sample	ND
Ethylbenzene	ug/sample	ND
Xylenes, total	ug/sample	ND
sec-Butylbenzene	ug/sample	ND
Styrene	ug/sample	ND
Toluene	ug/sample	ND
Trichloroethene	ug/sample	ND
VOCs, Total	*ug/sample*	*ND*
MEM		
MEM	ug/sample	15,540

Footnote:

[1]Totals do not include analytes not detected

Note:

Results in bold above Method Reporting Limit

The remaining data were 'J' qualified.

Figures

Figure 1
Column Temperatures
Ashland/NSP Lakefront Site
Ashland WI

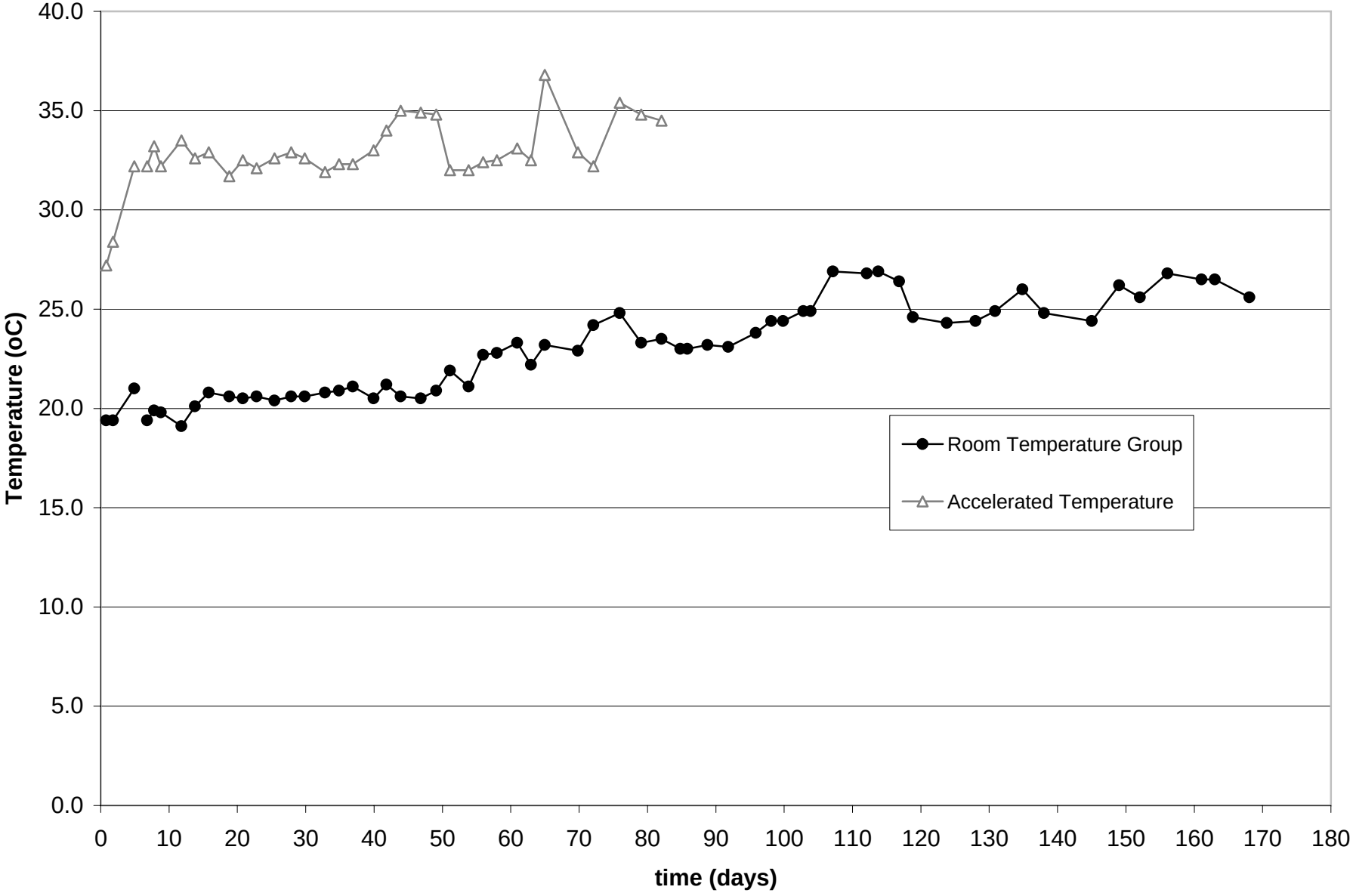


Figure 2
Cumulative Water Production
Ashland/NSP Lakefront Site
Ashland, WI

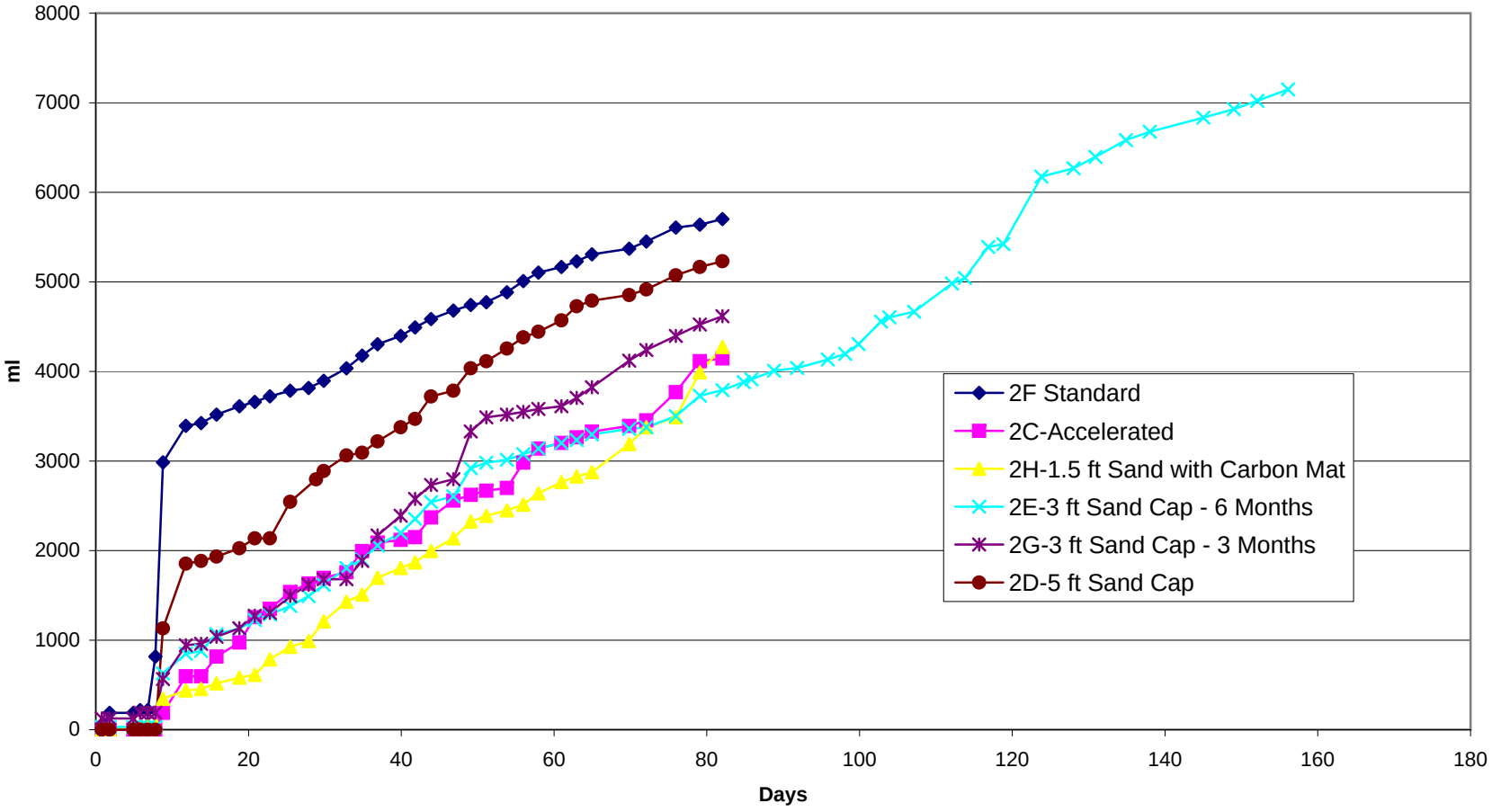


Figure 3
Cumulative Gas Production
Ashland/NSP Lakefront Site
Ashland WI

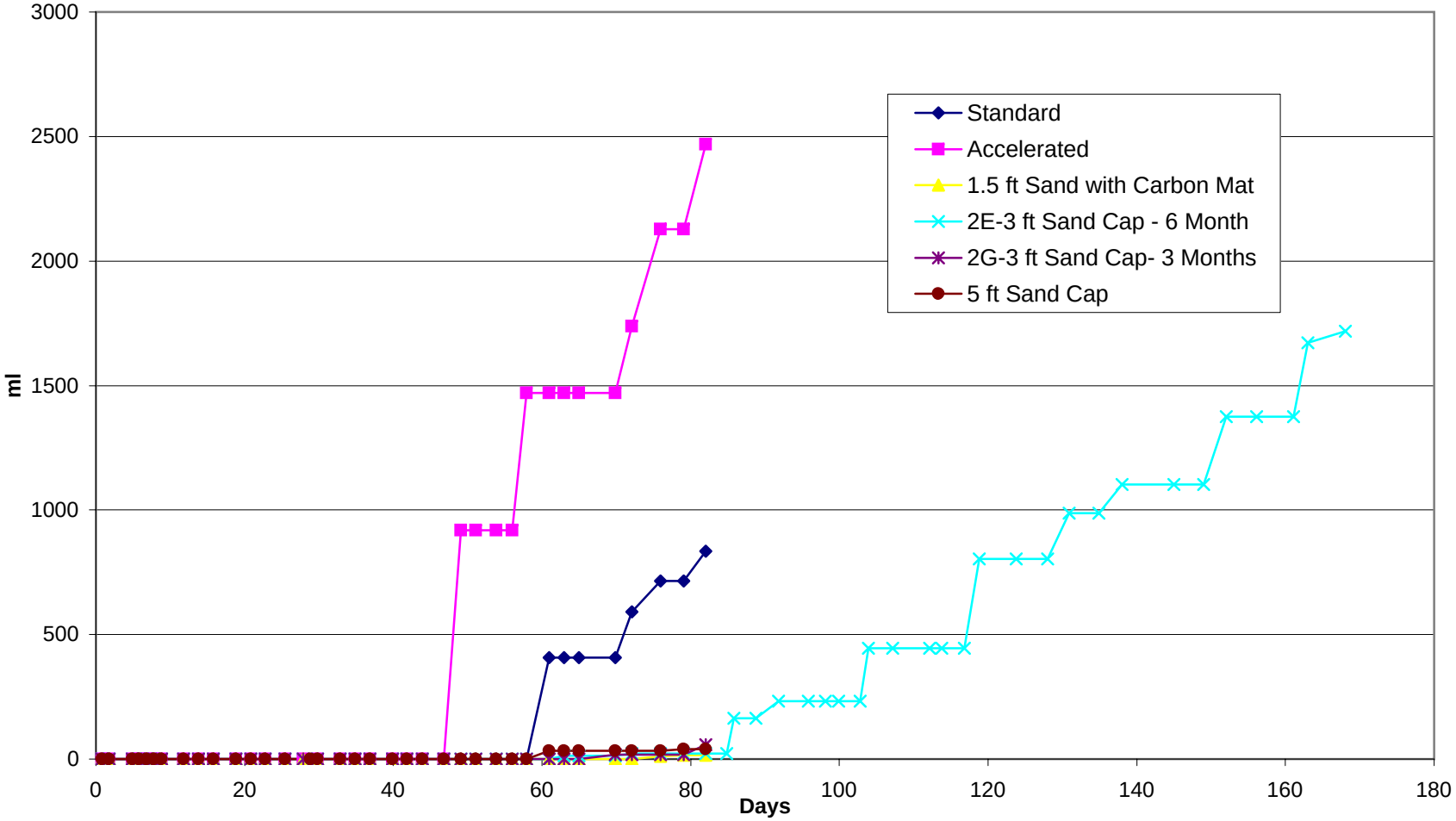
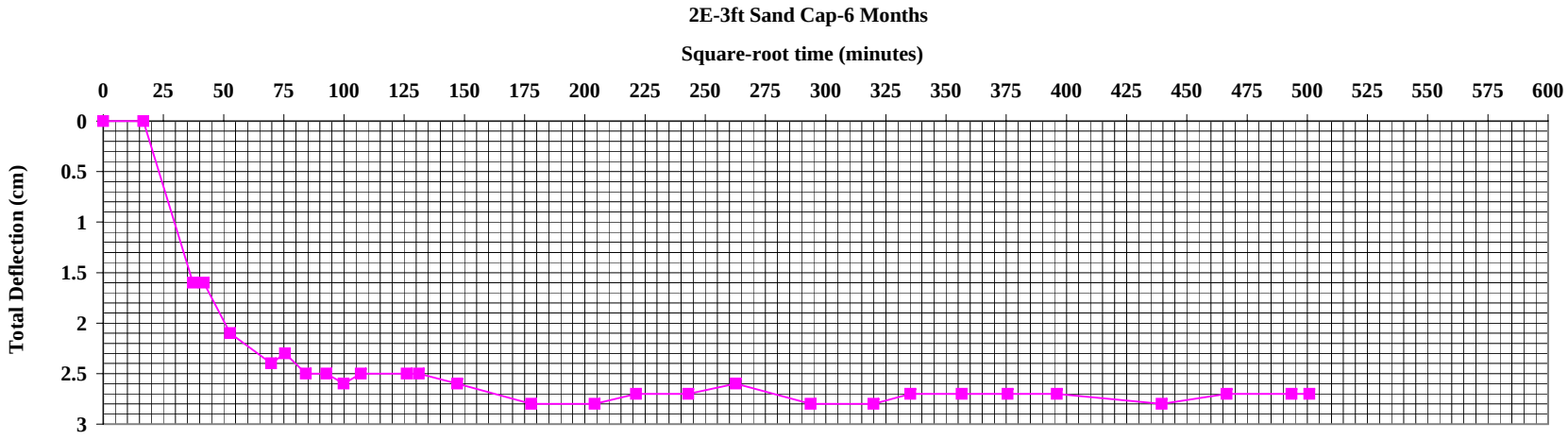


Figure 4
Consolidation Results (Deflection)
Columns 2E and 2G
Ashland/NSP Lakefront Site
Ashland WI



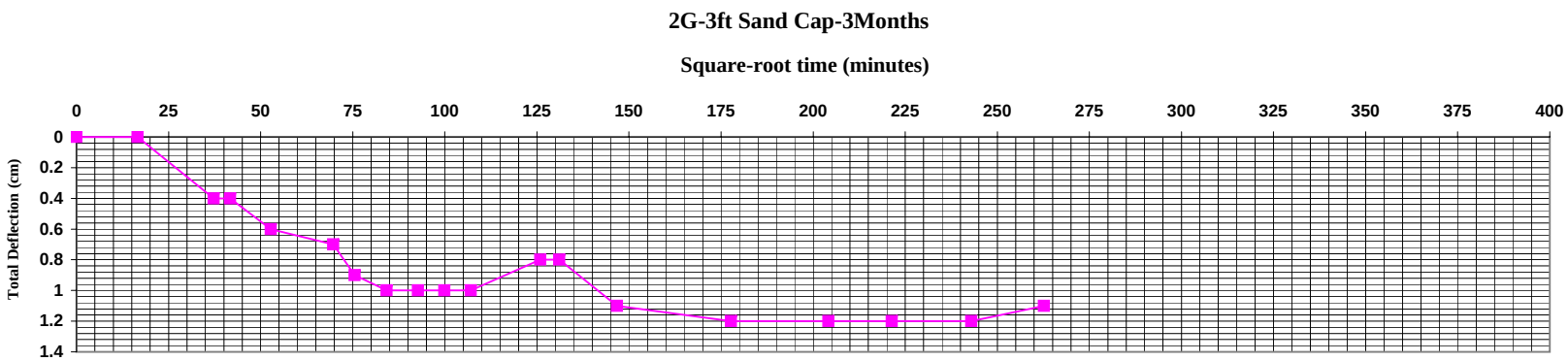
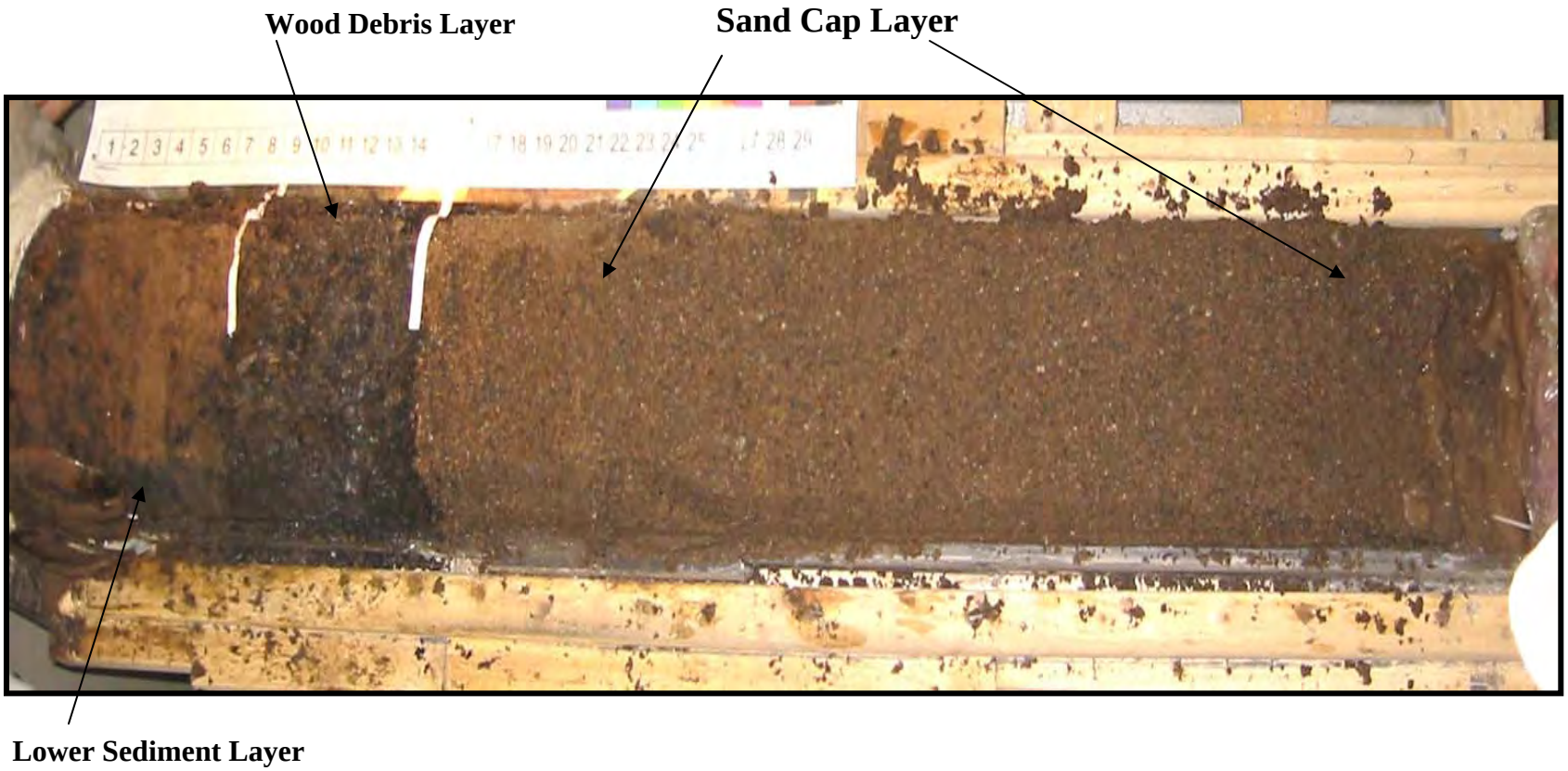


Figure 5
Column 2E Cap Surface
July, 2007
Ashland/NSP Lakefront Site
Ashland WI

Figure 6
Column 2G Cap Surface
June, 2007
Ashland/NSP Lakefront Site
Ashland WI

Figure 7
Column 2E Layers
Ashland/NSP Lakefront Site
Ashland WI



Appendix A

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

September 27, 2007

Work Order #: 0705565

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on September 06, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relevant to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Qualifiers and Abbreviations

vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
ts	This analysis was performed by a subcontract laboratory.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
go	The laboratory control sample recovery is outside of laboratory control limits.
gg	The sample was received past the method specified holding time.
A1	The Relative Percent Difference between the Blank Spike and Blank Spike Duplicate was 28.5%. The laboratory limit is 20. This may indicate a larger uncertainty to the accuracy of the reported results.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit
NA	Not Applicable
ND	Analyte NOT DETECTED
NR	Not Reported
%Rec	Percent Recovery
RPD	Relative Percent Difference
VOC	Volatile Organic Compound

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Col 2E Upper Sediment Layer	0705565-01	Soil	09/05/07 11:10	09/06/07 09:45
Col 2E Lower Sediment Layer	0705565-02	Soil	09/05/07 11:15	09/06/07 09:45
Col 2E Cap Base	0705565-03	Soil	09/05/07 10:55	09/06/07 09:45
Col 2E Cap Base Duplicate	0705565-04	Soil	09/05/07 11:00	09/06/07 09:45
Col 2E Compliance Zone	0705565-05	Soil	09/05/07 11:05	09/06/07 09:45
Col 2E Glass Wool	0705565-06	Glass Wool	09/05/07 10:00	09/06/07 09:45
Col 2E Composite	0705565-07	ug-airtube	07/18/07 12:00	09/06/07 09:45
Col 2E Composite (7/18)	0705565-08	Water	07/18/07 12:00	09/06/07 09:45
Col 2E Composite (8/31 & 8/22 & 9/4)	0705565-09	Water	08/31/07 12:00	09/06/07 09:45

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	7.8 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	No
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	NA	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Upper Sediment Layer

0705565-01 (Soil)

9/5/07 11:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**85**	0.050	0.010	% Wt	B7I0073	9/6/07	9/6/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**470**	0.037	0.0060	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
1-Methylphenanthrene	**92**	0.037	0.0044	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**50**	0.0037	0.00044	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**230**	0.037	0.0055	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2-Methylnaphthalene	**880**	0.18	0.063	mg/kg dry	B7I0154	9/11/07	9/14/07	EPA 8270C	
Acenaphthene	**350**	0.037	0.0055	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthylene	**21**	0.0037	0.00038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Anthracene	**170**	0.037	0.0055	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benz(a)anthracene	**60**	0.037	0.0055	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(a)pyrene	**37**	0.0037	0.00044	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(b)fluoranthene	**28**	0.0037	0.00093	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(e)pyrene	**21**	0.0037	0.00046	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(g,h,i)perylene	**4.0**	0.0037	0.00033	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(k)fluoranthene	**29**	0.0037	0.00077	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Biphenyl	**51**	0.0037	0.00066	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Chrysene	**45**	0.0037	0.00055	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Dibenz(a,h)anthracene	**0.70**	0.0037	0.0012	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluoranthene	**140**	0.037	0.0038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluorene	**160**	0.037	0.0022	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**4.7**	0.0037	0.00049	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Naphthalene	**1100**	0.18	0.014	mg/kg dry	B7I0154	9/11/07	9/14/07	EPA 8270C	
Perylene	**5.3**	0.0037	0.00060	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Phenanthrene	**380**	0.37	0.0044	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Pyrene	**190**	0.037	0.0055	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*70.2 %*	*Limits: 30-104%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*70.5 %*	*Limits: 30-90%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*81.8 %*	*Limits: 30-115%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Upper Sediment Layer

0705565-01 (Soil)

9/5/07 11:10

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**14**	1.2	0.038	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
1,2,4-Trimethylbenzene	**31**	1.2	0.083	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
1,3,5-Trimethylbenzene	**8.5**	1.2	0.12	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.2	0.14	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
Benzene	**4.1**	1.2	0.052	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
Carbon Tetrachloride	ND	12	0.066	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
Ethylbenzene	**52**	1.2	0.13	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
m,p-Xylenes	**40**	1.2	0.15	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	go
o-Xylene	**21**	1.2	0.17	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
sec-Butylbenzene	ND	1.2	0.050	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
Styrene	ND	1.2	0.054	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	go
Toluene	**18**	1.2	0.20	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
Trichloroethene	ND	1.2	0.087	mg/kg dry	B7I0213	9/11/07	9/12/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*95.2 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/12/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*101 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/12/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*100 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/12/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*112 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/12/07*	*EPA 8260B*	

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**360000**	1000	1000	mg/kg	B7I0206	9/11/07	9/11/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Lower Sediment Layer

0705565-02 (Soil)

9/5/07 11:15

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**85**	0.050	0.010	% Wt	B7I0073	9/6/07	9/6/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**180**	0.013	0.0021	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
1-Methylphenanthrene	**38**	0.013	0.0015	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**31**	0.013	0.0015	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**93**	0.013	0.0019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2-Methylnaphthalene	**340**	0.065	0.022	mg/kg dry	B7I0154	9/11/07	9/14/07	EPA 8270C	
Acenaphthene	**140**	0.013	0.0019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthylene	**12**	0.0013	0.00013	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Anthracene	**69**	0.013	0.0019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benz(a)anthracene	**27**	0.013	0.0019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(a)pyrene	**21**	0.013	0.0015	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(b)fluoranthene	**14**	0.0013	0.00033	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(e)pyrene	**11**	0.0013	0.00016	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(g,h,i)perylene	**1.9**	0.0013	0.00012	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(k)fluoranthene	**15**	0.0013	0.00027	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Biphenyl	**29**	0.013	0.0023	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Chrysene	**24**	0.013	0.0019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Dibenz(a,h)anthracene	**0.33**	0.0013	0.00040	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluoranthene	**57**	0.013	0.0013	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluorene	**71**	0.013	0.00077	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**2.3**	0.0013	0.00017	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Naphthalene	**420**	0.065	0.0048	mg/kg dry	B7I0154	9/11/07	9/14/07	EPA 8270C	
Perylene	**3.0**	0.0013	0.00021	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Phenanthrene	**150**	0.13	0.0015	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Pyrene	**78**	0.013	0.0019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*97.2 %*	*Limits: 30-104%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*81.7 %*	*Limits: 30-90%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*110 %*	*Limits: 30-115%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Lower Sediment Layer

0705565-02 (Soil)

9/5/07 11:15

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**5.5**	0.29	0.0094	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,2,4-Trimethylbenzene	**12**	0.29	0.021	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,3,5-Trimethylbenzene	**3.2**	0.29	0.029	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.29	0.035	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Benzene	**1.3**	0.29	0.013	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Carbon Tetrachloride	ND	2.9	0.016	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Ethylbenzene	**22**	0.29	0.031	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
m,p-Xylenes	**17**	0.29	0.037	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
o-Xylene	**9.0**	0.29	0.041	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
sec-Butylbenzene	ND	0.29	0.012	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Styrene	ND	0.29	0.013	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
Toluene	**10**	0.29	0.050	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Trichloroethene	ND	0.29	0.022	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*96.4 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*105 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*97.6 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*110 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**3050**	1000	1000	mg/kg	B7I0206	9/11/07	9/11/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Cap Base

0705565-03 (Soil)

9/5/07 10:55

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**89**	0.050	0.010	% Wt	B7I0073	9/6/07	9/6/07	EPA 3545 7.2	

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**0.30**	0.00025	0.000041	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
1-Methylphenanthrene	ND	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**0.019**	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**0.10**	0.00025	0.000037	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2-Methylnaphthalene	**0.46**	0.00025	0.000086	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthene	**0.15**	0.00025	0.000037	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthylene	**0.021**	0.00025	0.000026	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Anthracene	**0.038**	0.00025	0.000037	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benz(a)anthracene	ND	0.00025	0.000037	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(a)pyrene	ND	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(b)fluoranthene	ND	0.00025	0.000064	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(e)pyrene	ND	0.00025	0.000031	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	0.00025	0.000022	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(k)fluoranthene	ND	0.00025	0.000052	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Biphenyl	**0.028**	0.00025	0.000045	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Chrysene	**0.028**	0.00025	0.000037	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	0.00025	0.000079	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluoranthene	**0.027**	0.00025	0.000026	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluorene	ND	0.00025	0.000015	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	0.00025	0.000034	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Naphthalene	**0.84**	0.00025	0.000019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Perylene	ND	0.00025	0.000041	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Phenanthrene	**0.091**	0.0025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Pyrene	**0.037**	0.00025	0.000037	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*82.0 %*	*Limits: 30-104%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*65.7 %*	*Limits: 30-90%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Cap Base

0705565-03 (Soil)

9/5/07 10:55

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Terphenyl-d14	*84.0 %*	*Limits: 30-115%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.024	0.00078	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,2,4-Trimethylbenzene	**0.027**	0.024	0.0017	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.024	0.0024	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.024	0.0029	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Benzene	**0.13**	0.024	0.0011	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Carbon Tetrachloride	ND	0.24	0.0014	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Ethylbenzene	**0.091**	0.024	0.0026	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
m,p-Xylenes	**0.035**	0.024	0.0031	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
o-Xylene	**0.056**	0.024	0.0034	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
sec-Butylbenzene	ND	0.024	0.0010	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Styrene	ND	0.024	0.0011	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
Toluene	ND	0.024	0.0042	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Trichloroethene	ND	0.024	0.0018	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*98.4 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*100 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.0 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*112 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	ND	1000	1000	mg/kg	B7I0206	9/11/07	9/11/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Cap Base Duplicate

0705565-04 (Soil)

9/5/07 11:00

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**86**	0.050	0.010	% Wt	B7I0073	9/6/07	9/6/07	EPA 3545 7.2	

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**0.18**	0.00025	0.000042	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
1-Methylphenanthrene	**0.019**	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**0.061**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2-Methylnaphthalene	**0.28**	0.00025	0.000087	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthene	**0.092**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthylene	**0.016**	0.00025	0.000027	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Anthracene	**0.032**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benz(a)anthracene	**0.017**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(a)pyrene	ND	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(b)fluoranthene	ND	0.00025	0.000064	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(e)pyrene	ND	0.00025	0.000032	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	0.00025	0.000023	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(k)fluoranthene	ND	0.00025	0.000053	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Biphenyl	**0.018**	0.00025	0.000045	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Chrysene	**0.016**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	0.00025	0.000080	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluoranthene	**0.040**	0.00025	0.000027	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluorene	**0.045**	0.00025	0.000015	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	0.00025	0.000034	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Naphthalene	**0.51**	0.00025	0.000019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Perylene	ND	0.00025	0.000042	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Phenanthrene	**0.084**	0.0025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Pyrene	**0.048**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*85.9 %*	*Limits: 30-104%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*71.8 %*	*Limits: 30-90%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*82.7 %*	*Limits: 30-115%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Cap Base Duplicate

0705565-04 (Soil)

9/5/07 11:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.024	0.00076	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.024	0.0017	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.024	0.0023	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.024	0.0029	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Benzene	**0.094**	0.024	0.0010	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Carbon Tetrachloride	ND	0.24	0.0013	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Ethylbenzene	**0.071**	0.024	0.0025	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
m,p-Xylenes	ND	0.024	0.0030	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
o-Xylene	**0.045**	0.024	0.0033	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
sec-Butylbenzene	ND	0.024	0.0010	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Styrene	ND	0.024	0.0011	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
Toluene	ND	0.024	0.0041	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Trichloroethene	ND	0.024	0.0018	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*98.0 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*98.8 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.8 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*112 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	ND	1000	1000	mg/kg	B7I0206	9/11/07	9/11/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Compliance Zone

0705565-05 (Soil)

9/5/07 11:05

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**86**	0.050	0.010	% Wt	B7I0073	9/6/07	9/6/07	EPA 3545 7.2	

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**0.17**	0.00025	0.000042	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
1-Methylphenanthrene	ND	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**0.051**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
2-Methylnaphthalene	**0.26**	0.00025	0.000087	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthene	**0.067**	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Acenaphthylene	ND	0.00025	0.000026	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Anthracene	ND	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benz(a)anthracene	ND	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(a)pyrene	ND	0.00025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(b)fluoranthene	ND	0.00025	0.000064	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(e)pyrene	ND	0.00025	0.000032	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	0.00025	0.000023	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Benzo(k)fluoranthene	ND	0.00025	0.000053	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Biphenyl	ND	0.00025	0.000045	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Chrysene	ND	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	0.00025	0.000079	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluoranthene	ND	0.00025	0.000026	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Fluorene	**0.020**	0.00025	0.000015	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	0.00025	0.000034	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Naphthalene	**0.50**	0.00025	0.000019	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Perylene	ND	0.00025	0.000042	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Phenanthrene	**0.021**	0.0025	0.000030	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Pyrene	ND	0.00025	0.000038	mg/kg dry	B7I0154	9/11/07	9/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*85.2 %*	*Limits: 30-104%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*73.8 %*	*Limits: 30-90%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Compliance Zone

0705565-05 (Soil)

9/5/07 11:05

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Terphenyl-d14	*83.4 %*	*Limits: 30-115%*			*B7I0154*	*9/11/07*	*9/12/07*	*EPA 8270C*	

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.058	0.0019	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.058	0.0041	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.058	0.0057	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.058	0.0070	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Benzene	ND	0.058	0.0026	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Carbon Tetrachloride	ND	0.58	0.0033	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Ethylbenzene	ND	0.058	0.0062	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
m,p-Xylenes	ND	0.058	0.0074	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
o-Xylene	ND	0.058	0.0082	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
sec-Butylbenzene	ND	0.058	0.0025	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Styrene	ND	0.058	0.0027	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	go
Toluene	ND	0.058	0.010	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Trichloroethene	ND	0.058	0.0043	mg/kg dry	B7I0213	9/11/07	9/11/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*99.2 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*98.4 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.8 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*114 %*	*Limits: 80-120%*			*B7I0213*	*9/11/07*	*9/11/07*	*EPA 8260B*	

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	ND	1000	1000	mg/kg	B7I0206	9/11/07	9/11/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Glass Wool

0705565-06 (Glass Wool)

9/5/07 10:00

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
MEM after 105	**15540**			ug/sample	B7I0255	9/10/07	9/11/07	In-House	
MEM after 550	**5844**			ug/sample	B7I0255	9/10/07	9/11/07	In-House	

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	0.20 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
1-Methylphenanthrene	ND	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
2,6-Dimethylnaphthalene	ND	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
2-Methylnaphthalene	ND	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Acenaphthene	0.27 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Acenaphthylene	0.48 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Anthracene	0.14 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Benz(a)anthracene	**0.66**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Benzo(a)pyrene	**0.91**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Benzo(b)fluoranthene	**0.60**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Benzo(e)pyrene	**0.52**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Benzo(g,h,i)perylene	**0.59**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Benzo(k)fluoranthene	**0.63**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Biphenyl	ND	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Chrysene	**0.61**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Dibenz(a,h)anthracene	0.13 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Fluoranthene	0.21 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Fluorene	ND	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	0.45 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Naphthalene	**2.0**	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Perylene	0.14 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Phenanthrene	ND	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Pyrene	0.42 J	0.50	0.10	ug/sample	B7I0133	9/10/07	9/14/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*88.4 %*	*Limits: 30-120%*			*B7I0133*	*9/10/07*	*9/14/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*81.2 %*	*Limits: 30-120%*			*B7I0133*	*9/10/07*	*9/14/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Glass Wool

0705565-06 (Glass Wool)

9/5/07 10:00

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Terphenyl-d14	*99.2 %*	*Limits: 30-120%*			*B7I0133*	*9/10/07*	*9/14/07*	*EPA 8270C*	

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
1,2,4-Trimethylbenzene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
1,3,5-Trimethylbenzene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
1,4-Dichlorobenzene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
Benzene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
Carbon Tetrachloride	ND	800	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
Ethyl Benzene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
sec-Butylbenzene	ND	410	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
Styrene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
Toluene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
Trichloroethene	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	
Xylenes, Total	ND	400	400	ug/sample	B7I0214	9/12/07	9/14/07	EPA 8015	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Composite

0705565-07 (ug-airtube)

7/18/07 12:00

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	3.03		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
1,2,4-Trimethylbenzene	ND	2.97		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	2.88		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
1,4-Dichlorobenzene	ND	3.47		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
Benzene	ND	2.97		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
Carbon Tetrachloride	**54.6**	6.12		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
Ethyl Benzene	ND	2.94		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
sec-Butylbenzene	ND	3.01		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
Styrene	ND	3.92		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	A1
Toluene	ND	3.02		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
Trichloroethene	ND	2.99		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	
Xylenes, Total	ND	2.99		ug/tube	[CALC]	9/13/07	9/14/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Composite (7/18)

0705565-08 (Water)

7/18/07 12:00

Polyaromatic Hydrocarbons by Selected Ion Monitoring

gg

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	55	39	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
1-Methylphenanthrene	ND	55	20	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	55	36	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
2,6-Dimethylnaphthalene	ND	55	38	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
2-Methylnaphthalene	ND	55	3.1	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Acenaphthene	ND	11	2.1	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Acenaphthylene	ND	11	2.3	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Anthracene	ND	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benz(a)anthracene	ND	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(a)pyrene	ND	11	2.3	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(b)fluoranthene	ND	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Benzo(e)pyrene	ND	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	11	6.2	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(k)fluoranthene	ND	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Biphenyl	ND	55	40	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Chrysene	ND	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	11	3.8	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Fluoranthene	ND	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Fluorene	ND	11	2.3	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	11	2.7	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Naphthalene	27 J	55	2.1	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Perylene	ND	22	13	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Phenanthrene	13 J	22	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Pyrene	8.1 J	11	5.5	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*71.6 %*	*Limits: 30-120%*			*B7I0087*	*9/7/07*	*9/7/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*61.1 %*	*Limits: 30-120%*			*B7I0087*	*9/7/07*	*9/7/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*100 %*	*Limits: 30-120%*			*B7I0087*	*9/7/07*	*9/7/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Col 2E Composite (8/31 & 8/22 & 9/4)

0705565-09 (Water)

8/31/07 12:00

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	54	39	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
1-Methylphenanthrene	ND	54	19	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	54	35	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
2,6-Dimethylnaphthalene	ND	54	38	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
2-Methylnaphthalene	ND	54	3.0	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Acenaphthene	ND	11	2.1	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Acenaphthylene	ND	11	2.3	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Anthracene	ND	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benz(a)anthracene	ND	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(a)pyrene	ND	11	2.3	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(b)fluoranthene	ND	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Benzo(e)pyrene	ND	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	11	6.1	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Benzo(k)fluoranthene	ND	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Biphenyl	ND	54	39	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Chrysene	ND	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	11	3.8	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Fluoranthene	ND	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Fluorene	ND	11	2.3	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	11	2.7	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	go
Naphthalene	3.5 J	54	2.1	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Perylene	ND	22	12	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Phenanthrene	15 J	22	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Pyrene	5.6 J	11	5.4	ng/L	B7I0087	9/7/07	9/7/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*87.1 %*	*Limits: 30-120%*			*B7I0087*	*9/7/07*	*9/7/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*78.3 %*	*Limits: 30-120%*			*B7I0087*	*9/7/07*	*9/7/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*119 %*	*Limits: 30-120%*			*B7I0087*	*9/7/07*	*9/7/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7I0073 - % Solids

Method Blank (B7I0073-BLK1)

Prepared & Analyzed: 09/06/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7I0073-SRM1)

Prepared & Analyzed: 09/06/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	87.4			% Wt	88.8	NA	98.4	90-110	NA	NA	

Batch B7I0255 - INHOUSE

Method Blank (B7I0255-BLK1)

Prepared: 09/10/07 Analyzed: 09/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
MEM after 105	0.000			ug/sample	NA	NA	NA	NA	NA	NA	
MEM after 550	0.000			ug/sample	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7I0154 - EPA 3545

Method Blank (B7I0154-BLK1) Prepared: 09/11/07 Analyzed: 09/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	0.00022	0.000037	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.00022	0.000027	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.00022	0.000027	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	0.00022	0.000033	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	0.00022	0.000076	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	0.00022	0.000033	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.00022	0.000023	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.00022	0.000033	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.00022	0.000033	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.00022	0.000027	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.00022	0.000057	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.00022	0.000028	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	0.00022	0.000020	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.00022	0.000047	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.00022	0.000040	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.00022	0.000033	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.00022	0.000070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.00022	0.000023	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.00022	0.000013	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.00022	0.000030	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	0.00022	0.000017	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.00022	0.000037	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	0.0022	0.000027	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	ND	0.00022	0.000033	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.701*			mg/kg	*0.831*	*NA*	*84.4*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.615*			mg/kg	*0.831*	*NA*	*74.0*	*30-90*			
Surrogate: Terphenyl-d14	*0.721*			mg/kg	*0.831*	*NA*	*86.8*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7I0154 - EPA 3545

Laboratory Control Sample (B7I0154-BS1) Prepared: 09/11/07 Analyzed: 09/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.29	0.00022	0.000033	mg/kg	1.64	NA	78.7	50-115	NA	NA	
Pyrene	1.41	0.00022	0.000033	mg/kg	1.64	NA	86.0	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.679*			mg/kg	*0.820*	*NA*	*82.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.593*			mg/kg	*0.820*	*NA*	*72.3*	*30-90*			
Surrogate: Terphenyl-d14	*0.696*			mg/kg	*0.820*	*NA*	*84.9*	*30-115*			

Laboratory Control Sample Duplicate (B7I0154-BSD1) Prepared: 09/11/07 Analyzed: 09/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.29	0.00022	0.000033	mg/kg	1.65	NA	78.2	50-115	0.00	25	
Pyrene	1.39	0.00022	0.000033	mg/kg	1.65	NA	84.2	50-130	1.43	25	
Surrogate: 2-Fluorobiphenyl	*0.678*			mg/kg	*0.823*	*NA*	*82.4*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.612*			mg/kg	*0.823*	*NA*	*74.4*	*30-90*			
Surrogate: Terphenyl-d14	*0.679*			mg/kg	*0.823*	*NA*	*82.5*	*30-115*			

Matrix Spike (B7I0154-MS1) **Source: 0705565-03** Prepared: 09/11/07 Analyzed: 09/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.62	0.00025	0.000037	mg/kg dry	1.87	0.15	78.6	30-115	NA	NA	
Pyrene	1.75	0.00025	0.000037	mg/kg dry	1.87	0.037	91.6	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.798*			mg/kg dry	*0.936*	*NA*	*85.3*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.677*			mg/kg dry	*0.936*	*NA*	*72.3*	*30-90*			
Surrogate: Terphenyl-d14	*0.847*			mg/kg dry	*0.936*	*NA*	*90.5*	*30-115*			

Matrix Spike Duplicate (B7I0154-MSD1) **Source: 0705565-03** Prepared: 09/11/07 Analyzed: 09/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.60	0.00025	0.000037	mg/kg dry	1.83	0.15	79.2	30-115	1.24	30	
Pyrene	1.67	0.00025	0.000037	mg/kg dry	1.83	0.037	89.2	30-130	4.68	35	
Surrogate: 2-Fluorobiphenyl	*0.810*			mg/kg dry	*0.915*	*NA*	*88.5*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.668*			mg/kg dry	*0.915*	*NA*	*73.0*	*30-90*			
Surrogate: Terphenyl-d14	*0.810*			mg/kg dry	*0.915*	*NA*	*88.5*	*30-115*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7I0087 - EPA 3510C

Method Blank (B7I0087-BLK1) Prepared & Analyzed: 09/07/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	3.97	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	11.2	20	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*176*			ng/L	*250*	*NA*	*70.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*152*			ng/L	*250*	*NA*	*60.8*	*30-120*			
Surrogate: Terphenyl-d14	*295*			ng/L	*250*	*NA*	*118*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7I0087 - EPA 3510C

Laboratory Control Sample (B7I0087-BS1) Prepared: 09/07/07 Analyzed: 09/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	404	50	36	ng/L	500	NA	80.8	50-120	NA	NA	
1-Methylphenanthrene	472	50	18	ng/L	500	NA	94.4	50-120	NA	NA	
2,3,5-Trimethylnaphthalene	434	50	32	ng/L	500	NA	86.8	50-120	NA	NA	
2,6-Dimethylnaphthalene	407	50	35	ng/L	500	NA	81.4	50-120	NA	NA	
2-Methylnaphthalene	388	50	2.8	ng/L	500	NA	77.6	50-120	NA	NA	
Acenaphthene	452	10	1.9	ng/L	500	NA	90.4	50-120	NA	NA	
Acenaphthylene	470	10	2.1	ng/L	500	NA	94.0	50-120	NA	NA	
Anthracene	527	10	5.0	ng/L	500	NA	105	50-120	NA	NA	
Benz(a)anthracene	561	10	5.0	ng/L	500	NA	112	50-120	NA	NA	
Benzo(a)pyrene	555	10	2.1	ng/L	500	NA	111	50-120	NA	NA	
Benzo(b)fluoranthene	597	10	5.0	ng/L	500	NA	119	50-120	NA	NA	
Benzo(e)pyrene	543	10	5.0	ng/L	500	NA	109	50-120	NA	NA	
Benzo(g,h,i)perylene	589	10	5.6	ng/L	500	NA	118	50-120	NA	NA	
Benzo(k)fluoranthene	577	10	5.0	ng/L	500	NA	115	50-120	NA	NA	
Biphenyl	436	50	36	ng/L	500	NA	87.2	50-120	NA	NA	
Chrysene	555	10	5.0	ng/L	500	NA	111	50-120	NA	NA	
Dibenz(a,h)anthracene	626	10	3.5	ng/L	500	NA	125	50-120	NA	NA	
Fluoranthene	535	10	5.0	ng/L	500	NA	107	50-120	NA	NA	
Fluorene	485	10	2.1	ng/L	500	NA	97.0	50-120	NA	NA	
Indeno(1,2,3-cd)pyrene	608	10	2.5	ng/L	500	NA	122	50-120	NA	NA	
Naphthalene	401	50	1.9	ng/L	500	NA	80.2	50-120	NA	NA	
Perylene	515	20	11	ng/L	500	NA	103	50-120	NA	NA	
Phenanthrene	469	20	5.0	ng/L	500	NA	93.8	50-120	NA	NA	
Pyrene	564	10	5.0	ng/L	500	NA	113	50-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*215*			ng/L	*250*	*NA*	*86.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*210*			ng/L	*250*	*NA*	*84.0*	*30-120*			
Surrogate: Terphenyl-d14	*295*			ng/L	*250*	*NA*	*118*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7I0087 - EPA 3510C

Laboratory Control Sample Duplicate (B7I0087-BSD1) Prepared: 09/07/07 Analyzed: 09/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	411	50	36	ng/L	500	NA	82.2	50-120	1.72	20	
1-Methylphenanthrene	493	50	18	ng/L	500	NA	98.6	50-120	4.35	20	
2,3,5-Trimethylnaphthalene	447	50	32	ng/L	500	NA	89.4	50-120	2.95	20	
2,6-Dimethylnaphthalene	413	50	35	ng/L	500	NA	82.6	50-120	1.46	20	
2-Methylnaphthalene	392	50	2.8	ng/L	500	NA	78.4	50-120	1.03	20	
Acenaphthene	465	10	1.9	ng/L	500	NA	93.0	50-120	2.84	20	
Acenaphthylene	474	10	2.1	ng/L	500	NA	94.8	50-120	0.847	20	
Anthracene	544	10	5.0	ng/L	500	NA	109	50-120	3.17	20	
Benz(a)anthracene	567	10	5.0	ng/L	500	NA	113	50-120	1.06	20	
Benzo(a)pyrene	575	10	2.1	ng/L	500	NA	115	50-120	3.54	20	
Benzo(b)fluoranthene	620	10	5.0	ng/L	500	NA	124	50-120	3.78	20	
Benzo(e)pyrene	569	10	5.0	ng/L	500	NA	114	50-120	4.68	20	
Benzo(g,h,i)perylene	575	10	5.6	ng/L	500	NA	115	50-120	2.41	20	
Benzo(k)fluoranthene	610	10	5.0	ng/L	500	NA	122	50-120	5.56	20	
Biphenyl	437	50	36	ng/L	500	NA	87.4	50-120	0.229	20	
Chrysene	577	10	5.0	ng/L	500	NA	115	50-120	3.89	20	
Dibenz(a,h)anthracene	614	10	3.5	ng/L	500	NA	123	50-120	1.94	20	
Fluoranthene	570	10	5.0	ng/L	500	NA	114	50-120	6.33	20	
Fluorene	496	10	2.1	ng/L	500	NA	99.2	50-120	2.24	20	
Indeno(1,2,3-cd)pyrene	602	10	2.5	ng/L	500	NA	120	50-120	0.992	20	
Naphthalene	404	50	1.9	ng/L	500	NA	80.8	50-120	0.745	20	
Perylene	535	20	11	ng/L	500	NA	107	50-120	3.81	20	
Phenanthrene	498	20	5.0	ng/L	500	NA	99.6	50-120	6.00	20	
Pyrene	601	10	5.0	ng/L	500	NA	120	50-120	6.35	20	
Surrogate: 2-Fluorobiphenyl	*212*			ng/L	*250*	*NA*	*84.8*	*30-120*			
Surrogate: Nitrobenzene-d5	*171*			ng/L	*250*	*NA*	*68.4*	*30-120*			
Surrogate: Terphenyl-d14	*300*			ng/L	*250*	*NA*	*120*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7I0133 - INHOUSE

Method Blank (B7I0133-BLK1) Prepared: 09/10/07 Analyzed: 09/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Pyrene	ND	0.50	0.10	ug/sample	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*2.05*			ug/sample	*2.50*	*NA*	*82.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*2.00*			ug/sample	*2.50*	*NA*	*80.0*	*30-120*			
Surrogate: Terphenyl-d14	*2.48*			ug/sample	*2.50*	*NA*	*99.2*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7I0133 - INHOUSE

Laboratory Control Sample (B7I0133-BS1) Prepared: 09/10/07 Analyzed: 09/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	4.32	0.50	0.10	ug/sample	5.00	NA	86.4	50-120	NA	NA	
1-Methylphenanthrene	4.32	0.50	0.10	ug/sample	5.00	NA	86.4	50-120	NA	NA	
2,3,5-Trimethylnaphthalene	4.35	0.50	0.10	ug/sample	5.00	NA	87.0	50-120	NA	NA	
2,6-Dimethylnaphthalene	4.31	0.50	0.10	ug/sample	5.00	NA	86.2	50-120	NA	NA	
2-Methylnaphthalene	4.37	0.50	0.10	ug/sample	5.00	NA	87.4	50-120	NA	NA	
Acenaphthene	4.58	0.50	0.10	ug/sample	5.00	NA	91.6	50-120	NA	NA	
Acenaphthylene	4.41	0.50	0.10	ug/sample	5.00	NA	88.2	50-120	NA	NA	
Anthracene	4.86	0.50	0.10	ug/sample	5.00	NA	97.2	50-120	NA	NA	
Benz(a)anthracene	4.60	0.50	0.10	ug/sample	5.00	NA	92.0	50-120	NA	NA	
Benzo(a)pyrene	4.64	0.50	0.10	ug/sample	5.00	NA	92.8	50-120	NA	NA	
Benzo(b)fluoranthene	5.15	0.50	0.10	ug/sample	5.00	NA	103	50-120	NA	NA	
Benzo(e)pyrene	4.59	0.50	0.10	ug/sample	5.00	NA	91.8	50-120	NA	NA	
Benzo(g,h,i)perylene	4.81	0.50	0.10	ug/sample	5.00	NA	96.2	50-120	NA	NA	
Benzo(k)fluoranthene	4.59	0.50	0.10	ug/sample	5.00	NA	91.8	50-120	NA	NA	
Biphenyl	4.28	0.50	0.10	ug/sample	5.00	NA	85.6	50-120	NA	NA	
Chrysene	4.72	0.50	0.10	ug/sample	5.00	NA	94.4	50-120	NA	NA	
Dibenz(a,h)anthracene	4.94	0.50	0.10	ug/sample	5.00	NA	98.8	50-120	NA	NA	
Fluoranthene	4.43	0.50	0.10	ug/sample	5.00	NA	88.6	50-120	NA	NA	
Fluorene	4.49	0.50	0.10	ug/sample	5.00	NA	89.8	50-120	NA	NA	
Indeno(1,2,3-cd)pyrene	4.88	0.50	0.10	ug/sample	5.00	NA	97.6	50-120	NA	NA	
Naphthalene	4.78	0.50	0.10	ug/sample	5.00	NA	95.6	50-120	NA	NA	
Perylene	4.38	0.50	0.10	ug/sample	5.00	NA	87.6	50-120	NA	NA	
Phenanthrene	4.92	0.50	0.10	ug/sample	5.00	NA	98.4	50-120	NA	NA	
Pyrene	4.63	0.50	0.10	ug/sample	5.00	NA	92.6	50-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*2.37*			ug/sample	*2.50*	*NA*	*94.8*	*30-120*			
Surrogate: Nitrobenzene-d5	*2.16*			ug/sample	*2.50*	*NA*	*86.4*	*30-120*			
Surrogate: Terphenyl-d14	*2.52*			ug/sample	*2.50*	*NA*	*101*	*30-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7I0133 - INHOUSE

Laboratory Control Sample Duplicate (B7I0133-BSD1) Prepared: 09/10/07 Analyzed: 09/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	4.18	0.50	0.10	ug/sample	5.00	NA	83.6	50-120	3.29	20	
1-Methylphenanthrene	4.18	0.50	0.10	ug/sample	5.00	NA	83.6	50-120	3.29	20	
2,3,5-Trimethylnaphthalene	4.25	0.50	0.10	ug/sample	5.00	NA	85.0	50-120	2.33	20	
2,6-Dimethylnaphthalene	4.04	0.50	0.10	ug/sample	5.00	NA	80.8	50-120	6.47	20	
2-Methylnaphthalene	4.21	0.50	0.10	ug/sample	5.00	NA	84.2	50-120	3.73	20	
Acenaphthene	4.45	0.50	0.10	ug/sample	5.00	NA	89.0	50-120	2.88	20	
Acenaphthylene	4.19	0.50	0.10	ug/sample	5.00	NA	83.8	50-120	5.12	20	
Anthracene	4.69	0.50	0.10	ug/sample	5.00	NA	93.8	50-120	3.56	20	
Benz(a)anthracene	4.45	0.50	0.10	ug/sample	5.00	NA	89.0	50-120	3.31	20	
Benzo(a)pyrene	4.55	0.50	0.10	ug/sample	5.00	NA	91.0	50-120	1.96	20	
Benzo(b)fluoranthene	5.09	0.50	0.10	ug/sample	5.00	NA	102	50-120	1.17	20	
Benzo(e)pyrene	4.47	0.50	0.10	ug/sample	5.00	NA	89.4	50-120	2.65	20	
Benzo(g,h,i)perylene	4.66	0.50	0.10	ug/sample	5.00	NA	93.2	50-120	3.17	20	
Benzo(k)fluoranthene	4.41	0.50	0.10	ug/sample	5.00	NA	88.2	50-120	4.00	20	
Biphenyl	4.15	0.50	0.10	ug/sample	5.00	NA	83.0	50-120	3.08	20	
Chrysene	4.56	0.50	0.10	ug/sample	5.00	NA	91.2	50-120	3.45	20	
Dibenz(a,h)anthracene	4.78	0.50	0.10	ug/sample	5.00	NA	95.6	50-120	3.29	20	
Fluoranthene	4.29	0.50	0.10	ug/sample	5.00	NA	85.8	50-120	3.21	20	
Fluorene	4.35	0.50	0.10	ug/sample	5.00	NA	87.0	50-120	3.17	20	
Indeno(1,2,3-cd)pyrene	4.73	0.50	0.10	ug/sample	5.00	NA	94.6	50-120	3.12	20	
Naphthalene	4.52	0.50	0.10	ug/sample	5.00	NA	90.4	50-120	5.59	20	
Perylene	4.24	0.50	0.10	ug/sample	5.00	NA	84.8	50-120	3.25	20	
Phenanthrene	4.78	0.50	0.10	ug/sample	5.00	NA	95.6	50-120	2.89	20	
Pyrene	4.47	0.50	0.10	ug/sample	5.00	NA	89.4	50-120	3.52	20	
Surrogate: 2-Fluorobiphenyl	*2.24*			ug/sample	*2.50*	*NA*	*89.6*	*30-120*			
Surrogate: Nitrobenzene-d5	*2.01*			ug/sample	*2.50*	*NA*	*80.4*	*30-120*			
Surrogate: Terphenyl-d14	*2.36*			ug/sample	*2.50*	*NA*	*94.4*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7I0213 - EPA 5035

Method Blank (B7I0213-BLK1)

Prepared & Analyzed: 09/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.0010	0.000032	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.0010	0.000070	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.0010	0.000098	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.0010	0.00012	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.0010	0.000044	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.010	0.000056	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.0010	0.00011	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.0010	0.00013	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.0010	0.00014	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.0010	0.000042	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.0010	0.000046	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.0010	0.00017	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.0010	0.000074	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*23.8*			ug/L	*25.0*	*NA*	*95.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: Dibromofluoromethane	*24.0*			ug/L	*25.0*	*NA*	*96.0*	*80-120*			
Surrogate: Toluene-d8	*27.6*			ug/L	*25.0*	*NA*	*110*	*80-120*			

Laboratory Control Sample (B7I0213-BS1)

Prepared & Analyzed: 09/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	75-125	NA	NA	
1,2,4-Trimethylbenzene	1.49	0.050	0.0035	mg/kg	1.25	NA	119	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.47	0.050	0.0049	mg/kg	1.25	NA	118	75-125	NA	NA	
1,4-Dichlorobenzene	1.53	0.050	0.0060	mg/kg	1.25	NA	122	75-125	NA	NA	
Benzene	1.35	0.050	0.0022	mg/kg	1.25	NA	108	75-125	NA	NA	
Carbon Tetrachloride	1.31	0.50	0.0028	mg/kg	1.25	NA	105	75-125	NA	NA	
Ethylbenzene	1.54	0.050	0.0053	mg/kg	1.25	NA	123	75-125	NA	NA	
m,p-Xylenes	3.12	0.050	0.0063	mg/kg	2.50	NA	125	75-125	NA	NA	
o-Xylene	1.56	0.050	0.0070	mg/kg	1.25	NA	125	75-125	NA	NA	
sec-Butylbenzene	1.46	0.050	0.0021	mg/kg	1.25	NA	117	75-125	NA	NA	
Styrene	1.57	0.050	0.0023	mg/kg	1.25	NA	126	75-125	NA	NA	
Toluene	1.51	0.050	0.0086	mg/kg	1.25	NA	121	75-125	NA	NA	
Trichloroethene	1.41	0.050	0.0037	mg/kg	1.25	NA	113	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*23.7*			ug/L	*25.0*	*NA*	*94.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Dibromofluoromethane	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: Toluene-d8	*26.8*			ug/L	*25.0*	*NA*	*107*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7I0213 - EPA 5035

Laboratory Control Sample Duplicate (B7I0213-BSD1) Prepared & Analyzed: 09/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	75-125	NA	20	
1,2,4-Trimethylbenzene	1.51	0.050	0.0035	mg/kg	1.25	NA	121	75-125	1.33	20	
1,3,5-Trimethylbenzene	1.49	0.050	0.0049	mg/kg	1.25	NA	119	75-125	1.35	20	
1,4-Dichlorobenzene	1.54	0.050	0.0060	mg/kg	1.25	NA	123	75-125	0.651	20	
Benzene	1.38	0.050	0.0022	mg/kg	1.25	NA	110	75-125	2.20	20	
Carbon Tetrachloride	1.31	0.50	0.0028	mg/kg	1.25	NA	105	75-125	0.00	20	
Ethylbenzene	1.56	0.050	0.0053	mg/kg	1.25	NA	125	75-125	1.29	20	
m,p-Xylenes	3.16	0.050	0.0063	mg/kg	2.50	NA	126	75-125	1.27	20	
o-Xylene	1.56	0.050	0.0070	mg/kg	1.25	NA	125	75-125	0.00	20	
sec-Butylbenzene	1.48	0.050	0.0021	mg/kg	1.25	NA	118	75-125	1.36	20	
Styrene	1.57	0.050	0.0023	mg/kg	1.25	NA	126	75-125	0.00	20	
Toluene	1.53	0.050	0.0086	mg/kg	1.25	NA	122	75-125	1.32	20	
Trichloroethene	1.43	0.050	0.0037	mg/kg	1.25	NA	114	75-125	1.41	20	
Surrogate: 1,2-Dichloroethane-d4	*24.0*			ug/L	*25.0*	*NA*	*96.0*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Dibromofluoromethane	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7I0214 - EPA 3550B

Method Blank (B7I0214-BLK1)

Prepared: 09/12/07 Analyzed: 09/14/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
Benzene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	800	400	ug/sample	NA	NA	NA	NA	NA	NA	
Ethyl Benzene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	410	400	ug/sample	NA	NA	NA	NA	NA	NA	
Styrene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
Toluene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	
Xylenes, Total	ND	400	400	ug/sample	NA	NA	NA	NA	NA	NA	

Batch B7I0250 - AIRTUBES Prep

Laboratory Control Sample (B7I0250-BS1)

Prepared: 09/13/07 Analyzed: 09/14/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	101	2.94	2.94	ug/tube	98.0	NA	103	75-125	NA	NA	
Xylenes, Total	302	2.99	2.99	ug/tube	299	NA	101	75-125	NA	NA	

Laboratory Control Sample (B7I0250-BS2)

Prepared: 09/13/07 Analyzed: 09/14/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	94.6	2.97	2.97	ug/tube	99.1	NA	95.5	75-125	NA	NA	
Styrene	83.4	3.92	3.92	ug/tube	131	NA	63.7	51-101	NA	NA	
Toluene	95.1	3.02	3.02	ug/tube	101	NA	94.2	75-125	NA	NA	
Trichloroethene	94.5	2.99	2.99	ug/tube	99.8	NA	94.7	75-125	NA	NA	

Laboratory Control Sample (B7I0250-BS3)

Prepared: 09/13/07 Analyzed: 09/14/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	77.3	3.03	3.03	ug/tube	87.6	NA	88.2	75-125	NA	NA	
1,2,4-Trimethylbenzene	85.2	2.97	2.97	ug/tube	94.3	NA	90.3	75-125	NA	NA	
1,3,5-Trimethylbenzene	81.6	2.88	2.88	ug/tube	88.4	NA	92.3	75-125	NA	NA	
1,4-Dichlorobenzene	84.0	3.47	3.47	ug/tube	96.8	NA	86.8	75-125	NA	NA	
Carbon Tetrachloride	110	6.12	3.06	ug/tube	92.6	NA	119	75-125	NA	NA	
sec-Butylbenzene	92.4	3.01	2.94	ug/tube	99.0	NA	93.3	75-125	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7I0250 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7I0250-BSD1) Prepared: 09/13/07 Analyzed: 09/14/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	90.2	2.94	2.94	ug/tube	98.0	NA	92.0	75-125	11.3	20	
Xylenes, Total	273	2.99	2.99	ug/tube	299	NA	91.3	75-125	10.1	20	

Laboratory Control Sample Duplicate (B7I0250-BSD2) Prepared: 09/13/07 Analyzed: 09/14/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	101	2.97	2.97	ug/tube	99.1	NA	102	75-125	6.54	20	
Styrene	107	3.92	3.92	ug/tube	131	NA	81.7	51-101	24.8	20	
Toluene	103	3.02	3.02	ug/tube	101	NA	102	75-125	7.98	20	
Trichloroethene	101	2.99	2.99	ug/tube	99.8	NA	101	75-125	6.65	20	

Laboratory Control Sample Duplicate (B7I0250-BSD3) Prepared: 09/13/07 Analyzed: 09/14/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	84.9	3.03	3.03	ug/tube	87.6	NA	96.9	75-125	9.37	20	
1,2,4-Trimethylbenzene	92.5	2.97	2.97	ug/tube	94.3	NA	98.1	75-125	8.22	20	
1,3,5-Trimethylbenzene	87.8	2.88	2.88	ug/tube	88.4	NA	99.3	75-125	7.32	20	
1,4-Dichlorobenzene	92.8	3.47	3.47	ug/tube	96.8	NA	95.9	75-125	9.95	20	
Carbon Tetrachloride	90.0	6.12	3.06	ug/tube	92.6	NA	97.2	75-125	20.0	20	
sec-Butylbenzene	98.6	3.01	2.94	ug/tube	99.0	NA	99.6	75-125	6.49	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0705565
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Page 1 of 1

For Braun Intertec Use Only
Laboratory Work Order No.
0705565

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

REPORT RESULTS TO
Contact Name: URS Corp Hubert Huls
Company: URS Corp. MN
Mailing Address: 700 3rd Street South
City, State, Zip: Minneapolis, MN
Telephone #: 612 373 6805 Fax #:
E-mail: Huls@urscorp.com

Project ID/Name: Ashland Wisconsin
P.O. #/Project #: 25688375

SEND INVOICE TO
Contact Name: Hubert Huls
Company: URS Corp, MN
Address: 700 3rd Street South
City, State, Zip: Minneapolis MN
Telephone #: 612 373 6805 Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH	VOC	TOC	Steven hydrometer	SIM PAH	MEAM					FOR LAB USE ONLY
1	Col 2E Upper Sed. Layer	9/5/07	11:10am	wood fiber				2	2	1								-1
2	Col 2E Lower Sed. Layer	9/5/07	11:15am	Sediment				2	2	1	1							-2
3	Col 2E Cap Base	9/5/07	10:55am	Sediment				2	2	1								-3
4	Col 2E Cap Base Duplicate	9/5/07	11:00am	Sediment				2	2	1								-4
5	Col 2E Compliance Zone	9/5/07	11:05am	Sediment				2	2	1								-5
6	Col 2E Glass Wool	9/5/07	10:00am	fiber				X	X				X					-6
7	~~Advanced Flux~~ Column 2E Composite	7/18/07	12:00pm	Aqueous	500mL @ 2°C				X		composite	141mL 7/18/07 329mL 8/31/07		cont. 9/5/07				-7
8	~~Advanced Flux~~ Column 2E Composite	7/18/07	12:00pm	water				~~X~~			composite	X 7/18/07						-8
9	~~Advanced Flux~~ Column 2E Composite	8/31/07	12:00pm	water				~~X~~			composite	X	8/31/07 cont. 8/22/07 cont. 9/6/07					-9
10																		
11																		
12																		
13																		
14																		
15																		

CHAIN OF CUSTODY
Collected by: (Print) Huls, DeFawe
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 9/5/07 1:30pm
Relinquished by: [signature] Date/Time 9/5/07 1:30pm
Received by: Date/Time
Received Contents Not Verified: [signature] Date/Time 9-6-07 9:40
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☒ Yes ☐ No
Temp Blank ☒ Yes ☐ No
Temp: 7-8 °C
Comments: waybill 861246058 7095

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

SEVERN TRENT STL

STL Los Angeles
1721 South Grand Avenue
Santa Ana, CA 92705

Tel: 714 258 8610 Fax: 714 258 0921
www.stl-inc.com

August 10, 2007

LOT NUMBER: **E7H030206**
PO/CONTRACT: 25688375.75000

Hubert Huls
URS Corporation
700 Third Street South
Minneapolis, MN 55415

Dear Mr. Huls,

This report contains the analytical results for the sample received under chain of custody by TestAmerica Los Angeles (fka STL) on August 3, 2007. This sample is associated with your Ashland Superfund project.

TestAmerica Los Angeles (fka STL) certifies that the test results provided in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of the report. NELAP Certification Number for TestAmerica Los Angeles (fka STL) is 01118CA / E87652.

Any matrix related anomaly is footnoted within the report. Historical control limits for the LCS are used to define the estimate of uncertainty for a method. All applicable quality control procedures met method-specified acceptance criteria.

Preliminary results were sent via facsimile on Tuesday, August 07, 2007.

This report shall not be reproduced except in full, without the written approval of the laboratory.

000014

This report contains _____ pages.

If you have any questions, please feel free to call me at (714) 258-8610.

Sincerely,

Marisol Tabirara
Project Manager

cc: Project File

E7H030206

SOIL TECHNOLOGY™
INNOVATIVE SOLUTIONS Phone: 206-842-8977 Fax: 206-842-9014

E7H030206

Soil Technology Job No.:07-2183

Project Name: Ashland Superfund	Client Phone: (612)373-6805	Client Address: 700 3rd St, Minneapolis, MN 55415
Client: URS Corporation	Send Report To: Hubert Huls	Project Manager: Hubert Huls / Waybill Number: Fedex 861246587084
Project Number: 25688375 / Site Location: Ashland, WI	P/O#/Billing Refernce: 25688375.75000	Turnaround Time: ☐ 1-2 Day ☐ 3-5 Day ☐ 10 Day ☐ 30 Day ☐ Other
Sampler: Defawe / Date: 8/2/07	Bill To: URS Corp.	

Sample ID# / Station:	Matrix: Air	Water	Sed.	Soil	No. of Containers	Type of Ct	Sampling Time/Date:	Analysis: D1946 (CO_2, CH_4 ea.)					Remarks:	Preservation:
Advanced Flux Column 2E	X				1	Tedlar Bag	11:20am 8/2/07	X						

Special Shipment / Handling or Storage Requirements:

Shipping Method:

Relinquished By: Rose Defawe	Received By: [illegible]	Relinquished By:	Received By:
Signature: Rose Defawe	Signature: Steve Gonzales	Signature	Signature
Printed Name: Soil Technology	Printed Name: TA LA	Printed Name	Printed Name
Company	Company	Company	Company
Date: 8/2/07 Time: 12:00pm	Date 8/3/07 Time 1040	Date Time	Date Time

Page 1 of 1

STAI/Forms/Lab/CCR 4

E7H030206

3

STL

Analytical Report

ANALYTICAL REPORT

PROJECT NO. 25688375

Ashland Superfund

Lot #: E7H030206

Hubert Huls

URS Corporation

TESTAMERICA LABORATORIES, INC. (FKA STL)

Marisol Tabirara
Project Manager

August 7, 2007

EXECUTIVE SUMMARY - Detection Highlights

E7H030206

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
ADVANCED FLUX COLUMN 2E 08/02/07 11:20 001				
Carbon dioxide	0.44	0.010	%(v/v)	ASTM D1946
Oxygen	9.9	0.20	%(v/v)	ASTM D1946
Nitrogen	48	1.0	%(v/v)	ASTM D1946
Methane	40	0.00020	%(v/v)	ASTM D1946

ANALYTICAL METHODS SUMMARY

E7H030206

PARAMETER	ANALYTICAL METHOD
Fixed Gases	ASTM D1946

References:

ASTM Annual Book Of ASTM Standards.

SAMPLE SUMMARY

E7H030206

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
J36HD	001	ADVANCED FLUX COLUMN 2E	08/02/07	11:20

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

URS Corporation

Client Sample ID: ADVANCED FLUX COLUMN 2E

GC Volatiles

Lot-Sample #...:	E7H030206-001	**Work Order #...:**	J36HD1AA	**Matrix.....:**	V
Date Sampled...:	08/02/07 11:20	**Date Received..:**	08/03/07		
Prep Date.....:	08/03/07	**Analysis Date..:**	08/03/07		
Prep Batch #...:	7215436	**Analysis Time..:**	13:18		
Dilution Factor:	1				
Analyst ID.....:	999995	**Instrument ID..:**	GC8		
		Method.....:	ASTM D1946		

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Carbon dioxide	**0.44**	**0.010**	**%(v/v)**
Oxygen	**9.9**	**0.20**	**%(v/v)**
Nitrogen	**48**	**1.0**	**%(v/v)**
Methane	**40**	**0.00020**	**%(v/v)**
Carbon monoxide	ND	0.0010	%(v/v)

STL

QA/QC

QC DATA ASSOCIATION SUMMARY

E7H030206

Sample Preparation and Analysis Control Numbers

SAMPLE#	MATRIX	ANALYTICAL METHOD	LEACH BATCH #	PREP BATCH #	MS RUN#
001	V	ASTM D1946		7215436	

METHOD BLANK REPORT

GC Volatiles

Client Lot #...: E7H030206
MB Lot-Sample #: M7H030000-436
Analysis Date..: 08/03/07
Dilution Factor: 1

Work Order #...: J4C131AA
Prep Date.....: 08/03/07
Prep Batch #...: 7215436
Analyst ID.....: 999995

Matrix.....: AIR
Analysis Time..: 10:13
Instrument ID..: GC8

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Carbon dioxide	ND	0.010	%(v/v)	ASTM D1946
Oxygen	ND	0.20	%(v/v)	ASTM D1946
Nitrogen	ND	1.0	%(v/v)	ASTM D1946
Methane	ND	0.00020	%(v/v)	ASTM D1946
Carbon monoxide	ND	0.0010	%(v/v)	ASTM D1946

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Volatiles

Client Lot #...: E7H030206 **Work Order #...:** J4C131AC-LCS **Matrix.....:** AIR
LCS Lot-Sample#: M7H030000-436 J4C131AD-LCSD
Prep Date.....: 08/03/07 **Analysis Date..:** 08/03/07
Prep Batch #...: 7215436 **Analysis Time..:** 09:18
Dilution Factor: 1 **Instrument ID..:** GC8
Analyst ID.....: 999995

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Carbon dioxide	**100**	**(75 - 125)**			**ASTM D1946**
	101	**(75 - 125)**	**1.3**	**(0-20)**	**ASTM D1946**
Oxygen	**102**	**(70 - 130)**			**ASTM D1946**
	102	**(70 - 130)**	**0.43**	**(0-30)**	**ASTM D1946**
Nitrogen	**101**	**(70 - 130)**			**ASTM D1946**
	101	**(70 - 130)**	**0.30**	**(0-30)**	**ASTM D1946**
Methane	**104**	**(75 - 135)**			**ASTM D1946**
	104	**(75 - 135)**	**0.36**	**(0-20)**	**ASTM D1946**
Carbon monoxide	**108**	**(70 - 130)**			**ASTM D1946**
	108	**(70 - 130)**	**0.50**	**(0-30)**	**ASTM D1946**
Ethane	**99**	**(70 - 130)**			**ASTM D1946**
	99	**(70 - 130)**	**0.24**	**(0-30)**	**ASTM D1946**
Ethene	**94**	**(70 - 130)**			**ASTM D1946**
	94	**(70 - 130)**	**0.32**	**(0-30)**	**ASTM D1946**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Volatiles

Client Lot #...: E7H030206 **Work Order #...:** J4C131AC-LCS **Matrix.....:** AIR
LCS Lot-Sample#: M7H030000-436 J4C131AD-LCSD
Prep Date.....: 08/03/07 **Analysis Date..:** 08/03/07
Prep Batch #...: 7215436 **Analysis Time..:** 09:18
Dilution Factor: 1 **Instrument ID..:** GC8
Analyst ID.....: 999995

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Carbon dioxide	0.500	0.498	%(v/v)	100		ASTM D1946
	0.500	0.504	%(v/v)	101	1.3	ASTM D1946
Oxygen	2.50	2.56	%(v/v)	102		ASTM D1946
	2.50	2.55	%(v/v)	102	0.43	ASTM D1946
Nitrogen	57.4	58.0	%(v/v)	101		ASTM D1946
	57.4	57.8	%(v/v)	101	0.30	ASTM D1946
Methane	0.0250	0.0260	%(v/v)	104		ASTM D1946
	0.0250	0.0259	%(v/v)	104	0.36	ASTM D1946
Carbon monoxide	0.0250	0.0271	%(v/v)	108		ASTM D1946
	0.0250	0.0269	%(v/v)	108	0.50	ASTM D1946
Ethane	0.0250	0.0248	%(v/v)	99		ASTM D1946
	0.0250	0.0247	%(v/v)	99	0.24	ASTM D1946
Ethene	0.0250	0.0235	%(v/v)	94		ASTM D1946
	0.0250	0.0234	%(v/v)	94	0.32	ASTM D1946

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

Appendix B

Visual Classification of Undisturbed Sample

Job Ashland, Wisconsin, URS
Job No. 07-2183
Exploration No.
Sample No. Column 2E, 3ft Cap Extended 5mo.
Depth of Sample
Sampled Length (from log) _____ (feet)
Sample Recovery _____ (feet)

Date 9-5-07
Sample Pushed by Sheets / Huls
Sample Logged by Sheets
Type of Sample: ☐ Shelby ☒ Other Vibracore 8" D
Diameter of Sample 8 (inches)
Sample Quality: ☐ Good ☐ Fair ☐ Poor ☐ Disturbed

Sed. Length Day 1 = 44.1cm 3/15/07

SPECIMEN SAVED	TEST TYPE	TEST CAN NO.	STRENGTH TV TSF	STRENGTH PP TSF	CONSISTENCY	MOISTURE	COLOR	SIZE % G Max.	SIZE % S Range	SIZE % F (PI)	DEPTH ~~FEET~~ cm	SAMPLE SKETCH	CLASSIFICATION AND REMARKS
											150		
											140		(138-139) fines-silt+clay (1cm) (42.5-138 cm) Brown Medium grained sand
											130		
											120		
											110		
											100		
											90		
											80		
											70		
											60		42.5 is top of sed, wet woody + black 24-42.5cm
											50		fluorescence was white in wood
											40		
											30		wet, tan fine silty sand 0-24cm
											20		
											10		fluorescent specs purple in fine sand

Test Code

WC	WATER CONTENT
MD	MOISTURE - DENSITY
~~8~~	~~IN-PLACE DENSITY~~
SPG	SPECIFIC GRAVITY
ATT	ATTERBURG LIMITS
MA	MECHANICAL ANALYSIS
HY	HYDROMETER
CA	COMBINED ANALYSIS
CBR	CALIFORNIA BEARING RATIO
DS	DIRECT SHEAR
CON	CONSOLIDATION TEST
QU	UNCONFINED COMPRESSION
TUU	TRIAXIAL UNCONSOLIDATED UNDRAINED
TCU	TRIAXIAL CONSOLIDATED UNDRAINED
TCD	TRIAXIAL CONSOLIDATED DRAINED
K_{20}	PERMEABILITY TEST

Moisture Content

CAN NO.						
TARE						
WET + TARE						
DRY + TARE						
WT. WATER						
WT. DRY SOIL						
% WATER						

Moisture

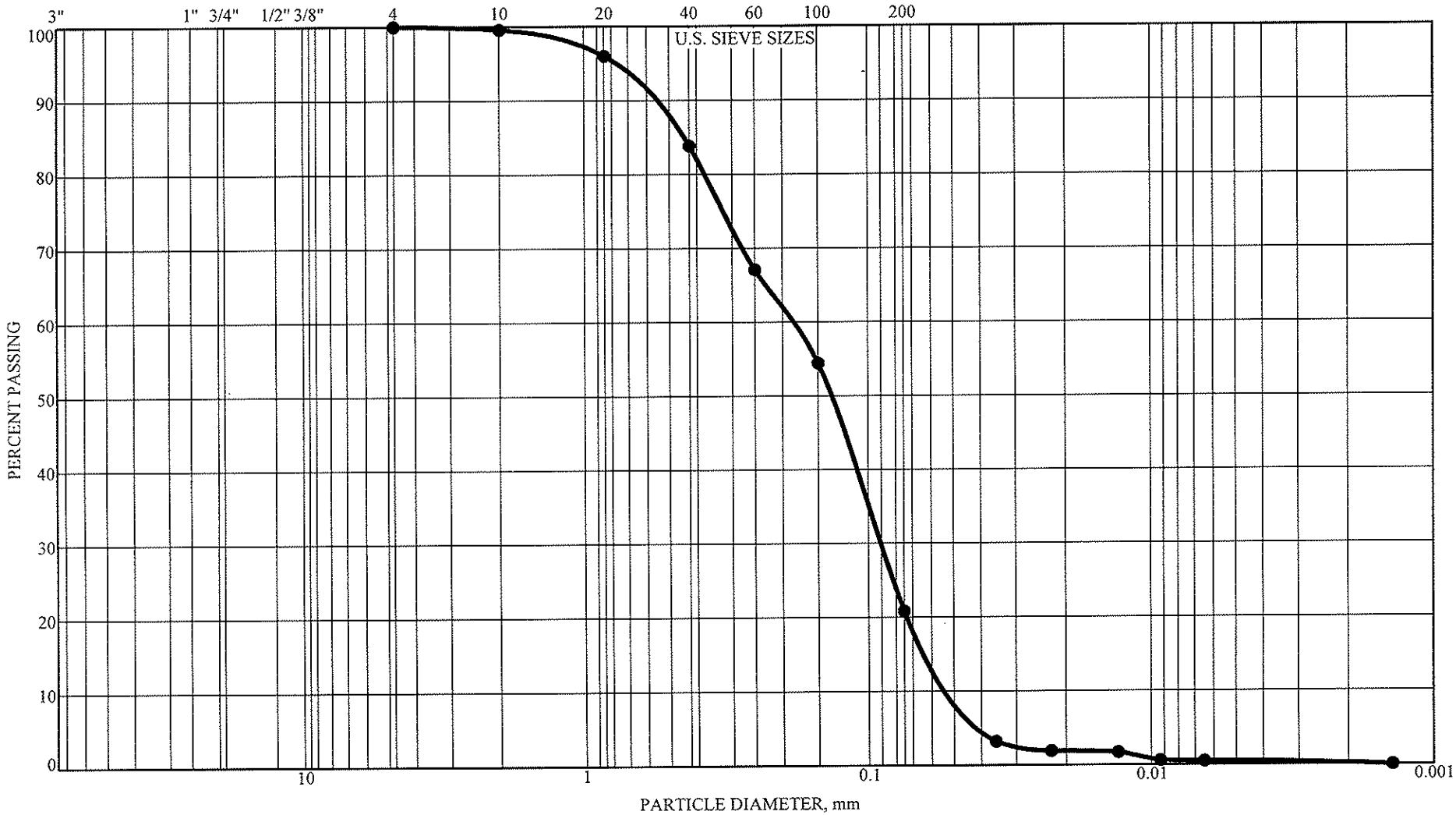
Dr	DRY
Dm	DAMP
M	MOIST
W	WET
S	SATURATED

SOIL TECHNOLOGY

Appendix C

GRAIN SIZE ACCUMULATION CURVE (ASTM)

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



BRAUN INTERTEC

Braun Project 0705565
Ashland Wisconsin
25688375

BORING: 02 DEPTH: 0.0'

GRAVEL	0.0%
SAND	79.2%
SILT	20.4%
CLAY	0.4%
D60=0.188	Cu=4.0
D30=0.091	Cc=0.9
D10=0.047	

CLASSIFICATION:
SILTY SAND(SM)

Cole 2E Lower Sed. Layer

GS ASTM 0705565.GPJ BRAUN.GDT 9/14/07 10:59

APPENDIX B3

BENCH SCALE AIR EMMISSION AND MULTIPHASE FLOW REPORT

FINAL REPORT

BENCH SCALE AIR EMISSIONS TREATABILITY STUDY - ASHLAND/NORTHERN STATES POWER LAKEFRONT SUPERFUND SITE

Prepared for

Northern States Power Company - WI
1414 West Hamilton Avenue
Eau Claire, WI 54701

August 8, 2007

URS

Milwaukee County Research Park
10200 Innovation Drive, Suite 500
Milwaukee, WI 53226
25688375.70000

EXECUTIVE SUMMARY

Bench Scale Air Emission testing and dispersion modeling was conducted on selected sediment and soil samples collected from the Ashland/NSP Lakefront Superfund Site in Ashland, WI following the United States Environmental Protection Agency (USEPA)-approved February 2007 Treatability Study Work Plan (URS 2007a). Sediment samples were collected in the part of the Site in Lake Superior at several nearshore locations (Areas 1, 2, and 2A); a soil sample was collected from one upland location (Area 4) (Figure ES-1). Emissions testing on the sediment samples was designed to simulate potential PAH and VOC emission rates associated with dredging operations, sediment dewatering and sediment treatment. Emissions testing on soil from Area 4 was intended to simulate potential PAH and VOC emission rates associated with saturated soil exposure during excavation.

Air dispersion modeling based upon the results of the emissions testing was conducted to evaluate how volatilized contaminants would be dispersed under scenarios developed to simulate remedial activities. In particular, modeling was conducted to determine whether receptors outside of the immediate Site area would be exposed to levels of volatile emissions that exceeded risk-based air quality criteria during remedial activities. The USEPA AERMOD model (version 07026) was used for this modeling assessment.

Sediment from each area was homogenized and split into batches to test sediment under three conditions:

1) Exposed sediment;
2) A 10% solids by weight slurry; and
3) A 1% solids by weight slurry.

The slurry mixtures were tested both while being mixed and while quiescent to simulate both active dredging operations and periods of inactivity. Air emissions and sediments were analyzed for 18 VOCs and 27 PAHs. Particular interest was given to benzene, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene based upon their sediment concentrations and their potential health effects.

Initial sediment analysis found Area 2A to be the most highly contaminated with PAHs and Area 4 to be the most highly contaminated with VOCs. In general, emission rates increased with increasing % of solids and decreased with elapsed time. The highest emission rates were from exposed sediment or mixed 10% solids slurry at the start of the testing runs. Area 2A had the highest overall emission rates.

Odor analysis was conducted on the 10% solids mixed slurry from both Area 2 and 2A to determine the potential for odor impacts resulting from dredging operations. Odor concentrations increased over time, with maximum odor concentrations occurring during the 6-22 hr time interval.

Air dispersion modeling results indicated that, under several of the remedial scenarios, receptors outside the Site work area would be exposed to naphthalene and benzene above health risk levels. The model predicted that under the worst case condition a much larger area outside of the immediate work area would be above the benzene standard than the naphthalene standard. Similarly, modeling of odor dispersion indicated odor detection units above one odor unit would be experienced beyond the immediate Site work area under some remedial scenarios.

In general, dispersion of volatile contaminants and odor was less for Remedial Alternative 2 (a Confined Disposal Facility) than for Remedial Alternative 3 (Dredge-Cap) or Alternative 4 (Dredge All).

TABLE OF CONTENTS

Executive Summary **ES-1**

1.0 Introduction **1-1**

2.0 Sample Collection **2-1**

3.0 Bench Scale Air Emission Test **3-1**
- 3.1 Methods and Materials 3-1
  - 3.1.1 Testing Apparatus 3-1
  - 3.1.2 Testing Procedure 3-2
  - 3.1.3 Sample Analysis Protocol 3-3
  - 3.1.4 Analytical Chemistry Methodology 3-4
- 3.2 Results 3-4
  - 3.2.1 Sample Analysis 3-5
  - 3.2.2 Sediment Analytical Results 3-5
  - 3.2.3 Soil Analytical Results 3-6
  - 3.2.4 Wind Tunnel Measurements 3-7
- 3.3 Discussion 3-7

4.0 Odor Evaluation **4-1**
- 4.1 Methods and Materials 4-1
- 4.2 Results 4-2
- 4.3 Discussion 4-2

5.0 Air Dispersion Modeling **5-1**
- 5.1 Methods and Materials 5-1
  - 5.1.1 Meterological Data 5-1
  - 5.1.1 Modeling Basis 5-2
  - 5.1.2 Emissions Test Modeling Input 5-4
  - 5.1.3 Emission Input Modeling Methods 5-5
- 5.2 Results 5-8
  - 5.2.1 Contaminant Dispersion 5-8
  - 5.2.2 Odor Dispersion 5-9
- 5.3 Discussion 5-10

6.0 Overall Summary and Conclusions **6-1**

7.0 References **7-1**

FIGURES, TABLES AND APPENDICES

FIGURES

Figure ES-1 Sample Locations
Figure 1 Site Location
Figure 2 Sample Locations
Figure 3 Push Core Photograph
Figure 4 Wind Tunnel Flow Diagram
Figure 5 Modeled Receptor Locations
Figure 6 Potential Air Emissions Locations – Alternative 4 Dredge All Option
Figure 7 Potential Air Emissions Locations – Alternative 2 CDF Option
Figure 8 Air Emission Location (Area 4)
Figure 9 Surface Wind Direction and Speed Frequency
Figure 10 Predicted Isoconcentration Lines for Naphthalene (Alternative 4)
Figure 11 Alternative 4 24-HR Modeled Benzene Concentrations; Isopleth Lines, including Dredge Area Receptors
Figure 12 Predicted Isoconcentration Lines for Naphthalene (Alternative 2)
Figure 13 Predicted Isoconcentration Lines for Benzene (Alternative 4)
Figure 14 Predicted Isoconcentration Lines for Benzene (Alternative 3)
Figure 15 Predicted Isoconcentration Lines for Benzene (Alternative 2)
Figure 16 Predicted Isoconcentration Lines for Methylnaphthalene (Alternative 4)
Figure 17 Predicted Isoconcentration Lines for Methylnaphthalene (Alternative 3)
Figure 18 Predicted Isoconcentration Lines for Methylnaphthalene (Alternative 2)
Figure 19 Predicted Isoconcentration Lines for Naphthalene (Area 4)
Figure 20 Predicted Isoconcentration Lines for Benzene (Area 4)
Figure 21 Area 4 – 24-HR Modeled Naphthalene Concentrations
Figure 22 Area 4 – 24-HR Modeled Benzene Concentrations
Figure 23 Predicted Isoconcentration Lines for Odor Detection Threshold (Alternative 4)
Figure 24 Predicted Isoconcentration Lines for Odor Recognition Threshold (Alternative 4)
Figure 25 Predicted Isoconcentration Lines for Odor Detection Threshold (Alternative 2)
Figure 26 Predicted Isoconcentration Lines for Odor Recognition Threshold (Alternative 2)
Figure 27 Detection Odor Unit Daily Impacts at Residence R1 June to Oct 2005 (Alternative 4)
Figure 28 1-hour Odor Units at Resident R1-July 27, 2005 (Alternative 4)

TABLES

Table 1 Sample Descriptions
Table 2 Summary of Emission Rates Area 1-Exposed Sediment and 1% Mixed
Table 3 Summary of Emission Rates Area 1-10% Mixed and 10% Quiescent
Table 4 Summary of Emission Rates Area 2-Exposed Sediment and 10% Mixed
Table 5 Summary of Emission Rates Area 2A-1% Mixed and 1% Quiescent
Table 6 Summary of Emission Rates Area 2A-10% Mixed and 10% Quiescent
Table 7 Summary of Emission Rates (Area 4- Exposed Soil)
Table 8 Summary of Odor Results (Area 2 and 2A)
Table 9 Emission Rates Used in Ambient Air Quality Model

TABLES (Cont.)

Table 10	Dredge-All Modeled Emission Parameters
Table 11	Maximum 24-hour Modeled Area Source Impacts and Comparison with WDNR and TLV Levels
Table 12	Maximum Annual Impacts
Table 13	Maximum Modeled Concentrations (Area 4)

APPENDICES

Appendix A	Sample Collection Core Logs
Appendix B	Bench Test Photo Log
Appendix C	Temperature, Flow, Humidity & Bench Test % Solids Raw Data
Appendix D	Test Summary and Odor Sample List
Appendix E	Summary of Sediment, Soil, and Slurry Concentration Tables
Appendix F	Braun Intertec Laboratory Reports for Air and Sediment Analysis
Appendix G	QA/QC Summary – Data Assessment Report
Appendix H	Air Emission Wind Tunnel Results and Summary Tables
Appendix I	St. Croix Laboratory Reports for Odor Analysis

ACRONYMS AND ABBREVIATIONS

3-AFC	Three-Alternative Forced Choice
AERMET	AERMOD meteorological processor
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) Model
ASTM	American Society for Testing and Materials
Braun	Braun Intertec Corporation
CAATM	Comparable Analysis of Alternatives Technical Memorandum
CDF	Confined Disposal Facility
cm	Centimeter
cm^2	Square Centimeters
COE	Army Corps of Engineers
DAR	Data Assessment Report
DOC	Dissolved Organic Carbon
DRET	Dredge Elutriate Test
DT	Detection Threshold
ft^3/min	Cubic Feet Per Minute
FS	Feasibility Study
hr	Hour
HAS	Hollow Stem Auger
I	Odor Intensity
in	Inches
in^2	Square Inches
kg	Kilogram
m	Meters

ACRONYMS AND ABBREVIATIONS (Cont.)

m^2	Square Meters
MDL	Method Detection Limit
mg	Milligram
mg/kg	Milligrams per Kilogram
mm	Millimeter
mph	Miles per Hour
m/s	Meters per Second
MVTL	Minnesota Valley Testing Laboratory
NAPL	Non-Aqueous Phase Liquid
NSPW	Northern States Power Company, a Wisconsin Corporation
OU	Odor Unit
PAH	Polynuclear Aromatic Hydrocarbon
PUF	Polyurethane Filter
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
RT	Recognition Threshold
SOP	Standard Operating Procedure
SOW	Scope of Work / Statement of Work
TFC	Triangular Forced-Choice
TLV	Threshold Limit Value
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TWA	Time Weighted Average
$\mu g/m^2/hr$	Micrograms per Square Meter per Hour
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WDNR	Wisconsin Department of Natural Resources
WWTP	Waste Water Treatment Plant

1.0 INTRODUCTION

The Ashland/NSP Lakefront Superfund Site (the "Site") consists of land and sediment located along the shore of Lake Superior, in Ashland, Wisconsin (Figure 1). The Site contains: (i) property owned by Northern States Power Company, a Wisconsin corporation (d.b.a. Xcel Energy, a subsidiary of Xcel Energy Inc. (NSPW); (ii) a portion of Kreher Park, a City-owned property fronting on the bay, which includes the former City Wastewater Treatment Plant (WWTP) structure; (iii) contaminated sediment directly offshore from Kreher Park, and (iv) Our Lady of the Lake Church/School, as well as private residences. The Site is bounded by US Highway 2 (Lake Shore Drive) to the south, Ellis Avenue and its extension to the City marina to the west, Prentice Avenue and its extension to a boat launch to the east, and a line between the north end of the marina and the boat launch to the northeast. The area of contaminated sediment is between 200 to 400 meters north of residences on St. Claire Street. Kreher Park, which it is anticipated will be utilized as a staging area for sediment remediation, for dewatering and treating sediment, is between 200 to 300 meters north of residences on St. Claire Street. Kreher Park under Remedial Alternative 2 is also proposed as the location for a Confined Disposal Facility (CDF),

This report presents the results of the Bench Scale Air Emissions Test that was one of several treatability studies that were recommended in the Candidate Technologies and Testing Needs Technical Memorandum [Treatability Studies Memorandum (Task 6 of the SOW): URS 2007b] originally submitted to USEPA on September 22, 2006. Based upon comments from USEPA this Treatability Studies Memorandum was revised to prioritize the treatability studies resulting in the following treatability studies being recommended for conducting during the Feasibility Study process:

- Cap Flux Test;
- Bench Air Emissions Test; and
- Multiphase Flow and Consolidation (Triaxial) Test.

USEPA approved the Work Plans for these three treatability studies (URS 2007a) on February 21, 2007.

Bench scale air emissions testing was conducted to evaluate the potential for release of volatile organic contaminants, both PAHs and VOCs, during dredging operations, sediment dewatering and sediment treatment. In addition the potential for release of volatile organic contaminants from saturated soils during excavation conducted in portions of the Site in Kreher Park was also evaluated.

Air dispersion modeling conducted as part of this treatability test evaluated how volatilized contaminants and odor would be dispersed under scenarios developed to simulate remedial activities. In particular modeling was conducted to determine whether receptors outside of the Site work area, i.e. in the Ashland community, would be exposed to levels of volatile emissions that exceeded risk-based air quality criteria.

2.0 SAMPLE COLLECTION

Samples were collected between February 26 and March 8, 2007 at the Ashland Site (Figure 1). Sediment samples were collected in Lake Superior at several nearshore locations (Areas 1, 2, and 2A); a soil sample was collected from one upland location (Area 4) (Figure 2). The areas where samples were collected depended upon a number of factors including:

1) Presence of contaminants;
2) Presence of representative amounts of wood debris; and
3) Ability to collect core samples which depended upon the amount of wood present as well as the cohesiveness of the sediment.

Sediment samples were collected using vibracore methods to enhance sediment penetration in Areas 1 and 2 (Figure 2). The vibracore method used four-inch diameter clear plastic tubes attached to a vibrating head. Samples were collected from these two areas where NAPL has been observed in Site sediments during remedial investigation (RI) sampling and other Site sediment studies. Area 1 is an area that has high concentrations of VOCs and PAHs with some wood debris and NAPL present, located slightly further from shore and in deeper water than Area 2. Area 1 samples were collected on February 27, 2007. Area 2 is located relatively near shore and is an area that has high concentrations of VOCs and PAHs with wood debris and NAPL. Area 2 samples were collected February 26 through 28, 2007. Multiple cores from each sampling area were needed to generate sufficient sample volume from the more highly contaminated sediment from each area for the air emissions tests.

Area 2A samples were collected using the push core method. The push core method advances eight-inch diameter clear PVC tubes into the sediment. Push core samples were collected on February 27, 2007 through March 6, 2007 and were originally intended for column flux testing. During bench scale air emissions testing on Area 2, it was observed that there was little evidence of visible NAPL and large grained wood debris in the vibracore samples from Area 2. Based upon observations during the column flux test set up, there was more visible NAPL and a courser-grained wood layer in the eight-inch push core samples. Therefore, additional bench scale air emissions testing was conducted on sediment from two of the eight-inch cores (Core 2A and 2B) as these cores would be a more representative sample of sediment with NAPL and wood debris. Core 2A and 2B were composited into one sample referred to as Area 2A. The eight inch cores were collected using an all-terrain drilling rig over ice. When the tube was advanced to the desired depth or refusal, the air space at the top of the tube was filled with water and sealed with a cap. This cap created a hydraulic seal and retained the sample as the core was retracted. A photograph of push core sampling equipment is shown in Figure 3.

After being pulled from the sediment, the bottom of each tube was capped, and a hole in the tube was drilled just above the top of the sediment layer to remove the water. The tubes were then cut immediately above the sediment, re-capped, and moved to the sample handling area in a near vertical position. The samples were retained under custody at the Site until ready for shipment. The cores were then packaged vertically into plastic 55-gallon drums with foam to stabilize the cores.

Soil was collected from one upland area (Area 4) using hollow stem auger (HSA) drilling and split spoon sampling methods.

All sediment and soil samples were logged by a field geologist. The core logs are presented in Appendix A. Core samples for bench scale air emissions testing were cut open on site and composited into five-gallon pails purged of oxygen with a nitrogen gas blanket, filled to the brim, and secured with a lid. The intervals from each core used to complete the composite samples are listed on each individual boring log in Appendix A. The pails were transported to SERVICE Engineering Group in St. Paul Minnesota (SERVICE) (the testing subcontractor) by SERVICE personnel.

Water for the bench tests was collected during the morning of March 7, 2007 from a hole cut in the ice of Chequamegon Bay in Lake Superior approximately one mile offshore from the Ashland Public Access, in approximately 15 feet of water. The water was pumped into fifteen-gallon containers using a 12 volt Whale pump. All water was driven to SERVICE by SERVICE personnel.

3.0 BENCH SCALE AIR EMISSION TEST

Bench scale air emissions testing was conducted to simulate volatile emissions from the following remedial activities/conditions:

- Exposed sediment found in stockpiles and while being transported;
- Active dredging;
- Dredging area after shutdown of dredging operations;
- Areas adjacent to active dredging areas;
- Primary treatment areas adjacent to active dredging or after shutdown of dredging operations; and
- Secondary treatment ponds or areas after initial setting in primary treatment areas such as in a CDF.

Air emission testing was conducted at SERVICE by URS and SERVICE personnel. All test runs were completed between March 14, 2007 and March 30, 2007.

3.1 Methods and Materials

3.1.1 Testing Apparatus

Figure 4 is a diagram of the air emission apparatus. Photos 1 and 2, Appendix B are pictures of the apparatus. The wind tunnel is designed to pass humidified air at a wind speed of five miles per hour (mph) over a known surface area of sediments to facilitate volatilization of contaminants into the air stream. Air samples are then collected from sampling ports just before the air discharges from the tunnel.

The inlet of the wind tunnel was a galvanized steel cone that allowed smooth air entry. To construct the humidifying zone (to minimize evaporation activity from the sediment sample), water from a constant temperature bath was gravity fed into three humidifier pads. Baffles were set immediately upstream and downstream of the humidifying zone, maximizing the evaporative surface of incoming air and reducing the localized moisture segregation. The sediment/slurry tank was attached approximately four feet downstream from the baffles to straighten airflow and allow evaporation of water droplets. Airflow was further straightened and distributed by a 5.08 cm (2 in) thick honeycomb panel placed immediately before the sediment/slurry tank. Two tanks were used: a sediment tank that was 12.7 cm (5 in) deep and a slurry tank that was 25.4 cm (10 in) deep. Both the sediment tank and the slurry tank had a 1238.7 cm^2 (192 in^2) surface area. The slurry tank contained PVC piping and two pumps to create an in-tank mixer. The tanks were removable to allow easy sediment/slurry set up and decontamination. An inert rubber gasket along the edges of the tanks ensured an airtight fit. Directly above the attached tank was a removable top, allowing post test sampling. This top was sealed during test runs. A thermohygrometer was connected immediately upstream of the tank to measure temperature and humidity. A flow meter was connected into the middle of the airflow above the tank. Baffles were constructed downstream of the sediment/ slurry tank to homogenize airflow. For air and odor samples, sampling tubes extended into the center of the airflow, and were connected to sampling ports lined along the center of the wind tunnel. Air and odor samples were drawn via a vacuum pump. The wind tunnel pulled air via a 14 inch, 1,800 ft^3/min fan.

3.1.2 Testing Procedure

Before the start of a test run, air sampling tubes were connected to the sample ports and vacuum pump, with the valves closed. A polyurethane filter (PUF) coated with di-n-butylamine (XAD-2) in an 8x110 millimeter (mm) glass tube was used for collection of PAHs. Sorbent tubes, 6x70 mm glass with Anasorb CSC 50/100 milligrams (mg), were used for the collection of VOCs. If an odor sample was taken, a VAC'SCENT sample vessel with tedlar bags was connected to a sample port and vacuum pump.

Before the start of the sediment tests, sediment was homogenized by placing samples in a clean five gallon bucket, sealing the bucket, and placing the bucket onto a horizontal rotary mixer. For the remainder of the test runs, the sediment was stored in a refrigerator and homogenized with a metal stirring spoon.

The sediment was then sampled as pretest sediment. If slurry was to be tested, the sediment was weighed out to the desired amount, and placed in the slurry tank. Lake water was also weighed out, poured into the slurry tank, and homogenized to meet the desired solids content. Desirable sediment and water weights were pre-determined by on-site percent solids testing. Slurry was then sampled as pretest slurry and the pumps in the tank were turned on. If exposed sediment was to be tested, the sediment was placed to the fill line in the sediment tank. The sediment/slurry tank was connected to the wind tunnel, and clamped down to ensure an airtight fit. If the test was for a quiescent slurry, the mixing pumps were turned off. The valves of the air/odor samples were opened, and the vacuum pump turned on. The fan was turned on, and throttled to approximately 5 mph (2.24 m/s).

Humidity, temperature, and air flow were measured and recorded every 30 minutes. Appendix C contains the raw data of these measurements. The temperature and humidity was monitored and adjusted throughout the test to prevent condensation. Two hours into the test run, the air samples were disconnected and capped, and new air sample media tubes were connected to the sample ports and vacuum pump. This was repeated to get the three air samples from the time intervals of 0-2 hours, 2-6 hours, and 6-22 hours into the test. These tests were terminated after 22 hours. If an odor sample was taken, the tedlar bag was connected at the start of the test, throttled to the lowest flow rate, and disconnected and sealed when the bag was filled. New tedlar bags were connected two hours into the test and six hours into the test. The odor samples were delivered to St. Croix Sensory within 30 hours of sampling.

After the full 22 hours of testing, the fan was shut off. If it was a mixed slurry test run, the mixing pumps were turned off at this time. A bailer was used to sample the post test slurry, and the tank was disconnected. For slurry test runs, sediment was allowed to settle for 15 to 20 minutes and water was decanted off and disposed of as non-hazardous waste. The post test sediment samples were collected and the remaining sediment was disposed of as non-hazardous waste. Tanks were scrubbed with a tri-sodium phosphate solution; after highly contaminated tests with visible NAPL, tanks were also scrubbed with hexane. Water was flushed through the tanks for 30 minutes and this water was decanted from the tank for a decontamination sample to ensure no cross-contamination. End-of-test samples were collected within four hours of test completion to allow the wind tunnel device to be decontaminated and prepared for the subsequent test run within the first two hours to keep the tests on a 24-hour schedule.

3.1.3 Sample Analysis Protocol

Three types of sediment mixtures and one type of soil sample were used for the bench scale air emissions testing to simulate typical sediment mixtures that would occur during sediment remediation. Sediment mixtures and soil samples tested included:

1) Sediment as collected (aka exposed sediment): This sediment mixture, at in-situ percent solids was used to simulate exposed sediment, such as uncovered sediment stockpiled after dewatering ponds. Exposed sediment was tested while quiescent.
2) 1% slurry: The sediment diluted with lake water to 1% solids and mixed during testing is representative of natural mixing adjacent to active dredge areas (e.g. water near, but not in the immediate vicinity, of the dredge and discharge areas). This sample was split and emissions were measured while agitated and quiescent. The 1% solids mixture is based on the Army Corps of Engineers (COE) Dredge Elutriate Test (DRET) standard evaluation.
3) 10% slurry: The sediment diluted with lake water 10% solids by weight simulates forced mechanical mixing in active hydraulic dredge and deposition areas (e.g. the sediment/slurry mixture being pumped into the CDF). The 10% mixed test is representative of the primary dewatering treatment ponds for the CDF. The 10% quiescent samples are representative of additional settling time in the secondary dewatering treatment ponds and also representative of the primary cells during dredging shut down.
4) Soil as collected: This is intended to represent exposed soil during excavation in upland areas. Exposed soil was tested while quiescent.

Percent solids of these sediment mixtures were initially measured at the wind tunnel testing site to determine the required volume of lake water needed to dilute sediments to obtain the target % solids by weight of the slurries, i.e. 1% and 10%. Small pumps were used during the test to mix sediment and water slurry in the chamber for the mixed tests only. The slurry was mixed to maintain mixing conditions during the 1% and 10% solids slurry tests.

Due to a limited sample volume of sediment available in some cases not all mixtures could be tested for each location. Deviations are listed as follows:

- Area 1 had sufficient material for 10% solids for mixed and quiescent slurries, and 1% solids mixed slurry. Exposed sediment and 1% quiescent slurry were not tested.
- Area 1 had limited visible NAPL and anticipated lower levels of contaminants. Therefore a 1% solids quiescent slurry was not run since the results were expected to be very low and was replaced by an additional test for Area 2A.
- Area 2A was the most visibly contaminated, so a 10% solids and 1% solids mixed and quiescent slurries were tested. There was insufficient sediment volume to test exposed sediment.
- Area 2 was tested with exposed sediment and 10% solids mixed slurry. At that time it was decided to replace the remaining tests with sample 2A because the eight-inch diameter cores collected at Area 2A appeared to have a higher NAPL content and contained a greater proportion of large wood fragments. It was decided that this was more representative of conditions in some of the more highly contaminated areas of the Site.

3.1.4 Analytical Chemistry Methodology

Aliquots from the above sediment mixtures and soil samples were taken for chemical analysis as follows:

- Pretest Sediment/Soil;
- Pretest Slurry (for 10% and 1% solids tests);
- Air: 0-2 hr, 2-6 hr, and 6-22 hr into the test;
- Odor (for Area 2 and Area 2A), see Section 3.3;
- Post Test Sediment/Soil;
- Post Test Slurry (for 10% and 1% solids tests); and,
- Post Test Decontamination Water (This was the water collected between tests to ensure no cross contamination occurred).

Homogenizing the entire sample volume from each area was not practical due to the presence of wood debris and the potential for loss of VOC's. As a result, pretest sediment/soil samples (aka bulk sediment samples) were collected for each test at the time of each test run. Samples were delivered to Braun Intertec for chemical analysis within 48 hours of collection. Sample analysis included analysis for PAHs, VOCs, total organic carbon (TOC), dissolved organic carbon (DOC), and total suspended solids (TSS) as described in Appendix D.

Exceptions to the above testing protocol included:

- The Area 1, 10% solids quiescent slurry test did not have any pretest sediment sample.
- Due to lack of available sediment, pretest sediment samples for Area 2A 1% solids quiescent slurry test were not analyzed.
- The TSS sample for the pretest 10% solids mixed test of Area 2A was not analyzed.

3.2 Results

This section presents the pretest and post test sediment data, pretest and post test soil data, and wind tunnel test data for each Area and describes unique differences. The sediment and soil analytical concentrations are presented in Appendix E. These contaminants include benzene, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene, as well as TOC, total PAHs, and total VOCs. Calculations of total VOC and total PAH values do not include analytes that were not detected.

Descriptions of pretest sediment/slurry, post test sediment/slurry, pretest soil, and post test soil are provided in Table 2. Representative photos of sediment and soil samples are provided in Appendix B. The sediment from Areas1 and 2 and the soil from Area 4 consisted of silty sand and contained small pieces of wood. Photo 3 and 4 are pictures of Area 1 and 2 pretest sediment respectively. Slurries were generally brown water with sand settled on the bottom (Photo 5). Slurries from Area 1 and 2 had a sheen or film (Photo 6).

Because there was little of visible NAPL and larger wood debris in vibracore samples from Area 2, additional emissions testing was conducted on sediment from the eight-inch cores 2A and 2B, originally collected for column flux testing. Based upon observations during the column flux test,

there was more visible NAPL and a courser-grained wood layer in these eight-inch core samples. It was decided these core samples would be a more appropriate representative sample of sediment with NAPL and wood.

Core samples 2A and 2B were composited and labeled Area 2A. Sediment in Area 2A contained wood debris ranging in size from small splinters to pieces greater than five inches long. This composite sample had visible NAPL and a strong odor. Pictures of this sediment and wood are included in Photo 7 and 8 of Appendix B. The slurries prepared from Area 2A contained a thick film or foam after the test run (Photo 9 and 10). The sediment settled at the bottom of the tanks had a very strong sheen (Photo 11). Due to the presence of varying wood sizes, test samples prepared from sediment collected at area 2A were not homogeneous.

3.2.1 Sample Analysis

Chemical analysis of sediment, soil, and air samples was conducted by Braun with the exception of TOC, which was subcontracted to Minnesota Valley Testing Laboratories (MVTL), Inc. of Bismarck, North Dakota, and ERA Laboratories, Inc. of Duluth, Minnesota. The Braun analytical reports are presented in Appendix F. URS Chicago, Illinois conducted a QA/QC review of the data in accordance with the Final RI/FS Work Plan (URS 2005). The results are summarized in a Data Assessment Report (DAR) presented in Appendix G. The DAR summarizes the data quality and usability of the analytical data generated for the treatability studies. The major components of the QA/QC program include the collection and analysis of QC samples, the use of standardized operating procedures (SOPs) for laboratory activities, and data validation of analytical results.

The DAR concluded all analytical results generated by Braun and its subcontractors were considered valid and could be used with confidence for decision-making. The data are considered usable based on the QC information provided by the laboratories and the results of their internal data validation. Although a complete independent validation was not completed, the review found that the laboratories followed industry-accepted test methods and performed standard QC analyses as required by the laboratory-specific SOPs provided in the approved quality assurance project plan (QAPP) (URS 2005; URS 2006). Some sample results were reported with elevated reporting limits due to the presence of high concentrations of target compounds or matrix interference. These results are still usable for quantitative purposes. However, the elevated reporting limits may prevent conclusive confirmation that the target chemicals of concern are not present at a specific location if the reporting limit is above the associate risk screening level. Some results should be used with caution (for quantitative purposes) due to the lack of an appropriate method detection limit (MDL). Although these results were not rejected, these results still have some value to the data user to guide further evaluations of the Site and its treatability goals.

3.2.2 Sediment Analytical Results

Area 1

This pretest bulk sediment was classified as brown sand, fine-grained to medium-grained, subangular, with wood slivers, woodchips less than 0.25 inches and wood chunks greater than two inches, very low plasticity, moist to slightly wet (Table 1).

Area 1 bulk sediment analytical results are summarized in Tables 2 and 3. There is some variability in the concentrations of the prevalent PAHs and VOCs in the three bulk sediment samples; however, the results appear to correlate. Total PAHs ranged from 840 mg/kg to 1,281 mg/kg and total VOC concentrations ranged from 30 mg/kg to 43.9 mg/kg. The lowest concentrations of the prevalent PAHs and VOCs were detected in Area 1.

Area 2

The pretest sediment at Area 2 was classified as brown silty sand, very fine grained to medium grained, subangular, with woodchips less than 0.25 inches, and wet (Table 1).

Area 2 bulk sediment analytical results are summarized in Table 4. The concentrations of the prevalent PAHs and VOCs in the two bulk sediment samples are comparable. Total PAH concentrations ranged from 2,942 mg/kg to 3,048 mg/kg and total VOC concentrations ranged from 131 mg/kg to 162 mg/kg.

Area 2A

The bulk sediment at Area 2A was classified as wood with small splinters to some chips greater than 2.0 inches to trace pieces greater than 5.0 inches, some silt, trace black sand, strong odor, visible NAPL, very moist (Table 1). Due to a lack of available sediment, bulk sediment samples were not collected for the 1% solids quiescent slurry test run.

Area 2A pretest sediment analytical results are summarized in Tables 5 and 6. Due to heterogeneities in the sample matrix, the agreement between prevalent PAHs and VOCs concentrations in the three bulk sediment analytical results includes one extremely high sample for PAHs. The total PAH concentrations averaged 2,171 mg/kg for two of the samples and 16,879 mg/kg in the high sample and total VOCs ranged from 165 mg/kg to 274 mg/kg. The bulk sediment sample from the 1% solids by weight slurry test contained the highest concentration of individual and total PAHs while the highest concentration of individual and total VOCs was detected in the bulk sediment sample for the 10% solids mixed test.

Due to lack of material, an exposed soil test run and a pretest sediment sample for the 1% solids quiescent test run was not completed for Area 2A.

3.2.3 Soil Analytical Results

This section presents the results from analysis of bulk and post test soil from Area 4 (Appendix E). Particular attention is placed on the most prevalent compounds or groups of compounds. These include benzene, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, TOC, total PAHs, and total VOCs. Calculations of total VOC and total PAH values do not include analytes that were not detected.

The soil was classified as a brown silty sand, soft, medium plasticity, small pieces of wood, and moist (Table 1).

Since Area 4 was a land site, no slurry test runs were necessary and the only test run was for exposed soil. A summary of pretest and post test exposed soil analytical results are summarized in Table 7. In comparison to pretest samples from Area 1 and Area 2, the Area 4 pretest sample

had higher concentrations of benzene, ethyl benzene, toluene, and total xylenes. The concentrations of 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene in Area 4 are comparable to the concentrations in Area 1. The pretest and post test soil samples for the Area 4 exposed soil test contain comparable concentrations of the selected VOCs, PAHs, and TOC.

3.2.4 Wind Tunnel Measurements

The total chemical mass emitted over the sampling period (0-2 hr, 2-6 hr, 6-22 hr) was divided by the exposed surface area in the test chamber (0.124 m^2) and then by the sampling hours, to determine an emission rate with the units $\mu g/m^2/hr$.

Emissions testing results are presented in Appendix H and summarized in Tables 2 through 7. In the 33 air samples analyzed during wind tunnel testing, three PAH compounds and six VOCs were detected that were considered important for possible modeling. The compounds that were detected in the 33 total samples tested, in order of frequency, with number of detections in parenthesis are as follows, naphthalene (32), benzene (32), toluene (32), 1,2,4-trimethylbenzene (29), total xylenes (27), ethyl benzene (19), trichloroethene (14), 2-methylnaphthalene (13), and 1-methylnaphthalene (9).

The highest emission rates during all sediment and slurry tests were during the first sampling period (0-2 hr). The three highest emission rates were from the Area 2A 10% solids mixed slurry test (Table 6), the Area 1 exposed sediment test (Table 2), and the Area 2 10% solids mixed slurry test (Table 4).

The exposed sediment emission rates for Area 1 for all compounds were typically higher than the 1% solids mixed slurry test, 10% solids mixed slurry test, and 10% solids quiescent slurry test emission rates. The exposed sediment emission rates for Area 2 were similar to the 10% solids mixed slurry test, with the exception of naphthalene and ethyl benzene, which had lower emission rates in the exposed sediment test. An exposed sediment test was not completed on Area 2A.

The emission rates for exposed soil at Area 4 are summarized in Table 7. The number of compounds detected increased from one compound (naphthalene) during the 0 to 2 hour sampling period to six (naphthalene, 1,2,4-trimethylbenzene, benzene, ethyl benzene, toluene, and total xylenes) during the 6 to 22 hour sampling period.

3.3 Discussion

Selection of contaminants for modeling was based upon their concentration in Site sediments, review of health standards for air quality and emissions rates from the bench scale test. In addition, the experience at Stryker Bay was considered. Based upon the approved work plan (URS 2006), contaminants that were to be modeled included benzene, naphthalene and up to two more compounds.

Naphthalene was selected because of its relatively low standard and relatively high emission rates in the bench scale test. In Stryker Bay, which has many contaminants similar to the Ashland site, the potential for volatilization of naphthalene from sediment was the basis for some of the remedial decision making.

Benzene was selected because it is found in relatively high concentrations in Site sediments and the air quality standard is relatively low. In addition, emission rates measured in the bench scale test were among the highest.

The remaining two compounds selected were the methylnaphthalenes, 1- methylnaphthalene and 2-methlnaphthalene, were selected because they were found in relatively high concentrations in Site sediments and because they have similar properties and emissions rates as naphthalene.

Toluene also had relatively high emission rates in the bench scale test and had relatively high concentrations in Site sediments. However, toluene was not selected because of its relatively high air quality standard (4,522 $\mu g/m^3$-24 hr maximum). Subsequent review of the individual station data indicated that there were some stations with concentrations of toluene even higher than that measured in the areas selected for sampling (220 mg/kg versus 18 mg/kg in the station sampled for the emissions testing). It is likely that emission rates for toluene would have been even greater than measured in the bench scale testing had sediment from that area been sampled.[1]

The emission rates were compared by area and test and include bulk sediment concentrations. The maximum measured emission rates were typically measured during the 0-2 hour time interval, and data from this period were used to simulate worst case conditions during active dredging operations which were assumed to occur on a 24 hour, 7 day schedule. One distinct trend was the large difference in sediment contaminant concentration between Area 2 and 2A. These samples were taken from approximately the same area (Figure 2). The difference illustrates the heterogeneity in sediment properties within a relatively small area. A large difference was found in bulk sediment contaminant concentration in the 1% mixed (Table 5) compared to the other two bulk sediment concentrations runs (Table 6) for Area 2A. Area 2A had a large amount of wood debris, which was not easily homogenized before sampling.

If Area 2 and 2A are grouped as one location, together they had the highest concentration for most contaminants, including 1-methlynaphthalene, 2-methylnaphthalene, and naphthalene. Any remediation activities in this location or other locations that share this area's characteristics have the highest probability of atmospheric release of contaminants.

Although Area 4, the upland station, contained the highest levels of benzene, no volatilization of benzene was detected in the 0-2 hr and 2-6 hr samples. Results were high in the 6-22 hr sample suggesting that benzene was initially lost near the soil surface during the set-up procedure.

[1] Should additional information for potential toluene volatilization be needed in Remedial Design, the data are available from this study to model toluene. Based upon the modeling results for benzene and comparison of benzene's characteristics with toluene's, it is likely that dispersion modeling would show that the spatial extent of toluene exceeding its air quality standard is less for benzene exceeding its.

4.0 ODOR EVALUATION

4.1 Methods and Materials

The potential for odors from contaminants as well as from naturally occurring materials, e.g. hydrogen sulfide, emanating from Site sediments and soil were evaluated. The testing apparatus shown in Figure 4 is the same for odor testing, only the sampling and analytical methods are different. All odor analyses were conducted and validated by St. Croix Sensory, Inc. The odor evaluation reports are presented in Appendix H.

Odor samples were collected using a VAC'SCENT sample vessel as described in Section 3.1.2 at three time intervals (0-2 hours, 2-6 hours, and at 6-22 hours after test initiation) during the 10% solids mixed slurry tests from Area 2 and 2A. The 10% solids mixed slurry tests from Area 2 and 2A were sampled for odor because they are expected to contain the highest contaminant concentration and used the most for worst case modeling Upon sample delivery, St. Croix Sensory assessed the sample using a certified odor panel in accordance with American Society of Testing and Materials (ASTM) E 679-04: "Standard Practice for Determination of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits," and the compatible, but more specific, European Odor Testing Standard prEN13725: "Air Quality – Determination of Odor Concentration by Dynamic Olfactometry."

The odor panel used five trained, experienced, and certified assessors. Odor thresholds were determined using a presentation method called the "Three-alternative forced choice" (3-AFC) method, or the "triangular forced-choice" (TFC) method. The 3-AFC and TFC processes involved the assessment of a group of three samples, consisting of one containing the odor and two odor-free blanks. The assessor was required to choose one of the three and acknowledge their response as a "guess," "detection," or "recognition," as defined by ASTM E679-04. Air sample dilutions also were presented to the assessors, starting with below the odor threshold (subthreshold) and then at successive higher odor concentrations. Results were computed for each assessor based on the dilution levels where correct "detection" or "recognition" responses were recorded. The responses of all assessors were averaged to determine the sample's detection and recognition thresholds. Odor thresholds are established by dilution of a sample and the number of dilutions at a certain threshold are expressed as odor units at that threshold. The maximum number of dilutions where the actual odor is still detectable is known as the detection threshold (DT). The recognition threshold (RT) is the maximum number of dilutions at which the assessor can still identify the odor's character ("smells like…"). This value is typically two to four times lower than the DT since one can detect an odor at a greater dilution than one can actually identify, or recognize, what the odor is. Results are reported in odor units with one unit as a standard for detection odor units and one unit as a standard for recognition odor units. Recognition of odors is usually a more offensive measure than only detection, especially for odors that are undesirable such as a coal tar chemical type smell.

4.2 Results

Odor detection thresholds and recognition thresholds were reported for each of the samples from the 10% solids mixed slurry tests from Area 2 and 2A and are presented in Appendix I. The odor emission rates are summarized in Table 8.

The 10% solids mixed slurry sample made from sediment from Area 2 and 2A resulted in the maximum odor values. Odor concentrations increased over time for Area 2, with the highest concentration obtained during the 6-22 hour time interval. At that time the maximum DT was 110 odor units (OU) and the maximum RT was 70 OU. For Area 2A, the 10 % solids mixed slurry odor concentrations spiked during the 2-6 hour time interval with a maximum DT of 180 OU and a maximum RT of 100 OU.

The DT and RT values were higher in Area 2A than Area 2. For both Area 2 and 2A the DT is approximately 30% greater than the RT in the 0-2 hour time interval and 60 to 90% greater than the RT in the 2-6 and 6-22 hour time intervals.

4.3 Discussion

In general, odor associated for both Area 2 and 2A the sediment samples increased from the 0-2 hr sample to the 2-6 hr sample, unlike the volatile emissions for naphthalene and benzene. This may indicate that less volatile compounds that take longer to volatilize may be an important contributor to the overall mix of odor emitting compounds.

The DT and RT odor units have the most relevance for evaluating if the public will detect or recognize an odor. The maximum values are DT of 180 OU and RT of 100 OU.

5.0 AIR DISPERSION MODELING

All sediment remediation alternatives will result in various levels of sediment disturbance and potential for the release of contaminants associated with these sediments. In order to evaluate the significance of these releases, air dispersion modeling was performed for the three sediment remediation alternatives:

1) Removal by dredging with onshore sediment dewatering and off-site disposal (Alternative 4);
2) Partial dredging and capping with onshore dewatering and off-site disposal (Alternative 3); and,
3) Dredging with a nearshore CDF for disposal (Alternative 2).

In addition, dispersion of volatile contaminants associated with excavation of soil from Area 4 (the NSPW Service Center) was also modeled. Modeling was conducted using publicly available USEPA models [AERMOD model (version 07026)] and the results compared to Wisconsin Department or Natural Resources (WDNR) air toxics guidance. Five years (2002-2006) of meteorological data from Ashland Kennedy Memorial Airport were used to as the basis for the model.

5.1 Methods and Materials

5.1.1 Meterological Data

There are four locations in the Ashland area that routinely measure meteorological parameters. These sites are known as Ashland, Ashland 3s, Ashland Experimental Farm, and the Ashland Kennedy Memorial Airport. Locations of each are provided in below.

Station	Latitude (N)	Longitude (W)	Period of Operation	Station Type	Base Elevation Above Sea Level (ft)
Ashland	46.600	90.883	Mar 1955 - present	Coop	659
Ashland 3s	46.550	90.917	Jul 1998 - present	AB Coop-A	826
Ashland Experimental Farm	46.567	90.967	Jan 1948 - present	AB Coop-A	650
Ashland Kennedy Memorial Airport	46.550	90.917	Jun 1959 - present	ASOS - FAA	826

Coop = Cooperative Station
ASOS – FAA = Automated Surface Observing Station – Federal Aviation Administration

The data from Ashland Kennedy Memorial Airport were selected for use in the dispersion modeling. The data obtained at the Ashland Kennedy Memorial Airport are readily available, recent, and routinely collected using an automated surface observing station (ASOS) maintained by the Federal Aviation Administration (FAA) to provide weather flight support. The data are collected and collated and made available in formats suitable for dispersion modeling.

Important input parameters to refined dispersion modeling include hourly values of wind speed, wind direction, and temperature. These values combined with others including cloud cover, time of day, solar radiation, etc., can all be used in the meteorological data processor to compute hourly atmospheric dispersion parameters used by the model to calculate emission fate and transport.

Data collected at ASOS stations are routinely done so at two levels with wind data collected at a height of 10 m above grade and temperature data collected at a height of 2 m above grade to conform to World Meteorological Organization (WMO) guidance. The height of the Ashland airport measurements was not confirmed but the guidance value of 10 m was used as the ASOS installation date was in the late 1990's and uniform installation procedures were being followed.

The Ashland airport wind and temperature measurements are augmented with measurements of cloud cover, ceiling height, visibility, and precipitation. Each of the measured parameters are used to form hourly values which are transmitted to the FAA and the National Climatic Data Center (NCDC) where the data are stored for subsequent use.

Data collected at the Ashland airport site during the five-year period was analyzed for completeness. Of the possible 43,824 hours of data there were 40,638 hours of data reported for wind speed and wind direction and 41,815 for temperature and dew point and 41,832 hours for cloud cover. These values represent greater than 90 percent data capture for the entire period which conforms with EPA guidance.

The WDNR does have pre-processed available meteorological data suitable for dispersion modeling analyses. However, the closest site to the Ashland project area is obtained at the Duluth, Minnesota airport which is located over 60 miles away. The Ashland airport site is more representative of the Ashland project site than other WDNR available data and given that the other Ashland cooperative sites do not routinely collect hourly information and especially wind information it was concluded that the airport site was the best source of surface meteorological data for this analysis.

The surface data were augmented with upper air data from International Falls rather than Chanhassen, Minnesota, given the more northerly exposure of the International Falls site. The influence of the upper air site is likely minimal given the surface release characteristics of the modeled activity.

5.1.1 Modeling Basis

A dispersion modeling analysis was completed to assess the potential impact on local air quality by the proposed remedial scenarios. Anticipated receptors (points where impacts were calculated) were placed in areas where the public currently lives or has access.

The model was designed up to simulate the following potential scenarios:

- Alternative 2 – CDF over most highly impacted area; dredge outside the CDF (21 cells) and place dredged sediments into CDF.
- Alternative 3 – Dredge entire area from zero up to four feet, dewater and stockpile sediment onshore.
- Alternative 4 – Dredge entire area from zero up to depth of impact (~ 8ft), dewater and stockpile onshore.
- Area 4 excavation of saturated contaminated soils in the NSPW service work area.

Each of the scenarios was modeled for three different compounds; naphthalene, benzene, and total methylnaphthalene. These compounds were selected based on the volatile compounds found to have the highest emission rates in the wind tunnel tests and potentially more restrictive air quality standards. Odor was also modeled for Alternatives 2 and 4 based on the results discussed in Section 4.3.

The USEPA approved AERMOD model (version 07026) was used to simulate emissions from the remedial scenarios. Each activity area (dredge cell, dewater/stockpile, and CDF) was modeled as an "area source" to best simulate the emissions of the three modeled compounds. An area source means that emissions are simulated to come from every point in the area rather than a single unique point such as a stack. The release heights were set very low to better account for volatilization of disturbed sediments and soils near the water surface and out of the water for stockpiles.

Once emitted to the atmosphere, emissions are transported and dispersed downwind. The transport distance and coherence of the emissions is determined in part by the condition of the atmosphere and how fast and steady the wind is blowing. Varying winds tend to disperse emissions and have lower downwind concentrations, while persistent wind directions will tend to have more localized and higher concentrations downwind. Faster winds can carry emitted compounds farther downwind in the same time period than light winds.

The dispersive capacity of the atmosphere is modeled by using local hourly meteorological data collected using standard instrumentation from the nearby Ashland airport. Each hour of wind speed and direction, and temperature information over a five year period (2002-2006) was used as input to the model. For every hour during an active sediment dredging or soil excavation period, the model, using the available meteorological information, calculated emission paths and amounts and then summed these values to determine hourly and daily values for comparison with standards or threshold levels.

As previously discussed, the model calculates concentrations at specific locations called receptors. The locations of the receptors are placed depending on the type of analysis being conducted. The purpose of typical dispersion modeling efforts is to determine the potential impact to the public, and therefore, receptors are located in "ambient" air or in areas where the public currently has access. For this analysis, however, receptors were placed both within and outside the active dredge and sediment remediation areas so that concentrations could be mapped to better allow decision makers to understand where maxima occur and the extent of the impact, so that both worker and public safety can be considered. The modeled receptor grid locations are shown in Figure 5.

In order to simulate dredging activity, the nearshore Site area which included sediment above the Preliminary Remediation Goal (PRG) was divided into 100 ft X 100 ft cells. In all there are 42 cells. Emission rates for each dredge cell area were calculated from sediment concentrations and activity coefficients. Then, a modeled area emission rate was used in the AERMOD model based on the area of the activity and emission level associated with that area. Onshore dewatering and stockpile areas were larger than the dredge cells and the emissions modeled were calculated to reflect activities taking place in these areas.

Alternative 4 includes dredging of all contaminated sediments that exceed the PRG, and onshore dewatering and stockpiling of sediments. The dredging activities will be conducted in the various candidate sites (represented as all 42 cells) and the sediment will be transported to shore for dewatering and temporary storage prior to removal. The modeled areas for Alternative 4 are shown in Figure 6. Under Alternative 4, dredging operations were modeled to occur over a 134 day period beginning June 1. The activity was simulated to move from dredge cell to dredge cell sequentially, with the activity at each cell lasting one to four days depending on depth to meet the clean-up goals.

The Alternative 3 remedial scenario is similar to the Alternative 4 scenario except that the dredging will be limited to a depth of up to four feet and a sand cap will be placed over the remaining deeper contaminated sediments to restore the original bathymetry. Because of the shallower depth, the dredging activity occurs over a shorter period of time than Alternative 3, 79 days. The same source parameters were used but the emissions were determined from the zero up to four feet depth samples.

Modeling for the Alternative 2 remediation scenario simulated emissions from limited dredging of cells in the bay beyond the CDF area where only cells 22-42 are actively dredged and the CDF is located in the bay as depicted in Figure 7. With fewer cells to dredge, this alternative also had a shorter active period, 54 days. The CDF is assumed to initially have two separate cells as illustrated in Figure 7.

Source emission locations associated with Area 4 (Figure 8) includes excavation of soil and stockpiling in portable dumpsters. The activity will last approximately one month and was simulated using a single area source located within the NSPW Service Center courtyard with the operations occurring in July. Because of the use of portable dumpsters, the activity was modeled occurring 1.0 meter above the ground rather than at ground level.

5.1.2 Emissions Test Modeling Input

Data selection for dispersion modeling is based on a maximum or worst case scenario and these data are summarized in Table 9. The following explains the basis for data inputs from the sediment/soil emissions testing shown in Table 9:

- Area 2 and 2A results were used for all dredging alternatives using the 0-2 hour rate. This was selected since samples 2 and 2A are most contaminated and the 0-2 hr rate reflects active dredging operations with fresh sediment.
- An estimated emission rate for each contaminant in each dredge cell was developed by applying a correction factor to the emissions testing results. Each cell's estimated maximum value (result in cell or value extrapolated from the nearest representative measurement) from sediment sampling in the RI was divided by the sediment value used as representative result of the bulk sediment in the emission test. Higher measured contaminant concentrations in the cell than in the test sediment would result in proportionately higher emissions, and lower cell contaminant concentrations would result in lower emission rates.

- In some cases bulk sediment results and emission rates from more than one of the test samples were averaged. Where more than one bulk sediment result was available, the two results most similar were averaged. The following summarizes how the bulk sediment and emissions rates were developed and are shown in Table 9.
    - For 2A an average concentration of 530 mg/kg naphthalene was used for calculating correction factors of the bulk sediment concentration. This was the average concentration for the 10% quiescent and 10% mixed slurries (Table 6).
    - Benzene results from 1% mixed and 10% mixed slurries were averaged (Tables 5 and 6) and a bulk sediment value of 5.1 mg/kg was used for correction factor calculation (See above).
    - Total methylnaphthalene (Table 6) average of 10% quiescent and 10% mixed slurry of 520 mg/kg bulk sediment measured for 2-methylnaphthalene was used for calculating the correction factor. The only other result available for source material was 1% mixed slurry at 2,700 mg/kg, and like naphthalene for this same sample appeared to be high due to the heterogeneity of the sediments. 1-methylnaphthalene emissions were not detected in most samples and did not have much impact on the inputs.
    - Sample emission rates were averaged for Area 2 and 2a for benzene and naphthalene to account for variability in the results for the 10% mixed sample.
    - For total methylnaphthalene, both 1-methlynathalene and 2-methylnaphthalene were summed and where the 1-methlynapthalene was below detection limits the detection limit was added.
    - For the 1% mixed and quiescent, and 10% quiescent, only the Area 2A emission rates were used.
- Since only one composite sample of the boring taken from Area 4 exists, the results are used and assumed to be average for this soil without any correction factor needed. The benzene emission rate for the 6-22 hr sample was used since the other two samples were below detection limits (Table 7).

Once correction factors were applied to the estimated concentrations for each contaminant at each dredge cell, then emission rates could be developed from the test data. This was calculated as explained above by taking each cell maximum estimated contaminant concentration divided by the test bulk contaminant concentration. The emission rate was then adjusted by the same ratio, i.e. the estimated cell contaminant concentration to the test sediment concentration.

The worst case emission rates used as an estimate of active dredge cell emission rates were also applied continuously to the dewatering ponds and stockpile areas to represent dewatering and stockpiling emissions. The same modeling approach was used for Alternative 2 CDF although modeling began with cell 22 rather than cell 1 used for Alternatives 3 and 4. The emissions rates used from emission testing for modeling are shown for the various remedial sources in Table 9.

5.1.3 Emission Input Modeling Methods

Emission rates for all sources, i.e. dredge cells and onshore operation areas, used the same active cell correction factors for all emissions rates used for naphthalene, benzene and total methylnaphthalene. These cell emissions rates are shown for remedial Alternatives 3 and 4 in Table 10. While there are 48 emission sources shown in Table 10, not all are modeled as if all

activities are occurring simultaneously. Modeling to simulate Alternative 4 includes only the dredge and onshore dewatering and stockpile activities (cells 1-42, dewatering and stockpile sources). Under Alternative 2, the CDF ponds were modeled along with cells 22-42, whereas the Alternative 3 locations were the same as Alternative 4 but with different emission rates because of shallower dredging. While Area 4 remediation will possibly occur during the sediment remediation the cumulative effects were not modeled. Remediation of Area 4 was modeled independently.

The emission sources shown in Table 10 include dredging, stockpile, and dewatering pond sources. There are two pond sources for dewatering and include a primary pond for the first step in the dewatering and a secondary pond for additional treatment of the water from the primary pond. Under Alternative 2 emission sources are assumed for the dredging cells 22-42 from Alternative 4 data and primary and secondary pond surfaces associated with Alternative 2 CDF that represent the primary fill area (cdfp) and secondary non-active fill area (cdfs) (Table 10). The emission rates include those for the two different dredging depths (0-4 feet and 0-8 feet) for Alternatives 3 and 4 respectively.

Under Alternative 4, highest naphthalene emission rates from dredging were predicted for dredge cell 25. For benzene under Alternative 4 the highest emission rates were from cell 15[2] and for methylnaphthalene, from cell 9. These values were therefore subsequently used to model emissions for all dredging activities planned under Alternative 4. This approach was taken so that maximum short-term concentrations could be calculated for each modeled pollutant under all of the metrological conditions that occur during the dredging time period.

For Alternative 3, where only the upper four feet are dredged, the maximum emission rates remained the same as in Alternative 4 except for naphthalene, cell 9 was the maximum emissions rate.

For Alternative 2, emission rates from dredging were the same as for Alternative 4, although since dredging will only take place outside the footprint of the CDF, only emissions from cells 22-42 were included and the related shorter dredge time. The naphthalene cell 25, benzene cell 25 and methylnaphthalene cell 25 were used as maximum rate cells.

As explained in more detail below, estimated annual emissions were based on a time-weighted average of active and inactive periods, i.e. maximum emission rates when the cells were assumed to be dredged and emission rates estimated from quiescent slurries when the cells were assumed to be inactive.

Emission rates for onshore activities were as indicated in Table 10. The dimensions of the cells and pond areas modeled were shown in Figure 6 and Figure 7. For the CDF option, modeling assumed dredging of only cells 22-42 along with the CDF pond surface established over the area of cells 1-21. As discussed earlier, the CDF is broken into a primary pond area for active fill area and secondary pond area for settled inactive filling area. Each areas position within the CDF will shift over time as the dredged sediment fills the CDF, but will not significantly affect the model results since the relative surface area of the two ponds will be fairly similar until the CDF is almost full.

[2] While Cell 9 does have a slightly higher benzene emission rate than cell 15 (Table 10), because of the way in which the emissions were calculated and applied, and because of the emissions associated with dewatering activities, the aggregate benzene emission rates are greater using cell 15 rather than cell 9.

Dispersion modeling was conducted for naphthalene, total methylnaphthalenes and for benzene. Maximum modeled concentrations of naphthalene are compared to the WDNR ambient standards for naphthalene (24-hour value of 1258 $\mu g/m^3$). While methylnaphthalene is not specifically listed in the WDNR regulations, 2-methylynapthalene has similar properties as naphthalene and therefore both 1- and 2- methylnaphthalene were modeled as total methylnaphthalene.

Benzene is listed in the regulation but without a specific ambient threshold value, although it does have an annual averaging period listed in the WDNR regulation (Table A, NR 445.07). The WDNR air toxic rule discusses the possibility of using a 10% adjustment to a Threshold Limit Values (TLV; benzene TLV is 1600 $\mu g/m^3$) for a chemical listed with a 24-hour averaging period. Even though benzene is listed with an annual averaging period, because the activity periods are of a shorter-term nature it was thought that using 10 percent value of the TLV, or 160 $\mu g/m^3$, would be an acceptable approach at defining an impact threshold. If the WDNR chooses a different ambient standard for benzene, dispersion of benzene could be replotted against that standard to identify areas of potential concern. In comparison, the WDNR ambient air standard for naphthalene of 1,258 $\mu g/m^3$ is 2.4% of its TLV.

To predict annual impacts, modeling for Alternatives 2, 3 and 4 accounted for the successive dredging cell-by-cell movement to simulate sequential day emission activity by modeling specific daily periods for each discrete cell. For example, dredging was simulated to begin June 1 and each dredging period (lasting from one to four days in length) was modeled discretely for that time period. The active cell is modeled with full 1% mixed dredge emission rates, whereas the inactive cells are modeled with 1% quiescent emission rates using the active cell's correction factor. The areas within the slit curtain area also used the 1% quiescent emission rates using the active cell's correction factor. Each of the activities and choice of emissions rates are shown in Table 9 and would use the active cell's correction factor. The dredging activity was simulated to occur for 134 days for Alternative 4, 79 days for Alternative 3 and 54 days for Alternative 2.

The model output was used to develop isoconcentration lines (lines of constant concentrations) generated by taking the maximum values over 24 hours at each of the modeled receptor locations over the five-year modeled period for the modeled scenario. These were then plotted on aerial photographs to show the extent of the potentially affected region. For example, the maximum 24-hour concentration of naphthalene from activity at cell 25 was calculated by finding the maximum 24 hour value at each modeled receptor during each year of the five-year meteorological period and then using those maxima to develop isoconcentration lines

Annual impacts are calculated by first modeling each individual cell activity described above at each receptor, and then dividing by the ratio of the active dredging days/total days of the year. This ratio is determined by the number of active dredging days (134 for Alternative 4) divided by the total days per year (e.g., 134/365 = 0.367). Shorter activity periods associated with the CDF option (Alternative 2) as well as Alternative 3 will have a smaller ratio and hence less of an annual impact.

In Area 4 only excavation and stockpiling activities will occur so all of the 30 days of these activities are the same using the 0-2 hr emissions rates measured using the area shown in Figure 8.

As previously discussed modeling was based upon a five year local meteorological record (2002-2006) with surface data obtained at Ashland airport processed in AERMET to provide necessary parameters for AERMOD. A wind rose of the five year period is shown in Figure 9 noting the general annual patterns of the Ashland area. The five year period shown is only for the active dredging times (June-October) that were modeled. Average wind speeds during the period were six mph comparing favorably with the wind tunnel study emission derivation wind speed of five mph.

5.2 Results

5.2.1 Contaminant Dispersion

The three alternative remediation scenarios were modeled as described above and the maximum modeled values are shown in Table 11 and maximum annual impacts are shown in Table 12. The results of the Area 4 modeling are shown in Table 13. The modeled concentrations shown in all tables were all calculated at the receptor locations shown in Figure 5.

With the exception of the Area 4 activities, the impacts for all three of the alternatives potentially exceed air quality levels for benzene and naphthalene levels, although the extent varies in magnitude and spatially. The extent of the impacts predicted through the modeling is shown for the various modeled scenarios in Figure 10 through Figure 20. The extent of the impacts are a function of the time of occurrence (summer to autumn transition is usually associated with greater atmospheric stability with less dispersion and typically higher concentrations), and the wind patterns during the time of occurrence.

As shown in Figure 10, the naphthalene concentrations associated with Alternative 4 exceed the WDNR threshold of 1258 $\mu g/m^3$ near both the active dredging area as well as the onshore dewatering area. Maximum values with the active dredge and dewater areas are almost four times the WDNR threshold value. Similar results are shown for the Alternative 3 (Figure 11), whereas the Alternative 2 results (Figure 12) indicate higher offshore concentrations than Alternatives 4 or 3 and no onshore exceedances.

The maximum 24-hour impacts of benzene from Alternative 4 are shown in Figure 13. Concentrations potentially exceed both $1/10^{th}$ of the time weighted average (TWA)/TLV value of 160 $\mu g/m^3$ as well as the TWA/TLV level itself (1600 $\mu g/m^3$). Alternative 3 (Figure 14) results are similar to those in Alternative 4, and again the Alternative 2 impacts (Figure 15) are located away from the shore reflecting the location of activity.

The 24-hour concentrations of methylnaphthalene are depicted in Figures 16, 17, and 18. There is no TWA/TLV for methylnaphthalene and it is not listed in the WDNR regulation so there is no threshold of comparison shown in these figures.

In general, predicted contaminant concentrations outside active areas decrease rapidly away from the maxima with the longer concentration “tails” for some pollutants reflecting the predominant wind directions in the area.

The minimal extent of the impact from remediation activities at Area 4 is depicted in Figure 19 and 20. The 24-hour impact of naphthalene and benzene appear confined to an area very near the activity. As previously discussed, while the Area 4 activities and impacts may occur simultaneously with sediment remediation they were modeled separately.

A single receptor location was selected to examine daily impact trends. The receptor was selected to be above the shore bluff in a southeasterly direction from the remediation site (Figure 8). This location is referred to as R1 and the impacts were plotted by day for Alternatives 4 and 2. The results of this analysis are shown in Figures 21 and 22 respectfully. While not the nearest residence, R1 is located nominally downwind and is a residential receptor within an area of maxima concentration under Alternative 4. This receptor (R1) was chosen as a location to show the variability of potential residential (public) impacts based on the various alternative scenarios as well as potential odor. The results indicate that only a few days are above the benzene standard for Alternative 4, whereas all days were below the standard for Alternative 2.

5.2.2 Odor Dispersion

Sediment remediation alternatives also have the potential to release odors as well as contaminants. These odors may be directly associated the contaminants, i.e., the volatilized contaminants cause the odor, or the odors may result from the release of natural materials such as hydrogen sulfide. Odor prediction is difficult given the tenuous nature of the scent and the differences in population perception to any given odor. Odor typically has a very short duration response time and therefore can be difficult to model with standard steady-state approximations, such as those used in AERMOD. However, modeling can identify the likelihood that detectable odors will be associated with certain remedial activities and this was the intent of the comparison: not to develop an absolute determination of odor but to allow comparisons between some of the scenarios.

To assess the potential impact from odors released during sediment remediation, the results of the odor testing were applied to the modeling conducted for the different remediation scenarios. Values corresponding to the odor detection threshold (DT) and recognition threshold (RT) were used; these which can differ for each compound. The maximum 1-hour concentrations modeled for the remediation scenarios were converted to odor units based upon the results of the odor evaluation (Section 4.0).

The plot of those concentrations based on the DT units of 180 OU is shown in Figure 23. The concentrations based on the RT units of 100 OU are plotted in Figure 24. These are both for Alternative 4. Results for Alternative 2 DT and RT are shown in Figures 25 and 26 respectively. As expected, there is a considerable reduction in area exceeding the DT and RT for Alternative 2.

For the residence located near the site referenced as R1 (Figure 8) the daily impacts for DT odor units during 2005 for Alternative 4 are shown in Figure 27. There are no exceedances of one odor unit predicted. The highest value was on July 27, 2005. The hourly odor units for the DT and RT for Alternative 4 are shown for the peak day of July 27, 2005 in Figure 28. The values greater than one odor units are predicted to occur in the early morning hours from about 3 AM to 8 AM.

5.3 Discussion

Based on the modeling results, dredging, with onshore dewatering and stockpile pond areas, may potentially exceed the acceptable WDNR air quality threshold values for naphthalene and benzene at locations near the source. Alternative 2 is much less likely to exceed these standards compared to Alternative 4.

Because of the many uncertainties with odor modeling and actual occurrences, it is also likely that detectable odors in parts of the Ashland community will occur during the remediation activities. It is likely that such occurrences will be transient and limited in extent, although a few hours of persistent winds could yield an unpleasant smell for longer periods than modeled.

6.0 OVERALL SUMMARY AND CONCLUSIONS

- Areas 1, 2, and 2A samples had high VOC and PAH concentrations and contained some wood and NAPL. Test runs on these samples represented the potential PAH and VOC emission rates associated with dredging operations, sediment handling and treatment, and sediment exposure. Test runs on Area 4 represented the potential PAH and VOC emission rates associated with saturated soil exposure from excavation at the NSPW site.
- Initial sediment analysis results indicated Area 2A to be the most highly contaminated with PAHs and Area 4 to be the most highly contaminated in VOCs. In general, emission rates increased with increasing percent solids and decreased with increasing elapsed time. The highest emission rates were predominately found in exposed sediment or mixed 10% solids slurry at the start of the run (0-2 hr).
- Odor analysis was conducted on the Area 2 and 2A 10% solids mixed slurry samples to determine the potential odor impacts of active dredging operations. Odor intensity generally increased with time for Area 2 and increased to the maximum for Area 2A for the 2-6 hr time interval.
- Modeling results show that naphthalene and benzene are the contaminants of greatest concern for potential exposure to the public. The highest contaminant concentration potentially above a heath risk value was for benzene, if the assumed standard is one-tenth of the TLV or 160 µg/m3. The naphthalene standard is a 24-hour standard of 1258 µg/m3 according to WDNR regulations. A much larger area of the public is above the benzene standard than for naphthalene based on these maximum concentration modeling results.
- Should additional information for potential toluene volatilization be needed in Remedial Design, the data are available from this study to model toluene. Based upon the modeling results for benzene and comparison of benzene's characteristics with toluene's, it is likely that dispersion modeling would show that the spatial extent of toluene exceeding its air quality standard is less for benzene exceeding its.
- A comparison of Alternative 4 (Dredge All) and Alternative 2 (CDF) predicts a much smaller area of impact to the public for both benzene and naphthalene. Alternative 3 (Partial Dredge-Cap) isn't much different than Alternative 4 (Dredge All) for maximum exposures for benzene since the high concentration cells are still dredged, only for a shorter time. Odor modeling also shows a wider spread of odor exceeding one odor unit for the Alternative 4 (Dredge All) over Alternative 2 (CDF).
- In conclusion, the exposure to residents and public receptors above air quality standards is possible for Alternatives 3 (Dredge-Cap) and 4 (Dredge All) for benzene emissions. For Alternative 2 (CDF), benzene emissions are near the site activity and predominantly below the bluff. Naphthalene emissions exposures above standards are more limited to the area below the bluff and the public east and west ends of the remedial active areas on land for Alternative 4 (Dredge All). The Alternative 2 (CDF) emissions that are above standards for public areas are mostly on the water to the north of the dredging area. The residence referred to as R1 located above the bluff to the southeast of the dredging located in Figure 8, is predicted to exceed standards a for few days a year with Alternative 4 (Dredge All), but not with Alternative 2 (CDF). In general the methylnaphthalene isoconcentration lines were lower than naphthalene and below the naphthalene standard if applied except near the sources.

- Odor plots using the odor testing results show that a widespread area to the east of the Site into the city proper will see one to 10 OUs above the DT and one to four OUs above the RT for Alternative 4 (Dredge All). This is significantly reduced for the Alternative 2 (CDF) where only one OU is plotted to go above the bluff and most of the odor is on the water and land towards the north and east of the dredging and dewatering activity.
- We believe these results provide a reasonably conservative estimation of the possibility that air quality standards for some volatile contaminants will be exceeded in areas within the Ashland community. However, since these results are affected both by weather conditions and remedial operations, it is possible that actual experience may differ from these predictions.

7.0 REFERENCES

NewFields. 2005. Quality Assurance Project Plan RI/FS Tasks, Revision: 03, February 2005, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin, Remedial Investigation/Feasibility Study Addendum No. 03.

URS. 2005. Remedial Investigation Feasibility Study (RI/FS) Work Plan and associated planning documents. Revision 02. Ashland/NSP Lakefront Superfund Site, Ashland Wisconsin.

URS. 2006. Candidate Technologies and Testing Needs Technical Memorandum (SOW Task 6) – Ashland/Northern States Power Lakefront Superfund Site.

URS. 2006. Quality Assurance Project Plan RI/FS Tasks - Ashland/NSP Lakefront Superfund Site, Ashland Wisconsin, Addendum No. 4.

URS. 2007a. Treatability Phase I Treatability Study Work Plan and Sampling and Analysis Plan – Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin.

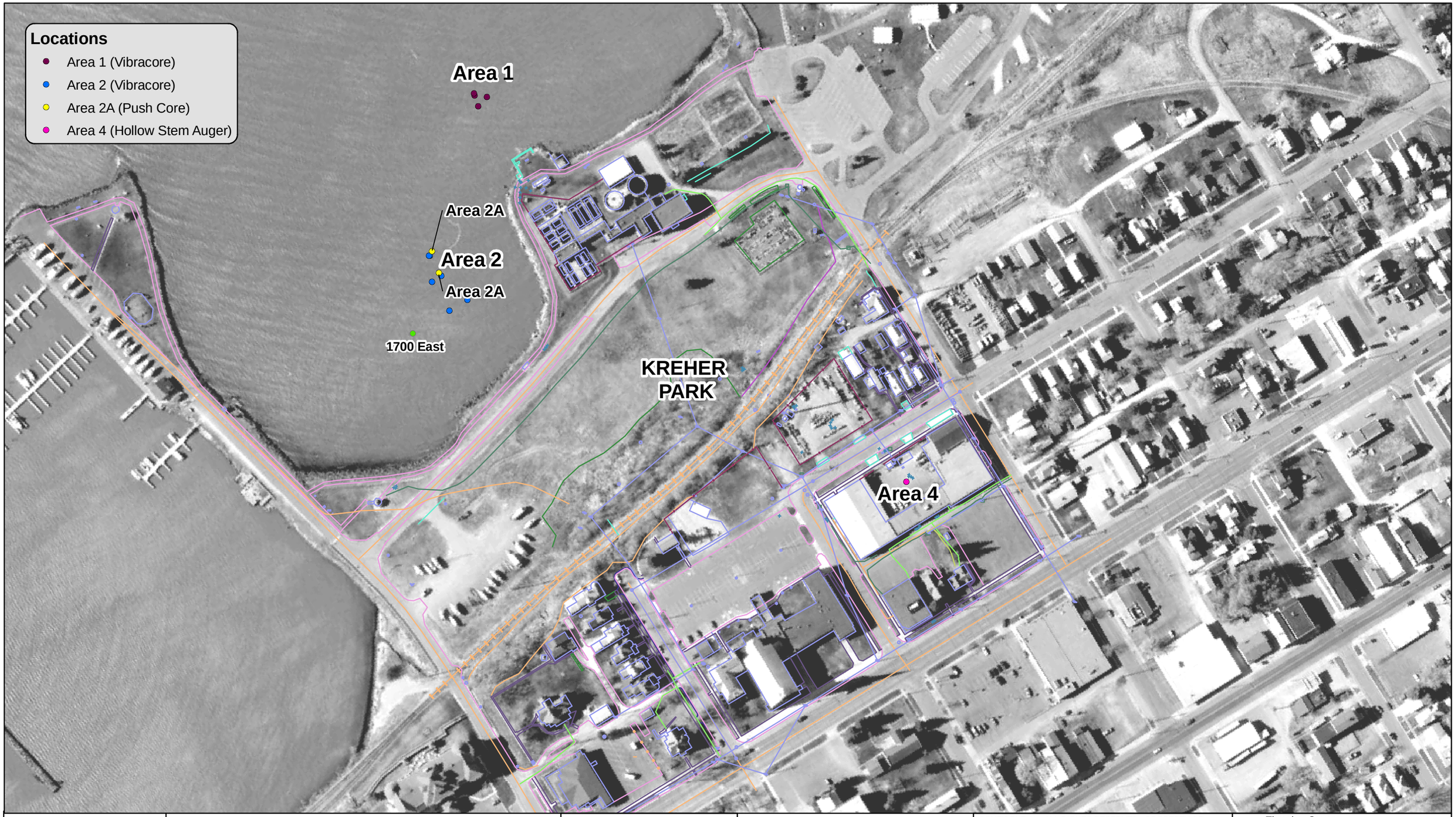
URS. 2007b. Candidate Technologies and Tests Needs Technical Memorandum – Ashland/ NSP Lakefront Superfund Site, Ashland, Wisconsin.

URS. 2007c. Comparative Analysis of Alternatives Technical Memorandum – Ashland/ Northern States Power Lakefront Superfund Site.

U.S. EPA. 2007. User's Guide for the AMS/EPA Regulatory Model AERMOD. EPA-454/B-03-001.

U.S. EPA. 2007. User's Guide for the AERMOD Meteorological Preprocessor (AERMET). EPA-454/B-03-002.

FIGURES



N
W E
S

0 50 100 200 300 400
Feet

ASHLAND SITE PLAN
AND KEY SHEET

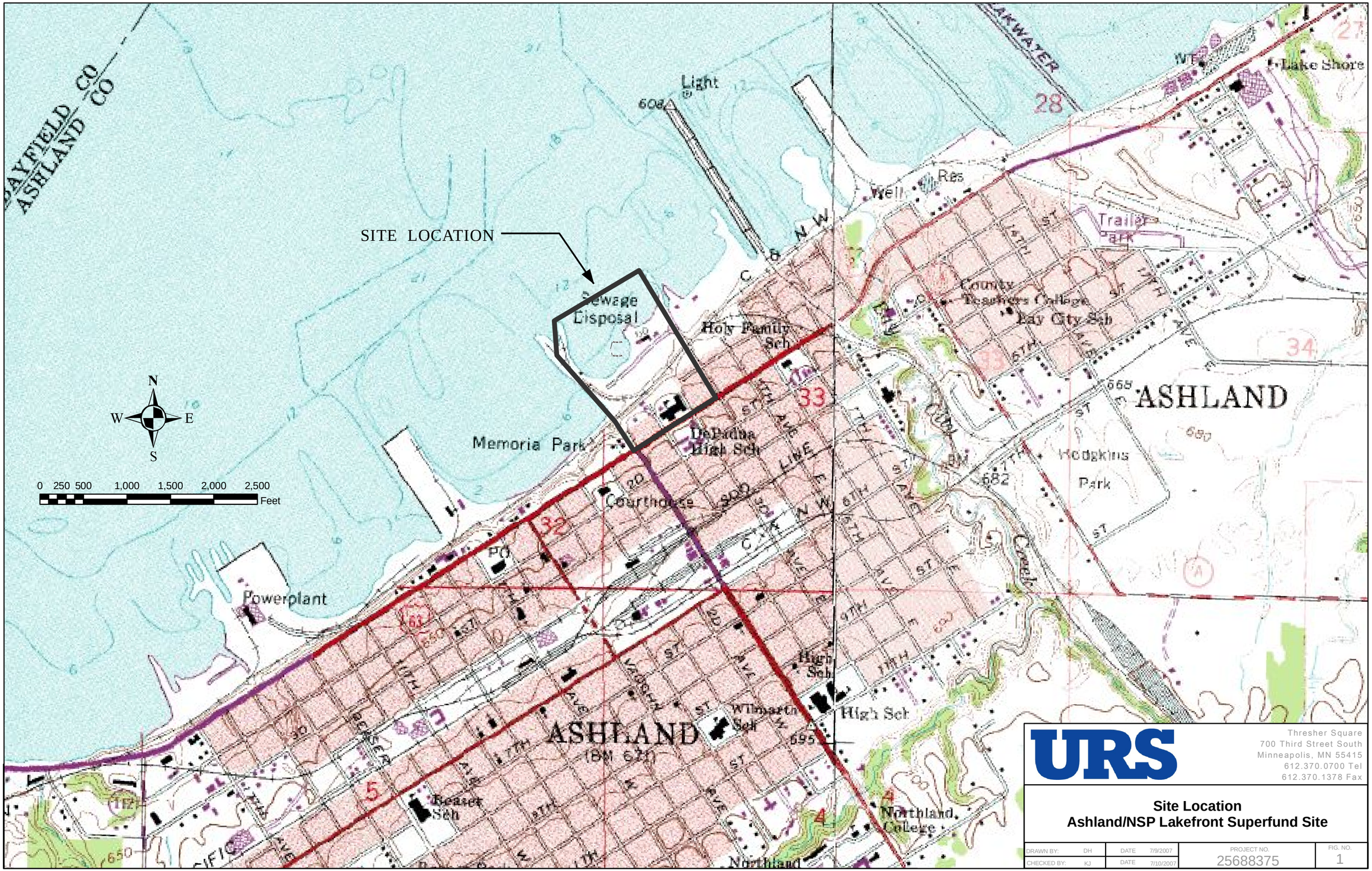
DESIGNED BY:	DH	DATE	7/4/2007
DRAWN BY:	DH	DATE	7/4/2007
CHECKED BY:	KJ	DATE	7/4/2007
APPROVED BY:	KJ	DATE	7/4/2007

CONFIDENTIAL - ALL RIGHTS RESERVED - PROPERTY OF

URS

Thresher Square
700 Third St S
Minneapolis, MN
(612) 370.0700 Tel
(612) 370.1378 Fax

ES-1: Sample Locations
Ashland/NSP Lakefront Site
Ashland, WI



URS

Thresher Square
700 Third Street South
Minneapolis, MN 55415
612.370.0700 Tel
612.370.1378 Fax

Site Location
Ashland/NSP Lakefront Superfund Site

DRAWN BY: DH	DATE 7/9/2007	PROJECT NO. 25688375	FIG. NO. 1
CHECKED BY: KJ	DATE 7/10/2007		

URS

Thresher Square
700 Third Street South
Minneapolis, MN 55415
612.370.0700 Tel
612.370.1378 Fax

Sample Locations
Ashland/NSP Lakefront Superfund Site

DRAWN BY:	DH	DATE	7/9/2007	PROJECT NO.	FIG. NO.
CHECKED BY:	KJ	DATE	7/10/2007	25688375	2

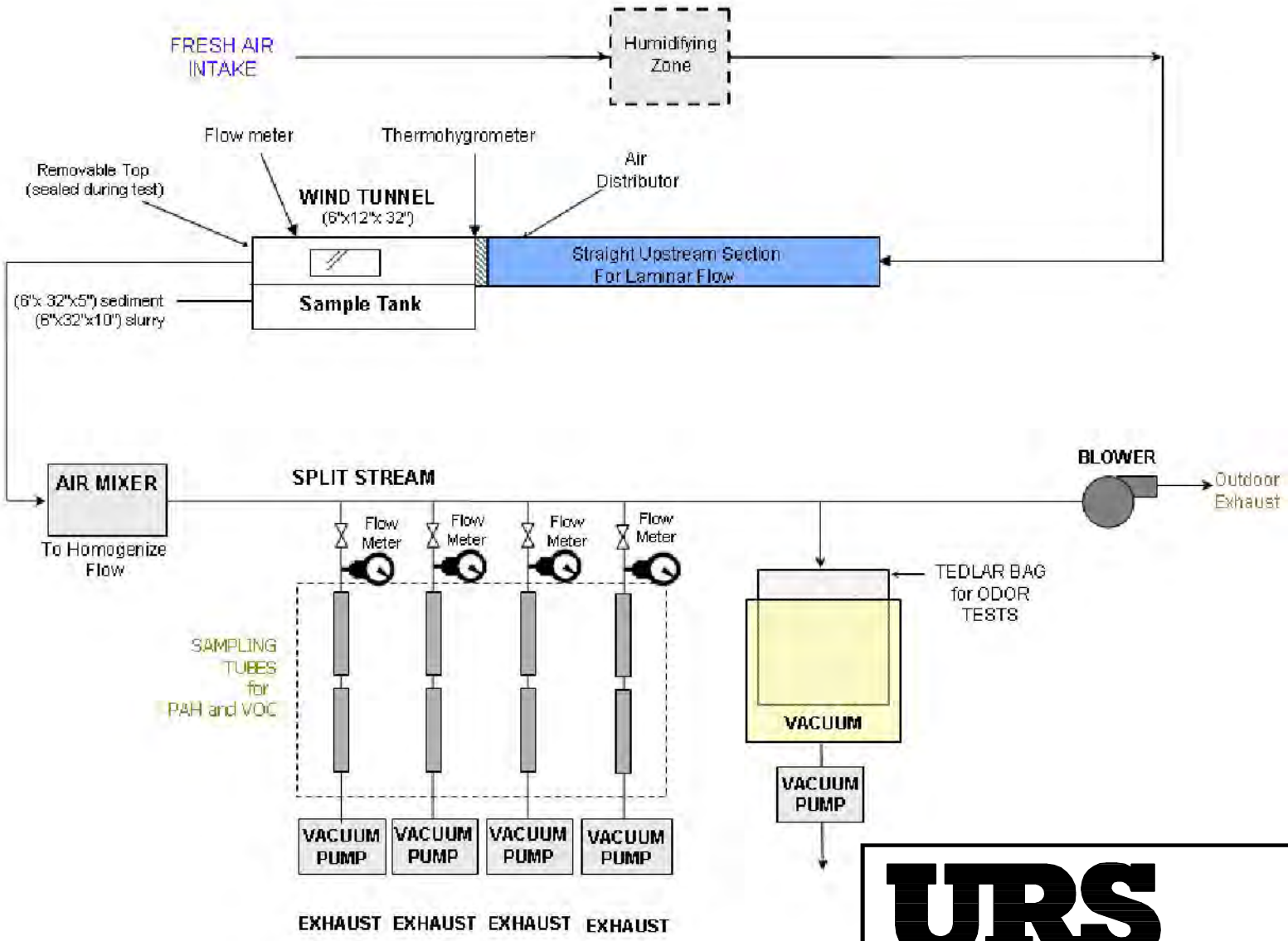
URS

10200 Innovation Drive.
Suite 500
Milwaukee, WI 53226

PUSH CORE PHOTOGRAPH
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/28/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/28/07	25688375	3

PLOT DATE: June 28, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-03.dwg



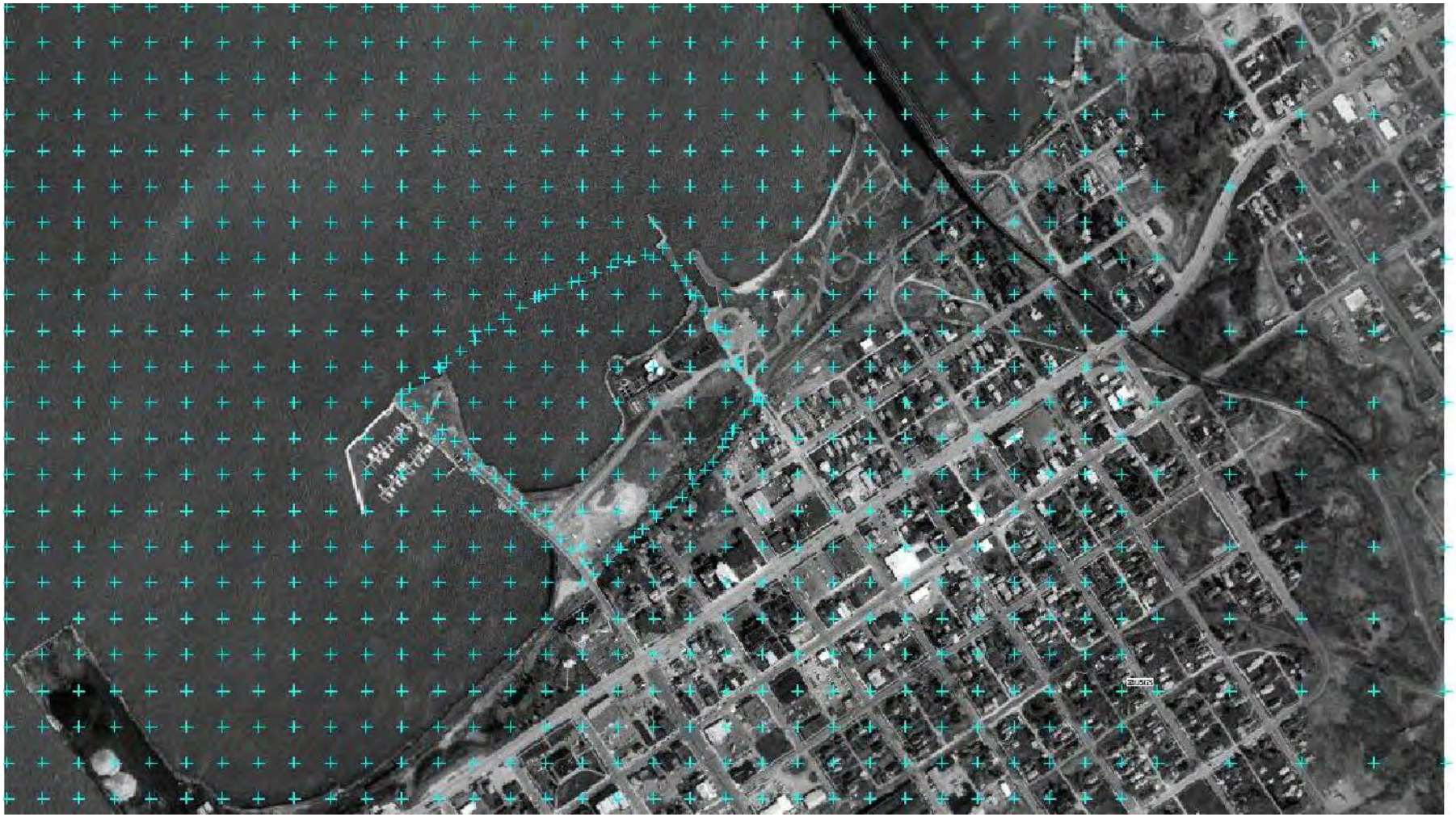
URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

WINDTUNNEL FLOW DIAGRAM
ASHLAND/NSP LAKEFRONT SUPERFUND SITE
(NOT TO SCALE)

DRN BY: CS	DATE: 06/28/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/28/07	25688375	4

PLOT DATE: June 28, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-04.dwg



*NOT TO SCALE

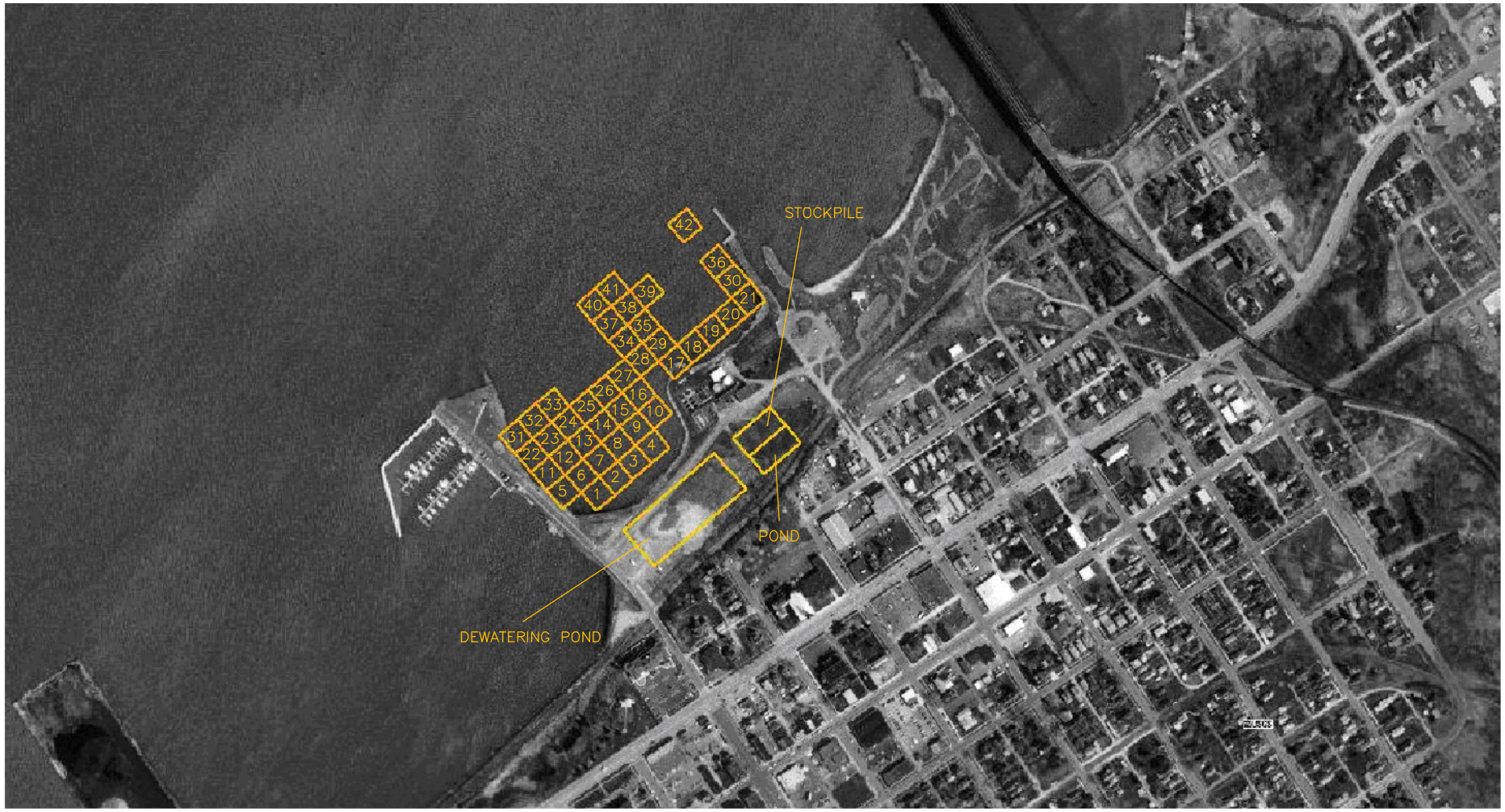
URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

MODELED RECEPTOR LOCATIONS
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	5

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-09.dwg



[#] =100 FT X 100 FT ACTIVITY CELL FOR MODELING

*NOT TO SCALE

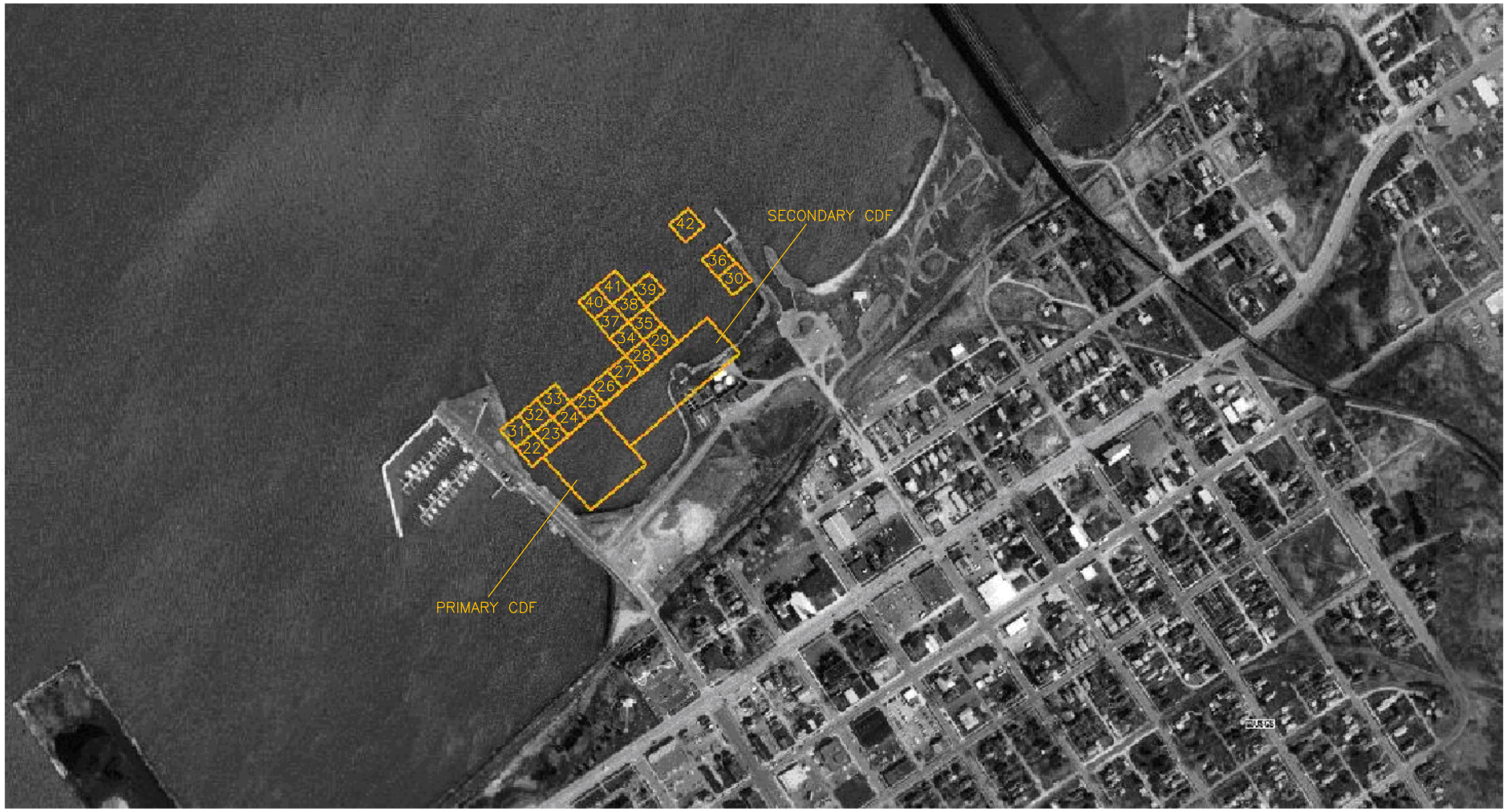
URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

POTENTIAL AIR EMISSIONS LOCATIONS
ALTERNATIVE 4 DREDGE ALL OPTION
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	6

PLOT DATE: June 28, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-05.dwg



[#] =100 FT X 100 FT ACTIVITY CELL FOR MODELING

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

POTENTIAL AIR EMISSIONS LOCATIONS
ALTERNATIVE 2 CDF OPTION
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	7

PLOT DATE: June 28, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-06.dwg

X = RESIDENCE R1

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

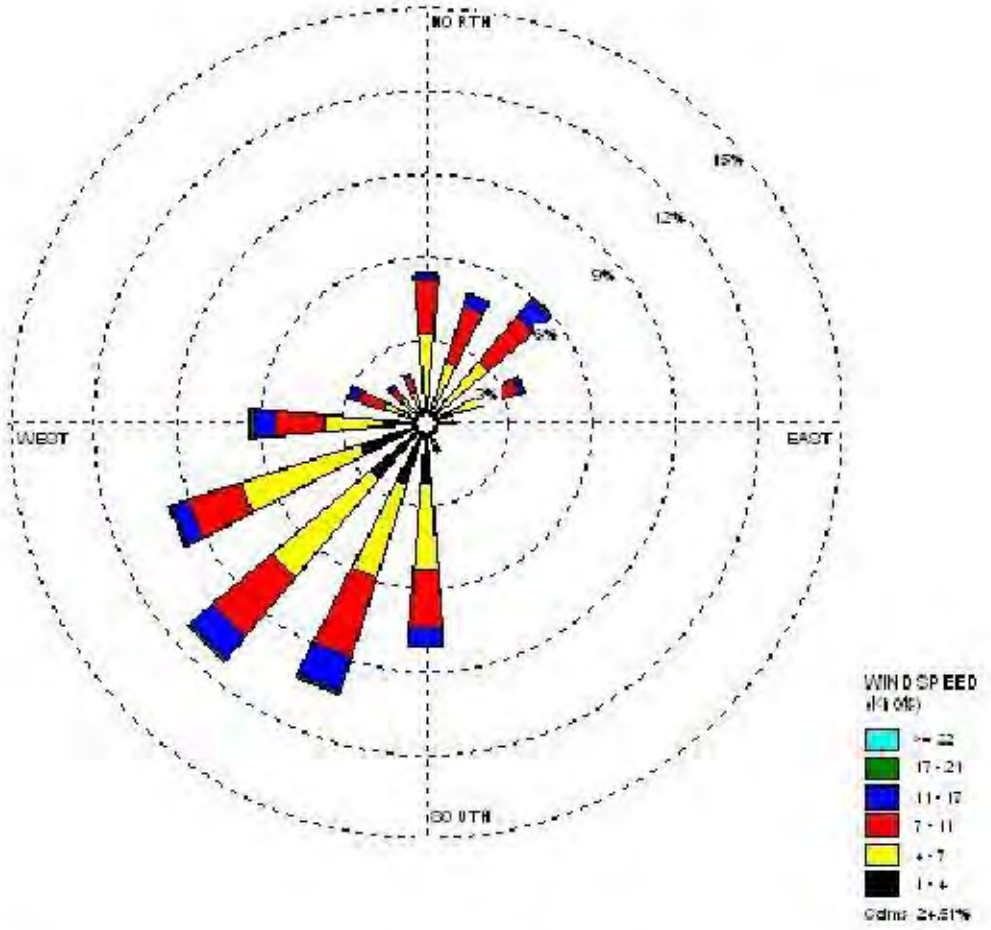
AIR EMISSION LOCATION (AREA 4)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: TMA	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: HH	DATE: 07/05/07	25688375	8

PLOT DATE: July 5, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-07.dwg

Station #21184

Wind Speed
Direction (blowing from)



2002 2003 2004 2005 2006 Jun 1 - Oct 12 00:00 - 23:00		
24.51%	16080 hrs.	
5.94 knots	8/2/2007	

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

SURFACE WIND DIRECTION AND SPEED FREQUENCY
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	9

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-08.dwg

Note: Alternative 4 Dredge All

Red contour: WDNR Compliance Line – 1258 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION NAPHTHALENE, (ALTERNATE 4)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: TMA	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 07/05/07	25688375	10

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-10.dwg

Note: Alternative 4 Dredge All with On-shore Dewatering - Receptors within Dredge Area (Red contours are TWA/TLV of 1600 micrograms per cubic meter and one-tenth TLV of 160 micrograms per cubic meter)

Red contour:	WDNR Compliance Line - 1258 micrograms per cubic meter
Green contour:	below Compliance line
Orange contour:	above Compliance line

*NOT TO SCALE

URS

Thresher Square
700 Third Street South
Minneapolis, MN 55415
612.370.0700 Tel
612.370.1378 Fax

ALTERNATIVE 4 24-HR MODELED BENZENE CONCENTRATIONS ISOPLETH LINES, INCLUDING DREDGE AREA RECEPTORS
ASHLAND / NSP LAKEFRONT SITE
ASHLAND, WI

DRN BY: TMA	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 07/05/07	25688375	11

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-11.dwg

Note: Alternative 2 Dredge with CDF

Red contour: WDNR Compliance Line – 1258 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Inovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR NAPHTHALINE (ALTERNATIVE 2)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: TMA	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 07/05/07	25688375	12

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-14.dwg

Note: Alternative 4 Dredge All

Red contour: WDNR Compliance Line – one–tenth TLV of 160 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Inovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR BENZENE
(ALTERNATIVE 4)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: TMA	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 07/05/07	25688375	13

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-11.dwg

Note: Alternative 3 Partial Dredge and Cap

Red contour: Compliance Line – One–tenth TLV of 160 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR BENZENE (ALTERNATIVE 3)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: TMA	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 07/05/07	25688375	14

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-16.dwg

Note: Alternative 2 Dredge with CDF

Red contour: Compliance Line – One–tenth TLV of 160 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR BENZENE
(ALTERNATIVE 2)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: TMA	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 07/05/07	25688375	15

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-17.dwg

Note: Alternative 4 Dredge All

No Statnards Available

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR METHYLNAPHTHALENE (ALTERNATIVE 4)

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	16

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-18.dwg

Note: Alternative 3 Partial and Cap Dredge

No Standards Available

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR METHYLNAPHTHALENE (ALTERNATIVE 3) ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	17

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-19.dwg

Note: Alternative 2 Dredge with CDF

No Standards Available

*NOT TO SCALE

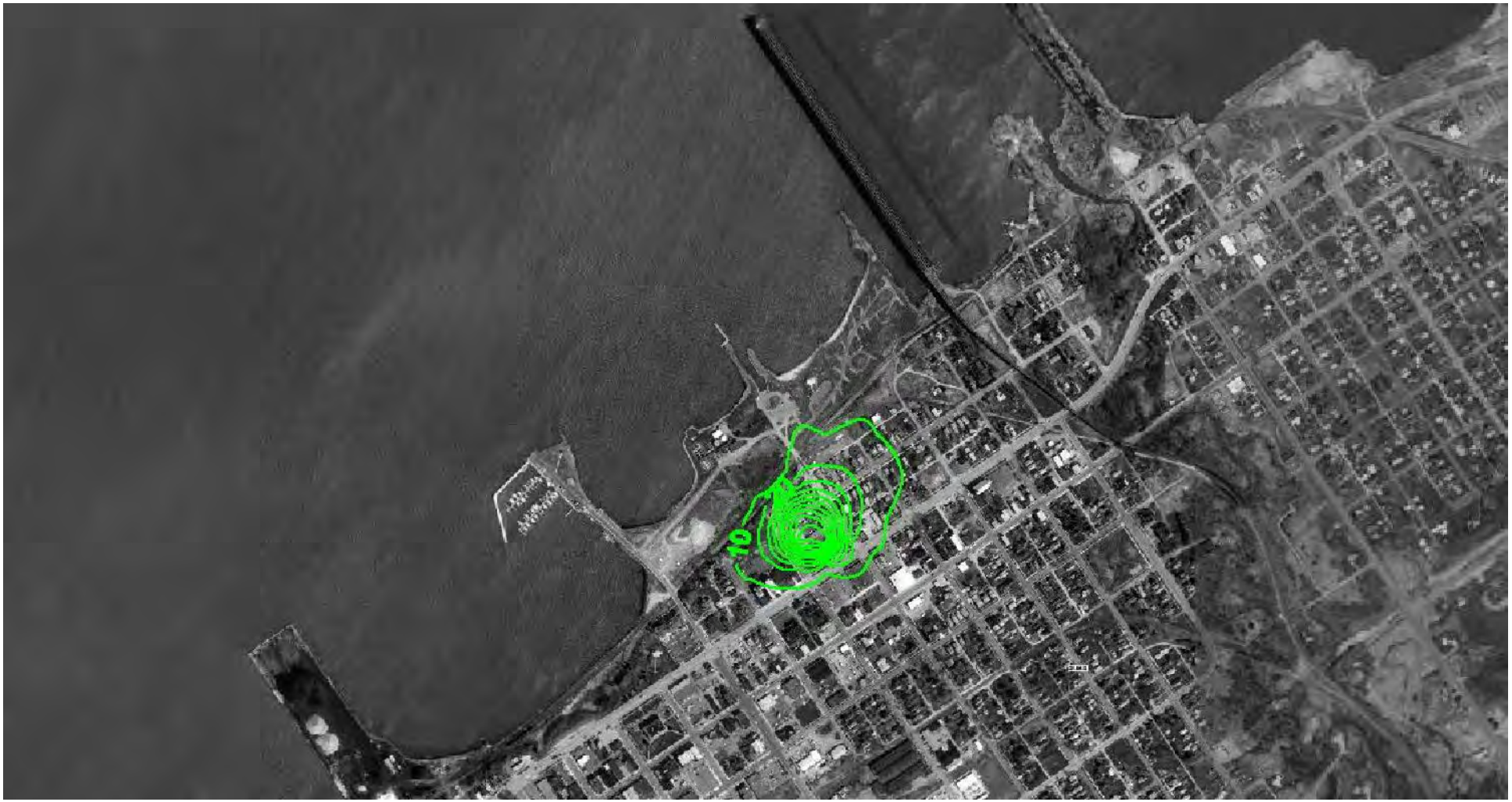
URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR METHYLNAPHTHALENE (ALTERNATIVE 2)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	18

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-20.dwg



Red contour: WDNR Compliance Line – 1258 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR NAPHTHALENE (AREA 4)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	19

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-21.dwg

Red contour: Compliance Line – One–tenth TLV of 160 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

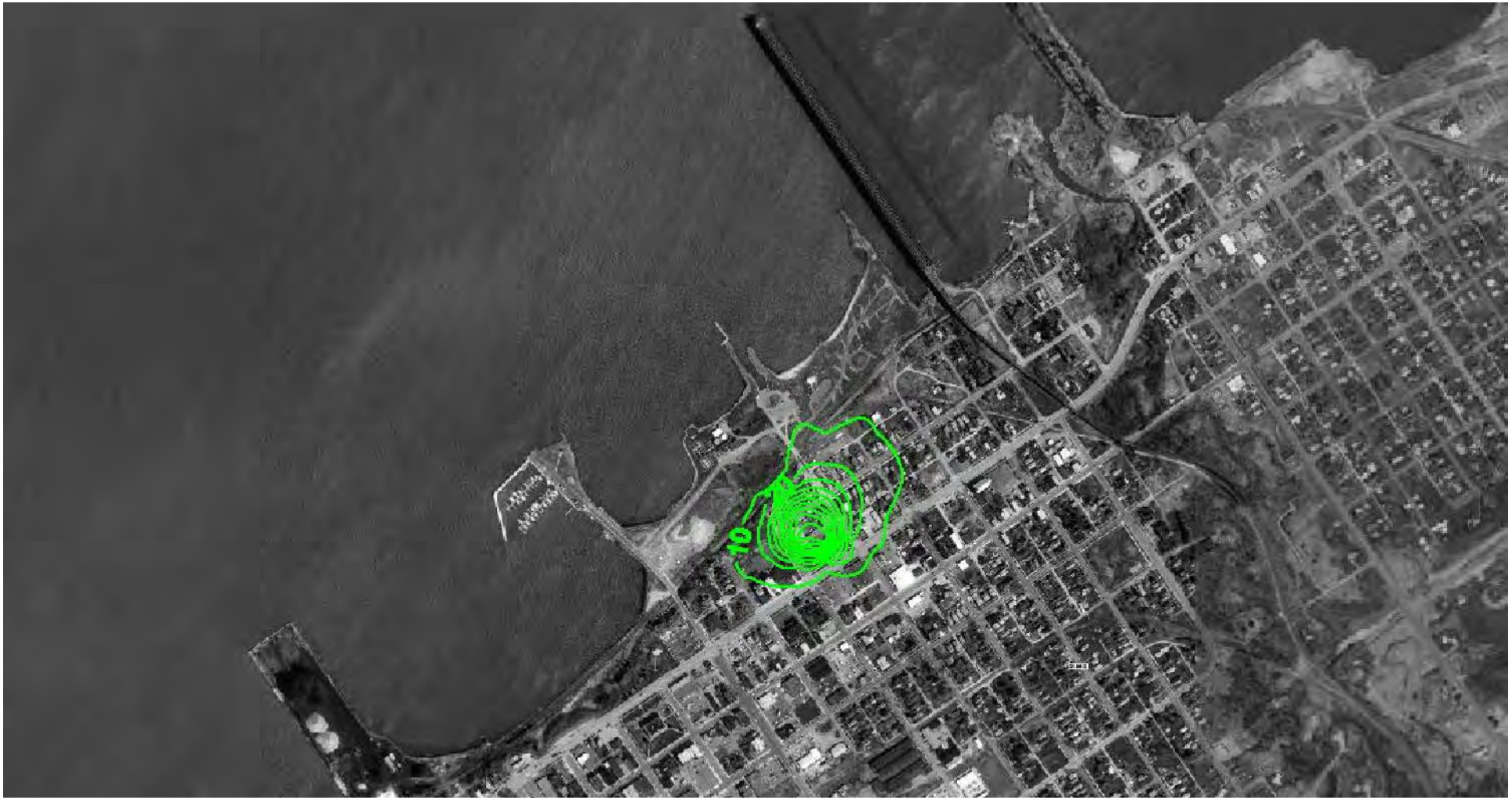
URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR BENZENE (AREA 4)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	20

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-22.dwg



Red contour: WDNR Compliance Line – 1258 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

URS

Thresher Square
700 Third Street South
Minneapolis, MN 55415
612.370.0700 Tel
612.370.1378 Fax

AREA 4 – 24-HR MODELED NAPHTHALENE CONCENTRATIONS
ASHLAND / NSP LAKEFRONT SITE
ASHLAND, WI

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	21

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-21.dwg

Red contour: Compliance Line – One–tenth TLV of 160 micrograms per cubic meter

Green contour: below Compliance line

Orange contour: above Compliance line

*NOT TO SCALE

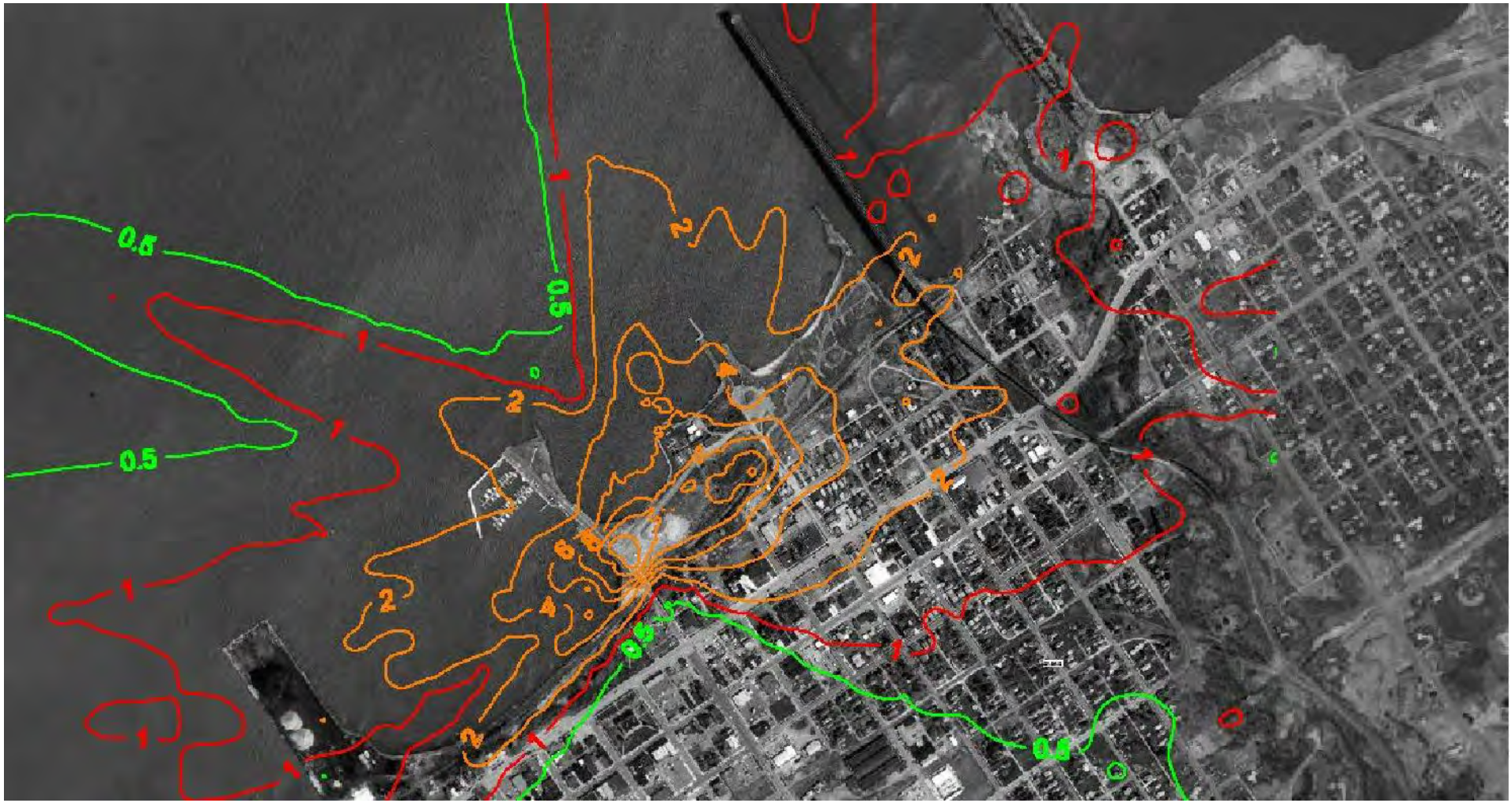
URS

Thresher Square
700 Third Street South
Minneapolis, MN 55415
612.370.0700 Tel
612.370.1378 Fax

AREA 4 – 24–HR MODELED BENZENE CONCENTRATIONS
ASHLAND / NSP LAKEFRONT SITE
ASHLAND, WI

DRN BY: CS	DATE: 06/29/07	PROJECT NO.	FIG. NO.
CHK'D BY: BG	DATE: 06/29/07	25688375	22

PLOT DATE: June 29, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-22.dwg



Note: Alternative 4 Dredge All

Red contour: Compliance Line – 1 odor unit
Green contour: below Compliance line
Orange contour: above Compliance line

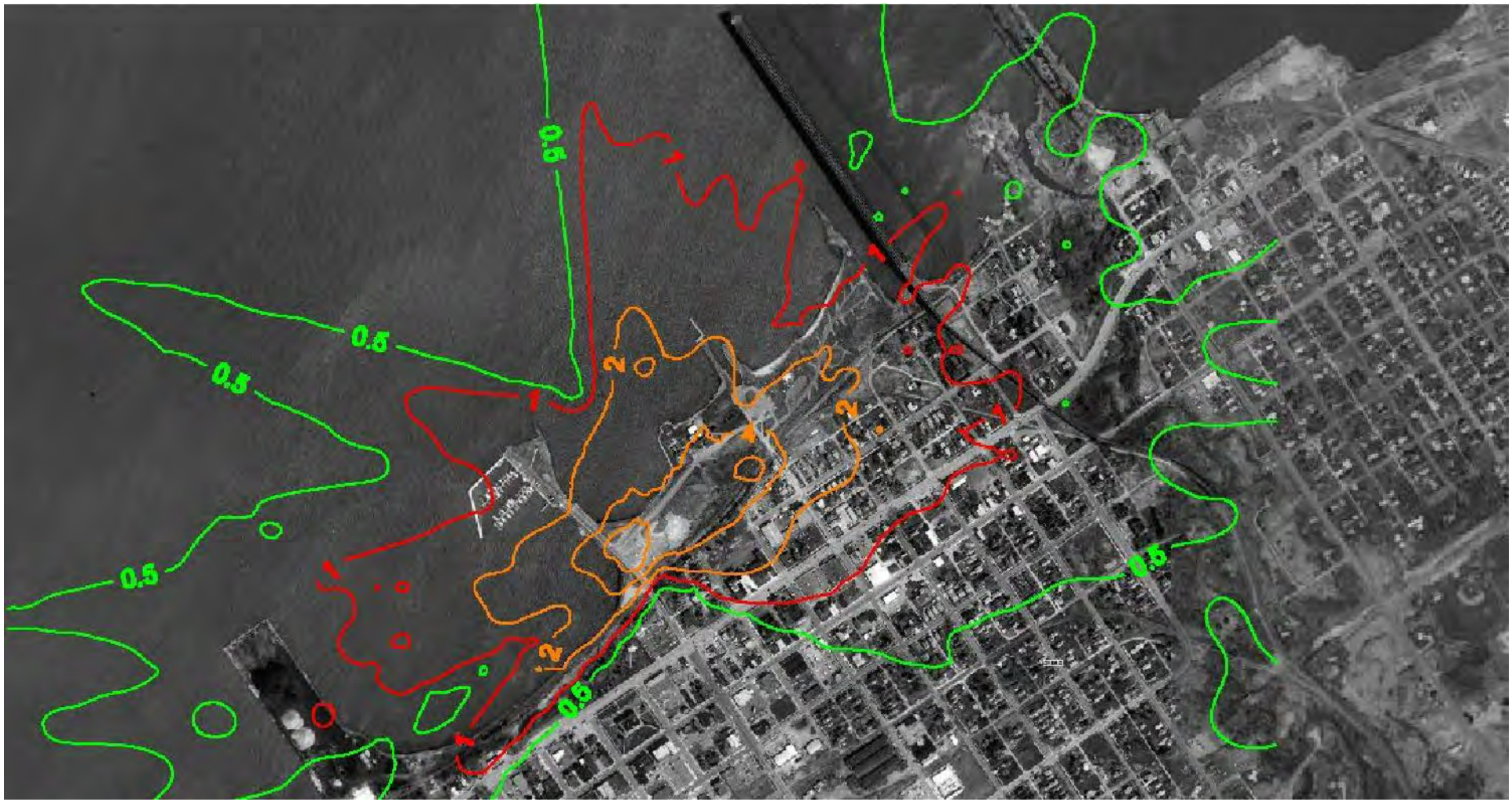
*NOT TO SCALE

URS
10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR ODOR DETECTION THRESHOLD (ALTERNATIVE 4)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: HH	DATE: 07/05/07	25688375	23

PLOT DATE: July 5, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-25.dwg



Note: Alternative 4 Dredge All

Red contour: Compliance Line – 1 odor unit
Green contour: below Compliance line
Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR
ODOR RECOGNITION THRESHOLD (ALTERNATIVE 4)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: HH	DATE: 07/05/07	25688375	24

PLOT DATE: July 5, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-26.dwg

Note: Alternative 2 Dredge with CDF

Red contour: Compliance Line – 1 odor unit
Green contour: below Compliance line
Orange contour: above Compliance line

*NOT TO SCALE

URS

10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR
ODOR DETECTION THRESHOLD (ALTERNATIVE 2)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: HH	DATE: 07/05/07	25688375	25

PLOT DATE: July 5, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-27.dwg

Note: Alternative 2 Dredge with CDF

Red contour: Compliance Line – 1 odor unit
Green contour: below Compliance line
Orange contour: above Compliance line

*NOT TO SCALE

URS
10200 Innovation Drive
Suite 500
Milwaukee, WI 53226

PREDICTED ISOCONCENTRATION LINES FOR
ODOR RECOGNITION THRESHOLD (ALTERNATIVE 2)
ASHLAND/NSP LAKEFRONT SUPERFUND SITE

DRN BY: CS	DATE: 07/05/07	PROJECT NO.	FIG. NO.
CHK'D BY: HH	DATE: 07/05/07	25688375	26

PLOT DATE: July 5, 2007 DISK FILE NAME: V:\Envir Mngt\URS Projects\Xcel Energy\Ashland\Treatability Studies\Bench Test Report\Figures\Fig-28.dwg

Figure 27
Detection Odor Unit Daily Impacts at Residence R1 June-October 2005 (Alternative 4)
Ashland/Northern States Power Lakefront Superfund Site

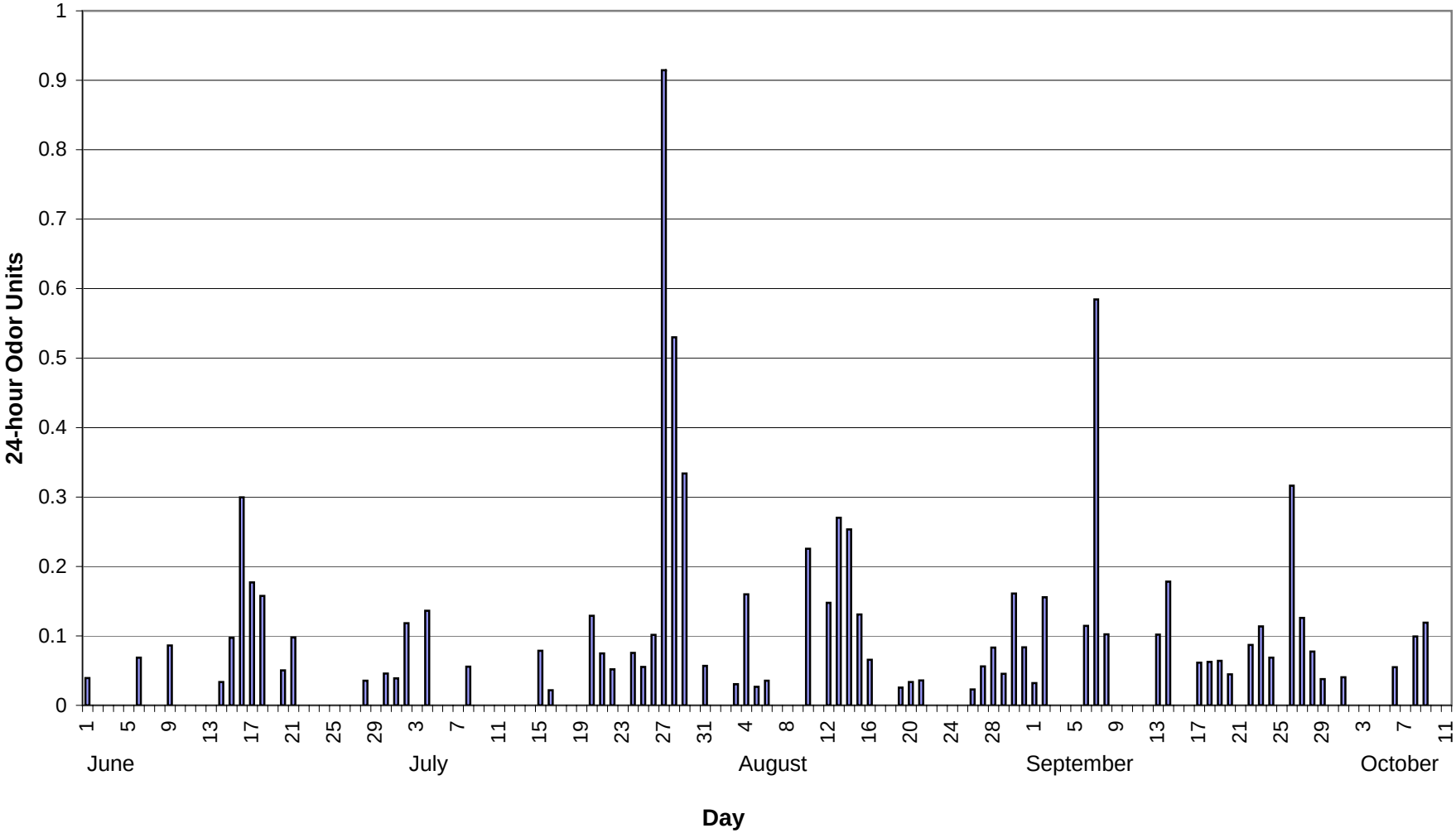
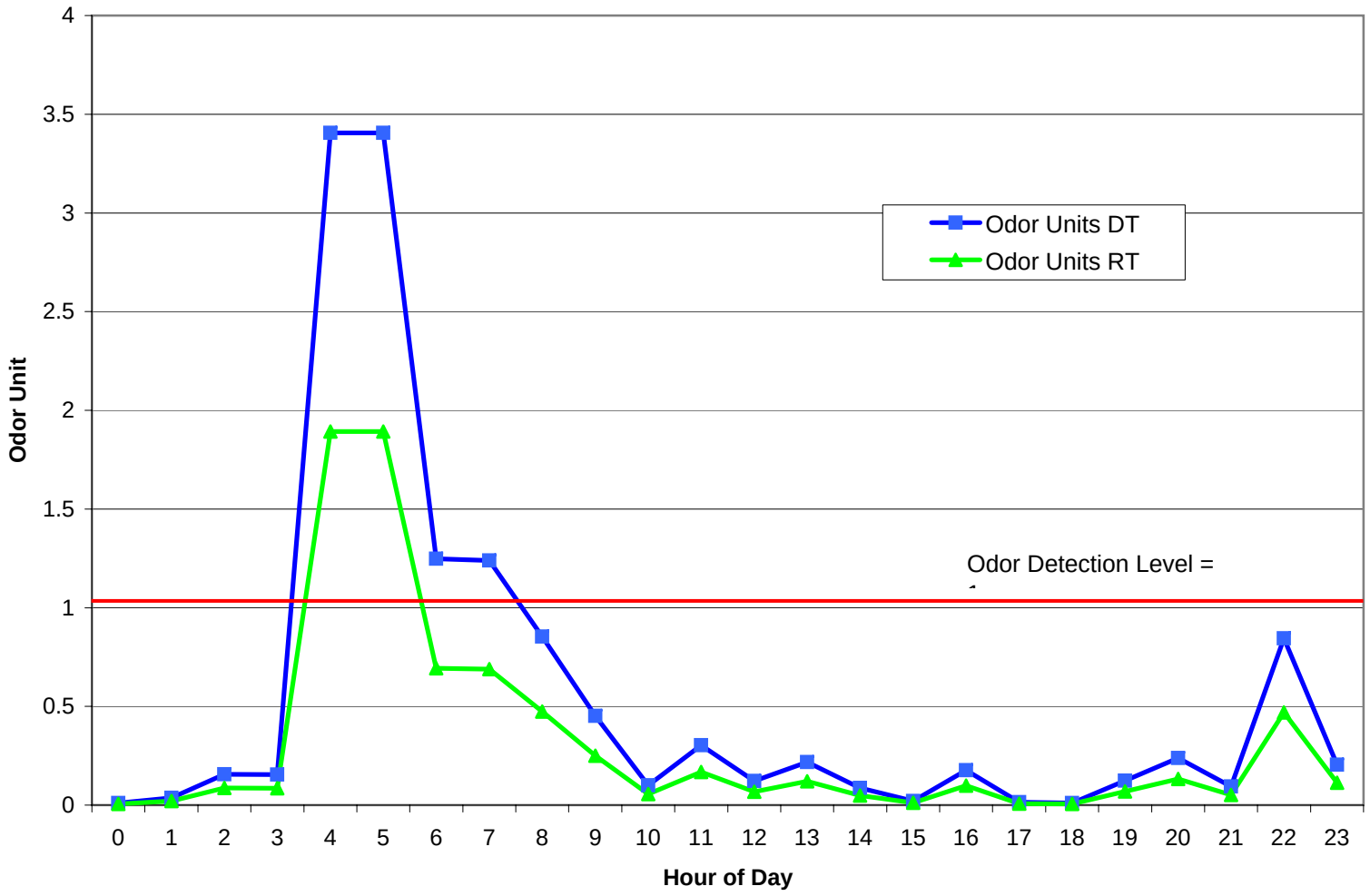


Figure 28
1-hour Odor Units at Resident R1- July 27, 2005 (Alternative 4)
Detection and Recognition Threshold Level Comparison
Ashland/Northern States Power Lakefront Superfund Site



TABLES

Table 1
Sample Descriptions
Ashland/Northern States Power Lakefront Superfund Site

Start Date	Sample	Pretest Description	Post Test Description
14-Mar-07	Area 4 Soil	SILTY SAND, brown, soft, medium plasticity, small pieces of wood, moist.	SILTY SAND, brown, soft, medium plasticity, small pieces of wood, dry and cracked.
15-Mar-07	Area 1 Sediment	SAND, brown, fine-grained to medium grained, subangular, wood slivers, wood >2" to <0.25", very low plasticity, moist to slightly wet.	SAND, brown, fine grained to medium grained, subrounded to subangular, trace silt, woodchips >1.5" to <0.25", slightly moist.
19-Mar-07	Area 2 Sediment	SILTY SAND, brown, very fine grained to medium grained, subangular, woodchips < 0.25", wet.	SILTY SAND, brown, soft, very fine grained to medium grained, low plasticity, moist.
20-Mar-07	Area 2 10% Solids Mixed Slurry	WATER, brown, opaque, black specks in suspension, slight sheen, sand settling on bottom.	WATER, brown, black specks in suspension and black bubbles, broken blue-grey film on top, black and brown sand settled on bottom.
21-Mar-07	Area 1 10% Solids Mixed Slurry	WATER, brown, very few black specks in suspension, slight sheen.	WATER, brown, broken darker brown film on top, slight sheen, somewhat transparent, sand settled on bottom, some black specks in suspension.
22-Mar-07	Area 1 10% Solids Quiescent Slurry	WATER, brown, slight sheen, black and brown sand settled on bottom, some black specks in suspension.	WATER, light brown, slightly transparent, sheen, darker brown broken film, black and brown sand settled on bottom.
23-Mar-07	Area 1 1% Solids Mixed Slurry	WATER, brown, sheen, no settled sand.	WATER, brown, sheen, trace settled sand.
26-Mar-07	Area 2A Sediment	WOOD, small splinters to some chips >2" to trace pieces >5", some silt, trace sand, black, strong odor, visible NAPL, very moist.	NA
26-Mar-07	Area 2A 10% Solids Quiescent Slurry	WATER, dark brown, sheen, bubbles, wood and some sand settled on bottom, NAPL staining on sides.	WATER, brown, darker brown NAPL swirled on surface, wood and sand settled on bottom, thick film on top.
27-Mar-07	Area 2A 1% Solid Mixed Slurry	WATER, brown, sheen, NAPL swirled on surface.	WATER, brown, sheen, thin film.
28-Mar-07	Area 2A 10% Solids Mixed Slurry	WATER, brown, sheen, NAPL swirled on surface, trace sand, wood >4" to <0.25", strong odor.	WATER, brown, slight sheen.
29-Mar-07	Area 2A 1% Solids Quiescent Slurry	WATER, brown, sheen, no settling.	WATER, brown, slight sheen, broken film on surface.

Table 2
Summary of Emission Rates
Area 1 - Exposed Sediment and 1% Mixed
Ashland/Northern States Power Lakefront Superfund Site

Compound	Concentration in Bulk Sed. Sample mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	Exposed Sediment Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	100		81.0		36,223	U	9,926	U	3,793	U
2-Methylnaphthalene	230		180		36,017	U	9,851	U	3,770	U
Naphthalene	270		170		102,437		82,033		23,374	
Total PAHs	600		431		174,678	U	101,810	U	30,937	U
VOCs										
1,2,4-Trimethylbenzene	8.60		9.80		79,088		53,565		35,696	
Benzene	0.044	U	0.110	U	205,765		107,879		43,918	
Ethyl Benzene	12.0		11.0		78,745		48,695		23,950	
Toluene	3.20		0.430	U	410,845		273,442		143,098	
Trichloroethene	0.074	U	0.180	U	34,032	U	18,617	U	9,626	
Xylenes Total	13.8		12.4		314,297		208,266		109,551	
Total VOCs	37.72	U	33.92	U	1,122,771	U	710,463	U	365,838	
Other										
TOC	9,810		5,790							
% Solids	75.0		82.0							

Compound	Concentration in Bulk Sed. Sample mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	1% Mixed Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	56		9.1		17,016	U	8,121	U	3,823	
2-Methylnaphthalene	170		9.9		16,920	U	8,060	U	8,021	
Naphthalene	120		7.7		25,090		15,935		6,072	
Total PAHs	360		92		42,010	U	23,995	U	14,093	
VOCs										
1,2,4-Trimethylbenzene	11		0.39		37,314		39,531		19,583	
Benzene	0.064	U	0.0032	U	71,732		63,741		24,100	
Ethyl Benzene	3.30		0.16		62,726	U	29,909	U	11,638	
Toluene	0.25	U	0.012	U	173,701		149,545		61,936	
Trichloroethene	0.11	U	0.0053	U	31,974	U	21,696		7,833	
Xylenes Total	11.7		0.299		64,012	U	116,756		48,050	
Total VOCs	26.42	U	0.87	U	441,459	U	421,179	U	173,140	
Other										
TOC										
% Solids	70		74							

Flags:
U=Analyte not detected

Note:
Due to lack of material, exposed sediment and 1% quiescent slurry test runs were not completed for Area 1

Table 3
Summary of Emission Rates
Area 1 - 10% Mixed and 10% Quiescent
Ashland/Northern States Power Lakefront Superfund Site

Compound	Concentration in Bulk Sed. Sample mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	10% Mixed Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	84.0		100		22,609	U	8,024	U	10,534	
2-Methylnaphthalene	190		230		22,481	U	7,964	U	21,068	
Naphthalene	180		230		86,332		36,336		22,116	
Total PAHs	454		560		131,422	U	52,324	U	53,719	U
VOCs										
1,2,4-Trimethylbenzene	9.10		2.00		64,963		33,611		41,991	
Benzene	0.150	U	0.014	U	117,959		51,174		47,899	
Ethyl Benzene	4.60		0.540		83,340	U	29,554	U	25,055	
Toluene	0.580	U	0.056	U	267,544		145,648		136,625	
Trichloroethene	0.250	U	0.024	U	42,482	U	15,049	U	9,661	
Xylenes Total	11.4		1.85		192,752		94,474		106,332	
Total VOCs	26.08	U	4.48	U	769,040	U	369,510	U	367,563	
Other										
TOC										
% Solids	75.0		74							

Compound	Concentration in Bulk Sed. Sample* mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	10% Quiescent Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene			79		18,208	U	7,948	U	6,460	
2-Methylnaphthalene			110		18,105	U	7,888	U	1,968	U
Naphthalene			94		49,566		21,864		12,202	
Total PAHs			283		85,879	U	37,699	U	20,630	U
VOCs										
1,2,4-Trimethylbenzene			4.20		43,714		26,602		26,797	
Benzene			0.060	U	96,378		41,388		30,207	
Ethyl Benzene			0.14	U	67,120	U	29,272	U	13,997	
Toluene			0.23	U	186,215		89,374		92,116	
Trichloroethene			0.10	U	34,214	U	17,455		9,032	
Xylenes Total			2.79		68,497	U	76,178		73,274	
Total VOCs			7.52	U	496,138	U	280,269	U	245,424	
Other										
TOC										
% Solids			72							

Flags:
U=Analyte not detected

Note:
Due to lack of material, exposed sediment and 1% quiescent slurry test runs were not completed for Area 1

Footnote:
*=pretest sediment samples not collected

Table 4
Summary of Emission Rates
Area 2 - Exposed Sediment and 10% Mixed
Ashland/Northern States Power Lakefront Superfund Site

Compound	Concentration Pretest Sediment mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	Exposed Sediment Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	320		350		21,817	U	8,316	U	2,022	U
2-Methylnaphthalene	450		490		21,693	U	8,253	U	2,009	U
Naphthalene	530		510		22,765	U	17,260		18,445	
Total PAHs	1,300		1,350		66,274	U	33,830	U	22,476	U
VOCs										
1,2,4-Trimethylbenzene	19.0		28.0		81,245	U	31,696	U	27,912	
Benzene	4.70		3.50		141,457		41,738		38,784	
Ethyl Benzene	39.0		48.0		63,511		18,233		19,483	
Toluene	16.0		16.0		348,900		111,092		112,992	
Trichloroethene	0.270	U	0.240	U	40,994	U	15,597	U	3,787	U
Xylenes Total	39.0		48.0		266,830		82,848		98,334	
Total VOCs	117.97	U	143.74	U	942,937	U	301,203	U	301,291	
Other										
TOC	26,000		16,400							
% Solids	66.0		80							

Compound	Concentration in Bulk Sed. Sample mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	10% Mixed Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	310		160		20,159	U	8,296	U	19,128	
2-Methylnaphthalene	440		230		20,045	U	8,234	U	32,470	
Naphthalene	520		280		133,761		102,372		64,940	
Total PAHs	1,270		670		173,965	U	118,902	U	116,538	U
VOCs										
1,2,4-Trimethylbenzene	21.0		11.0		75,836		36,002		22,670	
Benzene	5.30		0.190	U	130,712		57,917		31,289	
Ethyl Benzene	43.0		18.0		106,323		40,385		25,002	
Toluene	18.0		6.70		396,328		159,350		100,067	
Trichloroethene	0.260	U	0.320	U	37,880	U	15,559	U	4,752	
Xylenes Total	42.0		18.1		296,865		130,548		86,193	
Total VOCs	129.56	U	54.31	U	1,043,943	U	439,762	U	269,974	
Other										
TOC										
% Solids	72.0		68.0							

Flags:
U=Analyte not detected

Note:
Area 2 tested with exposed sediment and 10% solids mixed slurry only. Replaced remaining tests with Sample 2A

Table 5
Summary of Emission Rates
Area 2A - 1% Mixed and 1% Quiescent
Ashland/Northern States Power Lakefront Superfund Site

Compound	Concentration in Bulk Sed. Sample mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	1% Mixed Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	4800		110.0		23,168	U	8,607	U	9,454	
2-Methylnaphthalene	2700		140		61,753		26,210		16,403	
Naphthalene	3300		280		76,206		31,634		19,457	
Total PAHs	10,800		530		161,127	U	66,451	U	45,314	U
VOCs										
1,2,4-Trimethylbenzene	47.0		18.0		56,935		25,463		29,647	
Benzene	3.20		0.059	U	83,213		47,094		38,883	
Ethyl Benzene	62.0		21.0		85,403	U	31,699	U	18,687	U
Toluene	14.0		5.30		211,099		108,478		94,359	
Trichloroethene	0.140	U	0.10	U	43,534	U	42,872		143,893	
Xylenes Total	66.0		23.3		87,155	U	78,923		76,472	
Total VOCs	192.34	U	67.76	U	567,338	U	334,528	U	401,940	
Other										
TOC										
% Solids	49.0		37.0							

Compound	Concentration in Bulk Sed. Sample* mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	1% Quiescent Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene			440		23,676	U	8,509		10,456	
2-Methylnaphthalene			610		63,813		17,324		24,945	
Naphthalene			540		49,858		11,762		16,072	
Total PAHs			1,590		137,347	U	37,595		51,473	
VOCs										
1,2,4-Trimethylbenzene			23.0		104,367		34,759		30,189	
Benzene			0.16	U	101,385		39,486		29,103	
Ethyl Benzene			18.0		87,072	U	27,139	U	13,621	
Toluene			6.7		254,656		87,870		84,082	
Trichloroethene			0.260	U	44,490	U	13,820	U	12,193	
Xylenes Total			29.0		253,463		80,918		73,533	
Total VOCs			77.12	U	845,433	U	283,991	U	242,722	
Other										
TOC										
% Solids			31.0							

Flags:
U=Analyte not detected

Footnote:
*pretest sediment samples not collected due to lack of available sediment

Note:
Due to lack of material, exposed soil test run was not completed for Area 2A

Table 6
Summary of Emission Rates
Area 2A - 10% Mixed and 10% Quiescent
Ashland/Northern States Power Lakefront Superfund Site

Compound	Concentration in Bulk Sed. Sample mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	10% Mixed Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	250		1000		19,349	U	16,043	U	12,787	U
2-Methylnaphthalene	380		1500		79,004		45,496		32,063	
Naphthalene	410		1600		70,591		49,280		20,409	
Total PAHs	1,040		4,100		168,944	U	110,819	U	65,259	U
VOCs										
1,2,4-Trimethylbenzene	40.0		39.0		156,544		68,411		69,385	
Benzene	7.00		6.40		140,085		80,519		65,858	
Ethyl Benzene	58.0		49.0		90,342		40,259		39,118	
Toluene	19.0		18.0		291,875		204,929		194,172	
Trichloroethene	0.096	U	0.160	U	36,356		51,157		27,874	
Xylenes Total	67.0		61.0		387,704		192,518		186,582	
Total VOCs	191	U	174	U	1,102,907		637,792		582,988	
Other										
TOC	105,000									
% Solids	53.0		27.0							

Compound	Concentration in Bulk Sed. Sample mg/kg (dry wt.)	flag	Post Test Sediment mg/kg (dry wt.)	flag	10% Quiescent Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	330		1,600		32,427	U	17,326	U	9,209	U
2-Methylnaphthalene	660		2,300		32,243	U	17,195	U	18,669	U
Naphthalene	650		2,600		101,205		49,853		17,779	
Total PAHs	1,640		6,500		165,876	U	84,375	U	45,657	U
VOCs										
1,2,4-Trimethylbenzene	30.0		45.0		47,200		27,003		40,318	
Benzene	0.220	U	7.80		72,640		43,806		46,582	
Ethyl Benzene	49.0		75.0		81,221		31,906	U	24,473	U
Toluene	14.0		27.0		154,780		93,822		128,506	
Trichloroethene	0.370	U	0.170	U	30,466	U	16,247	U	21,218	U
Xylenes Total	52.0		80.0		30,466	U	72,573		108,516	U
Total VOCs	146	U	235	U	416,773	U	285,357	U	369,613	U
Other										
TOC										
% Solids	48.0		18.0							

Flags:
U=Analyte not detected

Note:
Due to lack of material, exposed soil test run was not completed for Area 2A

Table 7
Summary of Emission Rates
Area 4 - Exposed Soil
Ashland/Northern States Power Lakefront Superfund Site

Compound	Concentration in Bulk Soil Sample mg/kg (dry wt.)	flag	Post Test Soil mg/kg (dry wt.)	flag	Exposed Soil Mean Emission Rates $\mu g/m^2/hr$ 0-2 hrs		2-6 hrs		6-22 hrs	
PAHs										
1-Methylnaphthalene	62.0		78.0		22,144	U	7,873	U	1,983	U
2-Methylnaphthalene	100		130		22,018	U	7,813	U	1,971	U
Naphthalene	230		420		97,532		59,120		27,223	
Total PAHs	392		628		141,694	U	74,806	U	31,176	U
VOCs										
1,2,4-Trimethylbenzene	35.0		42.0		82,463	U	29,263	U	17,999	
Benzene	82.0		91.0		41,315	U	17,290		44,323	
Ethyl Benzene	98.0		93.0		40,855	U	14,498	U	17,070	
Toluene	140		130		41,859	U	22,608		90,443	
Trichloroethene	0.074	U	0.074	U	41,608	U	14,765	U	3,714	U
Xylenes Total	133		155		41,608	U	14,765	U	72,474	
Total VOCs	488	U	511	U	289,708	U	113,190	U	246,023	U
Other										
TOC	8,950		7,430							
% Solids	75.0		83.0							

Flags:
U=Analyte not detected

Note:
Since Area 4 is land site, test run completed for exposed soil only

Table 8
Summary of Odor Results Table (Area 2 and 2A)
Ashland/Northern States Power Lakefront Superfund Site

Area 2 - 10% Solids Mixed Slurry Test Run

Evaluation Date: 3/21/2007

Sample Name	Sample Type	Detection Threshold[1] (OU)	Recognition Threshold[1] (OU)	Intensity	Total Flow (m^3)	Surface Area (m^2)	Duration (hr)
NSP-2-10M-Odor-2-032007	0-2 hr Odor Sample	40	30	19	945	0.124	2
NSP-2-10M-Odor-5-032007	2-6 hr Odor Sample	65	40	18	1553	0.124	4
NSP-2-10M-Odor-6-032007	6-22 hr Odor Sample	110	70	19	5856	0.124	16

Area 2A - 10% Solids Mixed Slurry Test Run

Evaluation Date: 3/29/2007

Sample Name	Sample Type	Detection Threshold[1] (OU)	Recognition Threshold[1] (OU)	Intensity	Total Flow (m^3)	Surface Area (m^2)	Duration (hr)
NSP-2-10M-Odor-2-032007	0-2 hr Odor Sample	65	50	15	907	0.124	2
NSP-2-10M-Odor-5-032007	2-6 hr Odor Sample	180	100	18	1501	0.124	4
NSP-2-10M-Odor-6-032007	6-22 hr Odor Sample	160	85	15	6249	0.124	16

Footnote:

[1]Since the odor concentration is dimensionless, the units Odor Units (OU) are applied

Table 9
Emission Rates Used in Ambient Air Quality Model
Ashland/Northern States Power Lakefront Superfund Site

	ALTERNATIVE									
	Raking / Dredging				Dewatering Pool				Stockpile	
	Dredge Area Working Hrs		Bay Area Working Hrs		Primary Cell Working Hrs		Secondary Cell Working Hrs		Working Hrs	
Parameter	**1% Mixed 0-2hr (µg/m2/hr)**	flags	**1% Quiescent 0-2hr (µg/m2/hr)**	flags	**10% Mixed 0-2hr (µg/m2/hr)**	flags	**10% Quiescent 0-2hr (µg/m2/hr)**	flags	**10% Quiescent or exposed 0-2hr (µg/m2/hr)**	flags
Naphthalene	**76,206**		**49,858**		**102,176**		**101,205**		**101,205**	
Benzene	**83,213**		**101,385**		**135,399**		**72,640**		**141,457**	
Total Methylnaphthalene	**84,921**	U*	**87,490**		**98,353**		**64,670**		**21,817**	U

Flags:

U=Analyte not detected

U*= 1-methyl naphthalene was not detected for this total methyl naphthalene rate.

Notes:

Raking= removing large material from sediment surface prior to dredging

Table 10
Dredge-All Modeled Emission Parameters
Ashland/Northern States Power Lakefront Superfund Site

Source ID	Alternative 4 0-8 ft Naphthalene Emission Rate (g/m^2s)	Alternative 4 0-8 ft Benzene Emission Rate (g/m^2s)	Alternative 4 0-8 ft Methyl Naphthalene Emission Rate (g/m^2s)	Alternative 3 0-4 ft Naphthalene Emission Rate (g/m^2s)	Alternative 3 0-4 ft Benzene Emission Rate (g/m^2s)	Alternative 3 0-4 ft Methyl Naphthalene Emission Rate (g/m^2s)
1	2.04E-05	2.05E-05	1.56E-05	2.04E-05	2.98E-06	1.56E-05
2	9.30E-06	2.05E-05	6.03E-06	2.13E-06	2.98E-06	6.03E-06
3	1.94E-05	8.59E-06	4.98E-05	1.94E-05	4.58E-05	4.98E-05
4	1.91E-05	4.58E-05	2.69E-05	1.91E-05	4.58E-05	2.69E-05
5	2.04E-05	2.82E-05	1.56E-05	2.04E-05	2.82E-05	1.56E-05
6	2.04E-05	2.82E-05	1.56E-05	2.04E-05	2.82E-05	1.56E-05
7	2.13E-05	4.09E-06	2.34E-06	2.13E-05	4.09E-06	2.34E-06
8	7.08E-05	6.38E-05	4.98E-05	7.08E-05	6.38E-05	4.98E-05
9	7.08E-05	1.38E-04	1.13E-04	1.08E-04	1.38E-04	1.13E-04
10	2.55E-05	4.94E-05	4.48E-05	2.55E-05	4.94E-05	4.48E-05
11	7.06E-07	2.15E-07	2.60E-06	7.06E-07	2.15E-07	2.60E-06
12	1.81E-05	1.74E-05	5.94E-06	1.81E-05	1.74E-05	5.94E-06
13	3.14E-05	1.77E-05	3.24E-05	3.14E-05	1.77E-05	3.24E-05
14	1.30E-05	1.76E-05	1.55E-05	1.30E-05	1.76E-05	1.55E-05
15	6.64E-05	1.31E-04	1.00E-04	6.64E-05	1.31E-04	1.00E-04
16	3.34E-05	5.80E-05	8.66E-05	3.34E-05	5.80E-05	8.66E-05
17	1.63E-06	2.37E-05	2.62E-05	1.63E-06	8.84E-07	2.62E-05
18	1.57E-05	2.37E-05	4.58E-05	1.05E-06	8.84E-07	4.58E-05
19	3.58E-05	3.40E-05	5.31E-05	3.58E-05	3.40E-05	5.31E-05
20	3.58E-05	1.68E-05	7.60E-05	3.58E-05	3.87E-07	7.60E-05
21	1.47E-06	3.59E-07	4.59E-06	1.49E-07	1.68E-07	4.59E-06
22	3.14E-08	2.40E-07	2.90E-06	3.14E-08	2.40E-07	2.90E-06
23	1.05E-05	8.92E-06	6.78E-06	1.05E-05	8.92E-06	6.78E-06
24	1.74E-05	9.17E-06	2.24E-06	1.74E-05	9.17E-06	2.24E-06
25	1.31E-04	2.21E-07	1.07E-05	4.73E-06	2.21E-07	1.07E-05
26	5.49E-06	1.73E-06	4.30E-05	5.49E-06	4.80E-07	4.30E-05
27	5.49E-06	8.42E-07	2.20E-06	5.49E-06	1.71E-07	2.20E-06
28	4.52E-05	7.98E-05	3.68E-05	7.97E-06	7.12E-06	3.68E-05
29	2.01E-05	8.59E-05	1.47E-05	2.12E-06	3.87E-07	1.47E-05
30	7.37E-06	1.86E-05	6.40E-06	4.70E-07	2.76E-08	6.40E-06
31	2.14E-09	1.13E-07	0.00E+00	2.14E-09	1.13E-07	0.00E+00
32	4.31E-05	3.89E-06	2.16E-05	5.75E-06	1.49E-07	2.16E-05
33	2.05E-05	1.35E-05	6.96E-06	2.05E-05	1.35E-05	6.96E-06
34	4.89E-05	1.72E-05	6.41E-05	1.15E-05	9.44E-06	6.41E-05
35	3.40E-05	8.86E-05	3.42E-05	1.41E-05	8.86E-05	3.42E-05
36	4.70E-07	9.50E-07	3.96E-07	4.70E-07	9.50E-07	3.96E-07
37	1.07E-05	5.16E-05	1.34E-05	1.07E-05	5.16E-05	1.34E-05
38	3.08E-05	4.33E-06	4.11E-05	3.08E-05	4.33E-06	4.11E-05
39	2.77E-05	3.87E-05	2.90E-05	2.39E-06	1.16E-07	2.90E-05
40	6.32E-06	2.79E-05	7.52E-06	6.32E-06	2.79E-05	7.52E-06
41	2.14E-06	8.84E-08	3.34E-06	2.14E-06	8.84E-08	3.34E-06
42	3.03E-06	2.76E-07	9.67E-06	3.03E-06	2.76E-07	9.67E-06
dewater	1.75E-04	2.13E-04	1.36E-04	1.45E-04	2.13E-04	1.36E-04
stockpile	6.32E-06	3.93E-05	6.32E-06	6.32E-06	3.93E-05	6.32E-06
dewater 2	1.73E-04	1.14E-04	1.35E-04	1.44E-04	1.14E-04	1.35E-04
cdfp pond	2.00E-04	3.44E-05	1.16E-04	1.08E-04	1.48E-04	1.16E-04
cdfs pond	1.41E-04	1.85E-05	8.66E-05	7.08E-05	3.40E-05	8.66E-05
Area 4	1.15E-05	8.56E-06	--	--	--	--

Notes:

Alternative 2 CDF models only dredge emissions from cells 22-42 and cdfponds.

Area 4 models only area 4 activity.

Table 11
Maximum 24-hour Modeled Area Source Impacts and Comparison with WDNR and TLV Levels
Ashland/Northern States Power Lakefront Superfund Site

Year of Meteorological Data	Alternative 4 Dredge All 0-8 feet			Alternative 3 Dredge All 0-4 feet			Alternative 2 CDF		
	Naphthalene ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Methyl-naphthalene ($\mu g/m^3$)	Naphthalene ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Methyl-naphthalene ($\mu g/m^3$)	Naphthalene ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Methyl-naphthalene ($\mu g/m^3$)
2002	746	686	1122	398	686	1122	1222	942	2143
2003	833	972	994	449	972	994	1913	1288	3504
2004	989	1047	478	864	770	478	932	584	1526
2005	1315	1130	659	410	1116	659	917	656	1488
2006	1753	813	1630	681	614	1630	1697	1053	2760
Max	1753	1130	1630	864	1116	1630	1913	1288	3504
WDNR Threshold	1258	160[a]	--	1258	160[a]	--	1258	160[a]	--

Footnote:

[a]Represents 1/10th of the TLV-TWA value of 1600 $\mu g/m^3$

Table 12
Maximum Annual Impacts
Ashland/Northern States Power Lakefront Superfund Site

Year of Meteorological Data	Alternative 4 Dredge All 0-8 feet			Alternative 3 Dredge All 0-4 feet			Alterative 2 CDF		
	Naphthalene ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Methyl-naphthalene ($\mu g/m^3$)	Naphthalene ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Methyl-naphthalene ($\mu g/m^3$)	Naphthalene ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Methyl-naphthalene ($\mu g/m^3$)
2002	298	274	449	86	148	243	191	147	335
2003	333	389	398	97	210	215	299	201	547
2004	396	419	191	187	167	103	146	91	238
2005	526	452	264	89	242	143	143	102	232
2006	701	325	652	147	133	353	265	164	431
Max	701	452	652	187	242	353	299	201	547
WDNR Threshold	1258	160[a]	--	1258	160[a]	--	1258	160[a]	--

Footnote:

[a]Represents 1/10th of the TLV-TWA value of 1600 $\mu g/m^3$

Table 13
Maximum Modeled Concentrations (Area 4)
Ashland/Northern States Power Lakefront Superfund Site

Year of Meteorological Data	24-hour Naphthalene Concentration ($\mu g/m^3$)	24-hour Benzene Concentration ($\mu g/m^3$)	Annual Naphthalene Concentration ($\mu g/m^3$)	Annual Benzene Concentration ($\mu g/m^3$)
2002	100.4	74.9	2.2	1.6
2003	78.2	58.4	2.4	1.8
2004	75.3	56.2	2.1	1.6
2005	64.7	48.3	1.9	1.4
2006	109.2	81.5	2.4	1.8
Max	109.2	81.5	2.4	1.8
WDNR Threshold	1258	160[a]	1258	160[a]

Footnote:

[a]Represents 1/10th of the TLV-TWA value of 1600 $\mu g/m^3$

APPENDIX A

Sample Collection Core Logs

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 4

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	3/ /2 /07 (m m / d d / y y y y)	3/ /2 /07 (m m / d d / y y y y)	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	8 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
____ 1/4 of ____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
[x] N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
2/SS	24/12			0.0 - 2.0 Blind.										
			1											
4/SS	24/12		2	2.0 - 5.0 FILL, slag, coal, and glass, petroleum odor, black.	FILL									
			3											
			4											
6/SS	24/12		5	5.0 - 6.0 SANDY CLAY, reddish brown, medium plasticity, stiff, petroleum odor.	CL									
8/SS	24/12		6	6.0 - 8.0 SILTY CLAY, light brown, high plasticity, soft, rock fragments at 8'.	CL/M									
			7											
10/SS	24/12		8	8.0 - 11.0 Same as above, wet.	CL/M									
			9											
			10											
12/SS	24/12		11	11.0 - 12.0										
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

Facility/Project Name: NSP Ashland
Boring No. : Area 4

License/Project/Monitoring No. :
WI Unique Well No. :

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
14/SS	24/12		13	12.0 - 14.0 SILTY CLAY, coal tar and woodchips, black, mottled brown, high plasticity, soft, petroleum odor and very wet at 14'.	CL/M									
16/SS	24/12		14	14.0 - 16.0										
			15											
18/SS	24/12		16	16.0 - 18.0 CLAY, reddish brown, trace fine gravel and sand, stiff, dry, slight petroleum odor.	CL									
			17											
			18											

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 1

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ 7/ 007 (m m / d d / y y y y)	2/ 7/ 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 6.0 Water- Depth to sediment =6'.										
			1											
			2											
			3											
			4											
			5											
	30/24		6	6.0 - 6.58 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).	SP									
			7	6.58 - 8.0 SAND, reddish brown, fine to medium grained, poorly graded, medium dark, saturated, coal tar odor and surface sheen, coal tar stains to 8ft (5YR4/4).										
			8	8.0 - 8.5 EOB @ 8' Refusal. Sediment from 6-8', used in Area 1 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 1 set 12'N

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 6.0 Water- Depth to sediment = 6'.										
			1											
			2											
			3											
			4											
			5											
	48/29		6	6.0 - 6.67 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			7	6.67 - 8.33 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen, coal tar stains to 8.33 ft (5YR 4/4).	SP									
			8	8.33 - 8.5 EOB @ 8.33' Refusal. Sediment from 6 to 7.67', used in Area 1 conposite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 1 set 16'N

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
____ 1/4 of ____ 1/4 of Section 33 , T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
_____ Feet ☐ N ☐ S _____ Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 6.25 Water- Depth to sediment = 6.25'.										
			1											
			2											
			3											
			4											
			5											
			6											
	59/56			6.25 - 7.08 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			7	7.08 - 10.92 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen, heavy coal tar stains to 9.25ft, light coal tar stains to 10.92ft (5YR 4/4).	SP									
			8											
			9											
			10											
			11	10.92 - 11.25 EOB @ 10.92' Refusal. Sediment from 6.25 to 9.25', used in Area 1 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 1 set 20'S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 m m / d d / y y y y	2/ / 7/ / 007 m m / d d / y y y y	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 5.92 Water- Depth to water = 5.92'.										
			1											
			2											
			3											
			4											
			5											
	61/57		6	5.92 - 6.59 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			7	6.59 - 10.67 SAND, reddish brown, fine to medium grained, poorly grained, medium dense, saturated, coal tar odor and surface sheen, coal tar stain to 9.33ft. (5YR 2.5/1).	SP									
			8											
			9											
			10											
			11	10.67 - 11.25 EOB @ 10.67' Refusal. Sediment from 5.92 to 8.09', used in Area 1 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 1 set 20'E

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 5.75 Water- Depth to water = 5.75'.										
	24/24		6	5.75 - 6.33 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).	SP									
			7	6.33 - 8.33 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen, coal tar stains to 8.33 ft (5YR 4/4).										
			8	8.33 - 8.5 EOB @ 8.33' Refusal.										
				Sediment from 6 to 7.5', used in Area 1 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 2 0+ 20'W

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [X] (estimated: [X]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 4.5 Water- Depth to sediment = 4.5'.										
			1											
			2											
			3											
			4											
			5	4.5 - 5.33 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			6	5.33 - 7.83 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, heavy coal tar sheen and odor to 6.83 ft (5YR 4/4).	SP									
			7											
			8	7.83 - 8.25 EOB @ 7.83' Refusal Sediment from 0-18.5", kept in core for W.DELFT Testing.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area20 set 42'W

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ 7/ 007 (m m / d d / y y y y)	2/ 7/ 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [X] (estimated: [X]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 4.5 Water- Depth to sediment = 4.5'.										
	40/40		4	4.5 - 5.33 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			5	5.33 - 7.0 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen, coal tar stained to 6.10 ft (5YR 4/4).	SP									
			7	7.0 - 7.5 EOB @ 7' Refusal. Sediment was not used for analysis, incorporated into drum as IDW.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area20 set 39'W

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [X] (estimated: [X]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 4.42 Water- Depth to sediment = 4.42'.										
	39/27		4	4.42 - 5.25 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			5	5.25 - 6.75 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen, coal tar stained to 6.10 ft (5YR 4/4).	SP									
			7	6.75 - 7.25 EOB @ 6.75' Refusal. Sediment from 4.59 to 6.10', kept in core and sent to STI for testing.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 20

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _	_ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
_____ Feet ☐ N ☐ S _____ Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 4.42 Water- Depth to sediment = 4.42'.										
	49/46		4	4.42 - 5.59 WOOD CHIPS and WOOD DEBRIS, fibrous, trace fine sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			5	5.59 - 8.25 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen (5YR 4/4), less contaminated below 7.2 ft.	SP									
			8	8.25 - 8.5 EOB @ 8.25' Refusal. Sediment from 4.42 to 7.17', used in Area 2 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Alt. 2 set 55'N

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
____ 1/4 of ____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
_____ Feet ☐ N ☐ S _____ Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 5.75 Water- Depth to sediment = 5.75'.										
	41/36		6	5.75 - 6.58 WOOD CHIPS and WOOD DEBRIS, fibrous, trace fine sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			7	6.58 - 8.75 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen (5YR 4/4).	SP									
			9	8.75 - 9.0 EOB @ 8.75' Refusal. Sediment from 5.75 to 8', used in Area 2 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Alt. 2 set 25'W

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 m m / d d / y y y y	2/ / 7/ / 007 m m / d d / y y y y	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 5.58 Water- Depth to sediment = 5.58'.										
			1											
			2											
			3											
			4											
			5											
	10/10		6	5.58 - 6.25 WOOD CHIPS and WOOD DEBRIS, fibrous, trace fine sand, strong coal tar odor, free product, black (5YR 2.5/1).	SP									
				6.25 - 6.42 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen (5YR 4/4).										
				6.42 - 6.5 EOB @ 6.42' Refusal. Sediment from 5.58 to 6.25', used in Area 2 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Alt. 2 set 45'N

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	_____ inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
____ 1/4 of ____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
_____ Feet ☐ N ☐ S _____ Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 5.92 Water- Depth to sediment = 5.92'.										
	38/34		6	5.92 - 7.17 WOOD CHIPS and WOOD DEBRIS, fibrous, trace fine sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			7	7.17 - 8.75 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen (5YR 4/4).	SP									
			9	8.75 - 9.0 EOB @ 8.75' Refusal. Sediment from 5.92 to 8.25', used in Area 2 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Alt. 2

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 6/ / 007 (m m / d d / y y y y)	2/ / 6/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
____ 1/4 of ____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 5.33 Water- Depth to sediment = 5.33'.										
			1											
			2											
			3											
			4											
			5											
	32/27			5.33 - 6.33 WOOD CHIPS and WOOD DEBRIS, fibrous, trace black sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			6											
				6.33 - 8.0 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen, coal tar stained (5YR 4/4).	SP									
			7											
			8	8.0 - 8.25 EOB @ 8' Refusal.										
				Sediment from 5.33 to 7.58', used in Area 2 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Alt. 2 0/5+30'E

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 7/ / 007 (m m / d d / y y y y)	2/ / 7/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
_____ Feet ☐ N ☐ S _____ Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 4.75 Water- Depth to sediment = 4.75'.										
	33/19		5	4.75 - 5.58 WOOD CHIPS and WOOD DEBRIS, fibrous, trace fine sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			6	5.58 - 6.83 SAND, reddish brown, fine to medium grained, poorly graded, medium dense, saturated, coal tar odor and surface sheen, coal tar stained (5YR 4/4).	SP									
			7	6.83 - 7.0 EOB @ 6.83' Refusal. Sediment sample kept in core and sent to W. DELFT for testing.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		2-1

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	2/ / 6/ / 007 (m m / d d / y y y y)	2/ / 6/ / 007 (m m / d d / y y y y)	vibratory

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	4 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 4.75 Water- Depth to sediment = 4.75'.										
			1											
			2											
			3											
			4											
	22/9		5	4.75 - 5.5 WOOD CHIPS and WOOD DEBRIS, fibrous, trace fine sand, strong coal tar odor, free product, black (5YR 2.5/1).										
			6	5.5 - 6.0 EOB @ 5.5' Refusal. Sediment from 4.75 to 5.25', used in Area 2 composite.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 3

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	3/ /2 /07 (m m / d d / y y y y)	3/ /2 /07 (m m / d d / y y y y)	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	8 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
6/SS	24/18			0.0 - 4.0 Blind.										
			1											
			2											
			3											
8/SS	24/24		4	4.0 - 7.5 Wood and charcoal present.	ML									
			5											
			6											
			7											
10/SS	24/1		8	7.5 - 13.0 CLAYEY SILT, brown, mottled black, low plasticity, stiff, moist.	ML									
			9											
			10											
			11											
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

Facility/Project Name: NSP Ashland
Boring No. : Area 3

License/Project/Monitoring No. :
WI Unique Well No. :

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
12/SS	24/15		13	13.0 - 14.0 Wood present.	SM									
14/SS	24/6		14	14.0 - 16.0 SAND with some silt, sub-rounded, poorly graded, brown soft.	SM									
			15											
16/SS	24/6		16	16.0 - 18.0 CLAYEY SILT, reddish brown, stiff, very low plasticity, trace rock fragments 0.25 to 1" sized.	ML									
			17											
18/SS	24/6		18	18.0 - 18.01 EOB @ 18'.										

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☐ _____

Page 1 of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
NSP Ashland		Area 5

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
First Name: Mike Last Name: Miller Firm: Boart Longyear	3/ /2 /07 (m m / d d / y y y y)	3/ /2 /07 (m m / d d / y y y y)	hollow stem auger

WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
_ _ _ _ _ _	_ _ _ _		_____ Feet MSL	_____ Feet MSL	8 inches

Local Grid Origin [x] (estimated: [x]) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section 33, T 48 N, R 4 W

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
34101457	ASHLAND	2	Ashland

Sample: Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				0.0 - 9.0 Blind.										
			1											
			2											
			3											
			4											
			5											
			6											
			7											
			8											
			9	9.0 - 14.0 SANDY CLAY, brown, wood, stiff, moderate plasticity, moist.	CL									
			10											
			11											
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

Facility/Project Name: NSP Ashland
Boring No. : Area 5

License/Project/Monitoring No. :
WI Unique Well No. :

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			10											
			11											
			12											
			13											
			14	**14.0 - 16.0 Blind.**	**CL**									
			15											
			16	**16.0 - 30.0 CLAYEY SILT, reddish brown, low plasticity, medium stiffness, friable.**	**ML**									
			17											
			18											
			19											
			20											
			21											
			22											
			23											
			24											
			25											
			26											
			27											
			28											
			29											

Facility/Project Name: NSP Ashland
Boring No. : Area 5

License/Project/Monitoring No. :
WI Unique Well No. :

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in.)	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			30	**30.0 - 32.0 SANDY SILT, reddish brown, low plasticity, medium stiffness, friable.**	SM									
			31											
			32											

APPENDIX B

Bench Test Photo Log

PHOTOGRAPHIC RECORD

Client Name:	Site Location:	Project No.
Ashland/Northern States Power	Lakefront Superfund Site, Ashland, Wisconsin	25688375.75000

Photo No. 1

Location of Photo:

Service Engineering
St. Paul, MN

Description:

View of wind tunnel

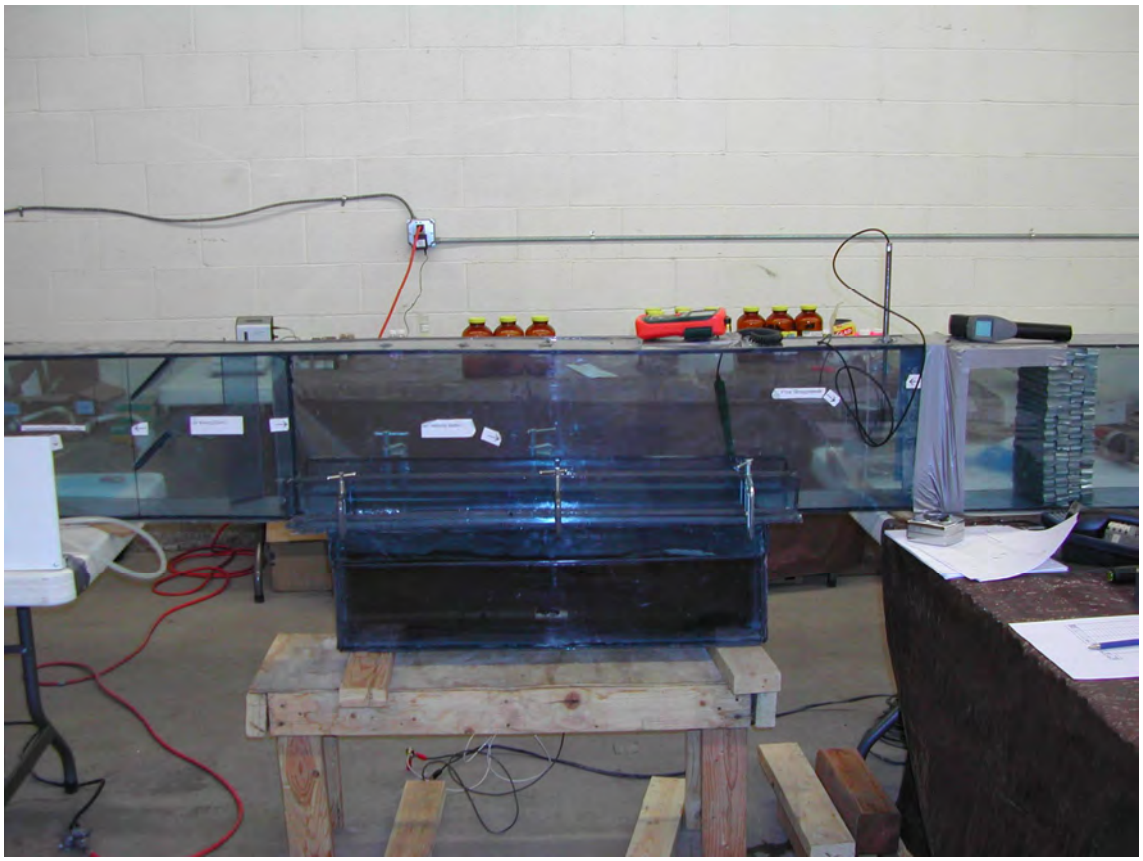
Photo No. 2

Location of Photo:

Service Engineering
St. Paul, MN

Description:

View of wind tunnel



PHOTOGRAPHIC RECORD

Client Name:	Site Location:	Project No.
Ashland/Northern States Power	Lakefront Superfund Site, Ashland, Wisconsin	25688375.75000

Photo No. 3

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/15/07

Area 1 exposed sediment

Pre-test

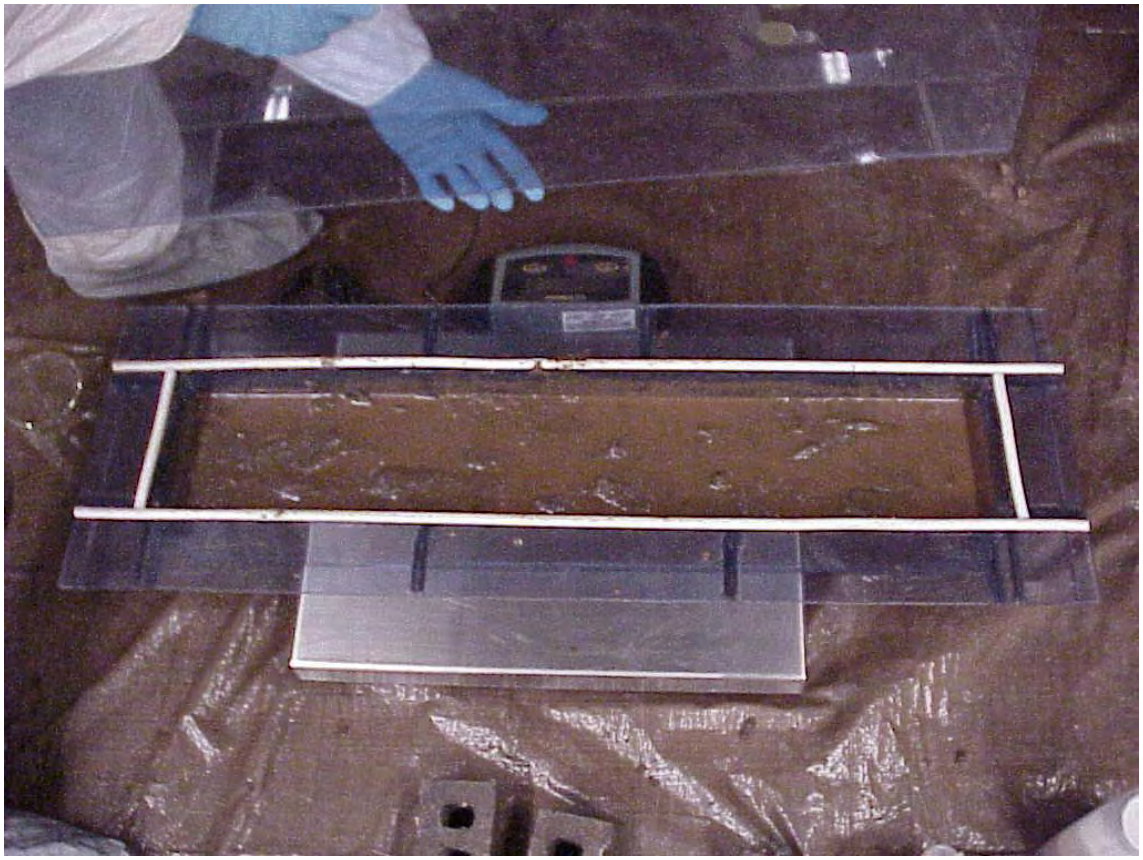


Photo No. 4

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/19/07

Area 2 exposed sediment

Pre-test

PHOTOGRAPHIC RECORD

Client Name:	Site Location:	Project No.
Ashland/Northern States Power	Lakefront Superfund Site, Ashland, Wisconsin	25688375.75000

Photo No. 5

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/20/07

Area 2 10% slurry

Pre-test

Mixed run

Photo No. 6

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/20/07

Area 2 10% slurry

Pre-test

Mixed run

PHOTOGRAPHIC RECORD

Client Name:	Site Location:	Project No.
Ashland/Northern States Power	Lakefront Superfund Site, Ashland, Wisconsin	25688375.75000

Photo No. 7

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/26/07

Area 2A

Exposed sediment

Photo No. 8

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/26/07

Area 2A

Large wood chips

PHOTOGRAPHIC RECORD

Client Name:	Site Location:	Project No.
Ashland/Northern States Power	Lakefront Superfund Site, Ashland, Wisconsin	25688375.75000

Photo No. 9

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/27/07

Area 2A 10% slurry

Post test

Quiescent run

In wind tunnel

Photo No. 10

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/29/07

Area 2A 10% slurry

Post test

Mixed run

In wind tunnel

PHOTOGRAPHIC RECORD

Client Name:	Site Location:	Project No.
Ashland/Northern States Power	Lakefront Superfund Site, Ashland, Wisconsin	25688375.75000

Photo No. 11

Location of Photo:

Service Engineering
St. Paul, MN

Description:

03/29/07

Area 2A 10% slurry

Post test

Mixed run

Settled soil

APPENDIX C

Temperature, Flow, Humidity
& Bench Test % Solids Raw Data

Appendix C
Data Sheet: Test Sediment Temperature (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #1 ES	3/15/07 10:08	65.5
Bay Area #1 ES	3/15/07 10:30	64.5
Bay Area #1 ES	3/15/07 10:54	64.0
Bay Area #1 ES	3/15/07 11:27	63.0
Bay Area #1 ES	3/15/07 12:05	61.5
Bay Area #1 ES	3/15/07 12:18	61.5
Bay Area #1 ES	3/15/07 12:48	61.5
Bay Area #1 ES	3/15/07 13:43	62.0
Bay Area #1 ES	3/15/07 14:30	62.0
Bay Area #1 ES	3/15/07 15:08	60.5
Bay Area #1 ES	3/15/07 15:48	59.5
Bay Area #1 ES	3/15/07 16:22	60.5
Bay Area #1 ES	3/15/07 17:05	60.0
Bay Area #1 ES	3/15/07 17:35	60.5
Bay Area #1 ES	3/15/07 18:41	60.0
Bay Area #1 ES	3/15/07 20:45	59.5
Bay Area #1 ES	3/16/07 7:55	59.0
Bay Area #1 ES	3/16/07 8:15	59.5
Maximum		**65.5**
Minimum		**59.0**
Average		**61.4**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #1 ES	3/15/07 10:08	64.2	35.8	457.6	5.2
Bay Area #1 ES	3/15/07 10:30	64.5	36.1	457.6	5.2
Bay Area #1 ES	3/15/07 10:54	65.1	34.8	466.4	5.3
Bay Area #1 ES	3/15/07 11:27	65.3	34.9	457.6	5.2
Bay Area #1 ES	3/15/07 12:05	65.6	34.5	466.4	5.3
Bay Area #1 ES	3/15/07 12:18	64.4	34.9	457.6	5.2
Bay Area #1 ES	3/15/07 12:48	65.6	33.7	466.4	5.3
Bay Area #1 ES	3/15/07 13:43	65.8	33.0	457.6	5.2
Bay Area #1 ES	3/15/07 14:30	64.7	33.2	466.4	5.3
Bay Area #1 ES	3/15/07 15:08	64.9	32.7	448.8	5.1
Bay Area #1 ES	3/15/07 15:48	65.4	32.2	457.6	5.2
Bay Area #1 ES	3/15/07 16:22	65.6	32.7	448.8	5.1
Bay Area #1 ES	3/15/07 17:05	65.1	33.1	448.8	5.1
Bay Area #1 ES	3/15/07 17:36	65.3	33.1	448.8	5.1
Bay Area #1 ES	3/15/07 18:41	65.1	32.9	440.0	5.0
Bay Area #1 ES	3/15/07 20:45	65.3	32.3	440.0	5.0
Bay Area #1 ES	3/16/07 7:55	65.1	31.4	440.0	5.0
Bay Area #1 ES	3/16/07 8:15	64.9	31.6	440.0	5.0
Bay Area #1 ES	3/16/07 8:16	64.9	31.6	440.0	5.0
Maximum		**65.8**	**36.1**	**466.4**	**5.3**
Minimum		**64.2**	**31.4**	**440.0**	**5.0**
Average		**65.09**	**33.39**	**452.97**	**5.15**

Appendix C
Data Sheet: Test Slurry Temperature (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #1 1M	3/23/07 9:42	62.0
Bay Area #1 1M	3/23/07 10:00	62.5
Bay Area #1 1M	3/23/07 10:32	63.0
Bay Area #1 1M	3/23/07 11:11	63.5
Bay Area #1 1M	3/23/07 11:36	64.0
Bay Area #1 1M	3/23/07 11:49	64.0
Bay Area #1 1M	3/23/07 12:33	65.0
Bay Area #1 1M	3/23/07 13:19	65.5
Bay Area #1 1M	3/23/07 13:44	66.0
Bay Area #1 1M	3/23/07 14:42	67.5
Bay Area #1 1M	3/23/07 15:14	68.5
Bay Area #1 1M	3/23/07 15:39	67.5
Bay Area #1 1M	3/23/07 15:49	67.0
Bay Area #1 1M	3/23/07 16:49	68.0
Bay Area #1 1M	3/23/07 17:11	68.0
Bay Area #1 1M	3/23/07 17:44	68.0
Bay Area #1 1M	3/23/07 18:14	68.5
Bay Area #1 1M	3/23/07 18:43	68.5
Bay Area #1 1M	3/23/07 19:47	69.0
Bay Area #1 1M	3/24/07 7:38	70.5
Bay Area #1 1M	3/24/07 7:47	70.0
Bay Area #1 1M	3/24/07 7:48	70.0
Maximum		**70.5**
Minimum		**62.0**
Average		**66.7**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #1 1M	3/23/07 9:42	61.8	81.1	466.4	5.3
Bay Area #1 1M	3/23/07 10:00	60.0	83.0	448.8	5.1
Bay Area #1 1M	3/23/07 10:32	60.0	83.1	440.0	5.0
Bay Area #1 1M	3/23/07 11:11	60.0	84.3	431.2	4.9
Bay Area #1 1M	3/23/07 11:36	60.0	83.8	448.8	5.1
Bay Area #1 1M	3/23/07 11:49	60.6	84.3	457.6	5.2
Bay Area #1 1M	3/23/07 12:33	60.0	83.7	457.6	5.2
Bay Area #1 1M	3/23/07 13:19	61.1	84.8	440.0	5.0
Bay Area #1 1M	3/23/07 13:44	60.4	84.6	448.8	5.1
Bay Area #1 1M	3/23/07 14:42	60.0	83.2	440.0	5.0
Bay Area #1 1M	3/23/07 15:14	60.9	84.3	440.0	5.0
Bay Area #1 1M	3/23/07 15:39	60.8	83.9	448.8	5.1
Bay Area #1 1M	3/23/07 15:49	61.1	84.2	448.8	5.1
Bay Area #1 1M	3/23/07 16:49	60.9	83.8	448.8	5.1
Bay Area #1 1M	3/23/07 17:11	60.8	83.2	440.0	5.0
Bay Area #1 1M	3/23/07 17:44	60.4	83.1	431.2	4.9
Bay Area #1 1M	3/23/07 18:14	60.2	83.0	440.0	5.0
Bay Area #1 1M	3/23/07 18:43	60.9	83.1	440.0	5.0
Bay Area #1 1M	3/23/07 19:47	60.5	83.4	448.8	5.1
Bay Area #1 1M	3/24/07 7:38	61.1	87.0	440.0	5.0
Bay Area #1 1M	3/24/07 7:47	62.2	88.5	431.2	4.9
Bay Area #1 1M	3/24/07 7:48	62.2	88.5	431.2	4.9
Maximum		**62.2**	**88.5**	**466.4**	**5.3**
Minimum		**60.0**	**81.1**	**431.2**	**4.9**
Average		**60.72**	**84.18**	**444.00**	**5.05**

Appendix C
Data Sheet: Test Slurry Temperature (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #1 10Q	3/22/07 9:57	64.5
Bay Area #1 10Q	3/22/07 10:36	64.0
Bay Area #1 10Q	3/22/07 11:00	65.0
Bay Area #1 10Q	3/22/07 11:49	64.5
Bay Area #1 10Q	3/22/07 12:12	64.0
Bay Area #1 10Q	3/22/07 12:57	64.5
Bay Area #1 10Q	3/22/07 13:27	64.5
Bay Area #1 10Q	3/22/07 13:57	64.5
Bay Area #1 10Q	3/22/07 14:39	64.0
Bay Area #1 10Q	3/22/07 15:14	65.0
Bay Area #1 10Q	3/22/07 15:56	64.5
Bay Area #1 10Q	3/22/07 16:03	64.5
Bay Area #1 10Q	3/22/07 16:36	65.0
Bay Area #1 10Q	3/22/07 17:09	64.5
Bay Area #1 10Q	3/22/07 17:39	65.0
Bay Area #1 10Q	3/22/07 18:16	65.5
Bay Area #1 10Q	3/22/07 19:23	65.0
Bay Area #1 10Q	3/22/07 20:12	65.5
Bay Area #1 10Q	3/23/07 7:36	65.0
Bay Area #1 10Q	3/23/07 7:51	65.0
Bay Area #1 10Q	3/23/07 8:00	64.5
Bay Area #1 10Q	3/23/07 8:01	64.5
Maximum		**65.5**
Minimum		**64.0**
Average		**64.7**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #1 10Q	3/22/07 9:57	60.2	80.8	431.2	4.9
Bay Area #1 10Q	3/22/07 10:36	61.3	88.7	440.0	5.0
Bay Area #1 10Q	3/22/07 11:00	59.7	84.6	448.8	5.1
Bay Area #1 10Q	3/22/07 11:49	61.1	85.9	457.6	5.2
Bay Area #1 10Q	3/22/07 12:12	60.6	83.2	448.8	5.1
Bay Area #1 10Q	3/22/07 12:57	60.2	82.0	448.8	5.1
Bay Area #1 10Q	3/22/07 13:27	60.8	80.5	457.6	5.2
Bay Area #1 10Q	3/22/07 13:57	60.6	84.1	457.6	5.2
Bay Area #1 10Q	3/22/07 14:39	60.9	84.5	448.8	5.1
Bay Area #1 10Q	3/22/07 15:14	60.9	84.7	457.6	5.2
Bay Area #1 10Q	3/22/07 15:56	59.3	80.0	466.4	5.3
Bay Area #1 10Q	3/22/07 16:03	61.3	83.5	457.6	5.2
Bay Area #1 10Q	3/22/07 16:36	61.3	81.5	448.8	5.1
Bay Area #1 10Q	3/22/07 17:09	61.3	84.2	448.8	5.1
Bay Area #1 10Q	3/22/07 17:39	61.1	83.2	448.8	5.1
Bay Area #1 10Q	3/22/07 18:16	61.5	83.5	440.0	5.0
Bay Area #1 10Q	3/22/07 19:23	62.7	84.8	448.8	5.1
Bay Area #1 10Q	3/22/07 20:12	62.9	85.4	431.2	4.9
Bay Area #1 10Q	3/23/07 7:36	60.2	73.0	448.8	5.1
Bay Area #1 10Q	3/23/07 7:51	61.1	77.2	431.2	4.9
Bay Area #1 10Q	3/23/07 8:00	60.9	80.3	440.0	5.0
Bay Area #1 10Q	3/23/07 8:01	60.9	80.3	440.0	5.0
Maximum		**62.9**	**88.7**	**466.4**	**5.3**
Minimum		**59.3**	**73.0**	**431.2**	**4.9**
Average		**60.95**	**82.54**	**447.60**	**5.09**

Appendix C
Data Sheet: Test Slurry Temperature (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #1 10M	3/21/07 10:06	51.5
Bay Area #1 10M	3/21/07 10:17	52.0
Bay Area #1 10M	3/21/07 11:02	54.5
Bay Area #1 10M	3/21/07 11:32	56.0
Bay Area #1 10M	3/21/07 12:10	59.0
Bay Area #1 10M	3/21/07 12:54	60.0
Bay Area #1 10M	3/21/07 13:29	61.0
Bay Area #1 10M	3/21/07 14:06	62.0
Bay Area #1 10M	3/21/07 14:33	63.0
Bay Area #1 10M	3/21/07 15:08	64.0
Bay Area #1 10M	3/21/07 15:39	64.5
Bay Area #1 10M	3/21/07 16:22	66.0
Bay Area #1 10M	3/21/07 16:53	66.5
Bay Area #1 10M	3/21/07 17:52	68.0
Bay Area #1 10M	3/21/07 18:26	68.5
Bay Area #1 10M	3/21/07 19:17	68.5
Bay Area #1 10M	3/21/07 20:23	68.5
Bay Area #1 10M	3/21/07 21:46	70.5
Bay Area #1 10M	3/22/07 7:45	72.5
Bay Area #1 10M	3/22/07 8:10	72.5
Maximum		**72.5**
Minimum		**51.5**
Average		**63.5**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #1 10M	3/21/07 10:06	61.3	94.4	440.0	5.0
Bay Area #1 10M	3/21/07 10:17	59.7	91.5	448.8	5.1
Bay Area #1 10M	3/21/07 11:02	60.8	91.1	440.0	5.0
Bay Area #1 10M	3/21/07 11:32	60.2	89.3	448.8	5.1
Bay Area #1 10M	3/21/07 12:10	59.7	89.1	440.0	5.0
Bay Area #1 10M	3/21/07 12:54	59.1	87.5	457.6	5.2
Bay Area #1 10M	3/21/07 13:29	59.3	85.5	448.8	5.1
Bay Area #1 10M	3/21/07 14:06	61.8	85.7	448.8	5.1
Bay Area #1 10M	3/21/07 14:33	61.7	88.9	440.0	5.0
Bay Area #1 10M	3/21/07 15:08	61.7	89.3	440.0	5.0
Bay Area #1 10M	3/21/07 15:39	61.1	87.6	440.0	5.0
Bay Area #1 10M	3/21/07 16:22	61.8	86.0	440.0	5.0
Bay Area #1 10M	3/21/07 16:53	63.3	88.6	440.0	5.0
Bay Area #1 10M	3/21/07 17:52	62.4	85.8	448.8	5.1
Bay Area #1 10M	3/21/07 18:26	62.7	84.8	440.0	5.0
Bay Area #1 10M	3/21/07 19:17	62.4	88.9	440.0	5.0
Bay Area #1 10M	3/21/07 20:23	63.1	86.7	448.8	5.1
Bay Area #1 10M	3/21/07 21:46	62.6	79.9	440.0	5.0
Bay Area #1 10M	3/22/07 7:45	62.7	79.7	431.2	4.9
Bay Area #1 10M	3/22/07 8:10	62.4	78.3	440.0	5.0
Bay Area #1 10M	3/22/07 8:11	62.4	78.3	440.0	5.0
Maximum		**63.3**	**94.4**	**457.6**	**5.2**
Minimum		**59.1**	**78.3**	**431.2**	**4.9**
Average		**61.53**	**86.52**	**442.93**	**5.03**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Area #2 ES	3/19/07 10:07	66.0	32.5	466.4	5.3
Area #2 ES	3/19/07 10:20	66.0	32.5	457.6	5.2
Area #2 ES	3/19/07 10:48	66.2	32.0	466.4	5.3
Area #2 ES	3/19/07 11:18	65.6	31.8	457.6	5.2
Area #2 ES	3/19/07 11:49	65.4	31.8	466.4	5.3
Area #2 ES	3/19/07 12:07	66.5	30.9	457.6	5.2
Area #2 ES	3/19/07 12:43	65.6	30.7	475.2	5.4
Area #2 ES	3/19/07 13:07	65.6	30.3	457.6	5.2
Area #2 ES	3/19/07 13:37	65.4	29.7	475.2	5.4
Area #2 ES	3/19/07 14:07	65.6	29.4	475.2	5.4
Area #2 ES	3/19/07 14:43	66.9	28.8	466.4	5.3
Area #2 ES	3/19/07 15:26	65.6	28.2	466.4	5.3
Area #2 ES	3/19/07 16:15	65.4	27.4	466.4	5.3
Area #2 ES	3/19/07 16:38	65.8	27.0	457.6	5.2
Area #2 ES	3/19/07 16:54	66.9	26.5	457.6	5.2
Area #2 ES	3/19/07 17:46	65.6	26.2	457.6	5.2
Area #2 ES	3/19/07 18:30	65.3	25.7	466.4	5.3
Area #2 ES	3/19/07 19:36	64.9	25.4	457.6	5.2
Area #2 ES	3/19/07 21:04	64.6	25.0	457.6	5.2
Area #2 ES	3/20/07 7:40	64.4	25.0	457.6	5.2
Area #2 ES	3/20/07 8:11	64.9	24.4	457.6	5.2
Area #2 ES	3/20/07 8:12	64.9	24.4	457.6	5.2
Maximum		**66.9**	**32.5**	**475.2**	**5.4**
Minimum		**64.4**	**24.4**	**457.6**	**5.2**
Average		**65.6**	**28.2**	**462.6**	**5.3**

Appendix C
Data Sheet: Test Sediment Temperature (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Area #2 ES	3/19/07 10:07	56.0
Area #2 ES	3/19/07 10:20	57.0
Area #2 ES	3/19/07 10:48	59.5
Area #2 ES	3/19/07 11:18	59.0
Area #2 ES	3/19/07 11:49	59.5
Area #2 ES	3/19/07 12:07	59.5
Area #2 ES	3/19/07 12:43	59.5
Area #2 ES	3/19/07 13:07	59.5
Area #2 ES	3/19/07 13:37	60.0
Area #2 ES	3/19/07 14:07	60.0
Area #2 ES	3/19/07 14:43	59.5
Area #2 ES	3/19/07 15:26	60.0
Area #2 ES	3/19/07 16:15	59.5
Area #2 ES	3/19/07 16:38	59.0
Area #2 ES	3/19/07 16:54	59.5
Area #2 ES	3/19/07 17:46	59.5
Area #2 ES	3/19/07 18:30	59.5
Area #2 ES	3/19/07 19:36	59.5
Area #2 ES	3/19/07 21:04	59.5
Area #2 ES	3/20/07 7:40	59.5
Area #2 ES	3/20/07 8:11	59.0
Area #2 ES	3/20/07 8:12	59.0
Maximum		**60.0**
Minimum		**57.0**
Average		**59.4**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #2 10M	3/20/07 10:28	64.0	85.4	457.6	5.2
Bay Area #2 10M	3/20/07 10:49	64.0	83.0	440.0	5.0
Bay Area #2 10M	3/20/07 11:08	63.6	82.9	440.0	5.0
Bay Area #2 10M	3/20/07 11:38	62.7	82.7	431.2	4.9
Bay Area #2 10M	3/20/07 12:38	64.5	87.5	431.2	4.9
Bay Area #2 10M	3/20/07 13:01	61.7	82.1	440.0	5.0
Bay Area #2 10M	3/20/07 13:35	61.1	71.8	466.4	5.3
Bay Area #2 10M	3/20/07 14:21	63.5	78.3	457.6	5.2
Bay Area #2 10M	3/20/07 14:31	65.3	82.6	466.4	5.3
Bay Area #2 10M	3/20/07 15:02	62.9	80.2	448.8	5.1
Bay Area #2 10M	3/20/07 15:36	62.9	80.6	457.6	5.2
Bay Area #2 10M	3/20/07 16:19	61.8	79.5	440.0	5.0
Bay Area #2 10M	3/20/07 16:38	60.8	77.6	466.4	5.3
Bay Area #2 10M	3/20/07 17:02	62.4	79.9	440.0	5.0
Bay Area #2 10M	3/20/07 17:51	63.3	77.6	475.2	5.4
Bay Area #2 10M	3/20/07 18:47	62.0	79.8	431.2	4.9
Bay Area #2 10M	3/20/07 19:10	65.8	82.6	457.6	5.2
Bay Area #2 10M	3/20/07 20:30	65.1	80.9	466.4	5.3
Bay Area #2 10M	3/21/07 7:40	61.5	79.9	448.8	5.1
Bay Area #2 10M	3/21/07 8:07	61.8	88.4	440.0	5.0
Bay Area #2 10M	3/21/07 8:08	61.8	88.4	440.0	5.0
Maximum		**65.8**	**88.4**	**475.2**	**5.4**
Minimum		**60.8**	**71.8**	**431.2**	**4.9**
Average		**63.0**	**81.5**	**449.6**	**5.1**

Appendix C
Data Sheet: Test Slurry Temperature (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #2 10M	3/20/07 10:28	50.0
Bay Area #2 10M	3/20/07 10:49	53.5
Bay Area #2 10M	3/20/07 11:08	54.5
Bay Area #2 10M	3/20/07 11:38	60.0
Bay Area #2 10M	3/20/07 12:38	59.5
Bay Area #2 10M	3/20/07 13:01	61.5
Bay Area #2 10M	3/20/07 13:35	62.0
Bay Area #2 10M	3/20/07 14:21	62.0
Bay Area #2 10M	3/20/07 14:31	62.0
Bay Area #2 10M	3/20/07 15:02	63.0
Bay Area #2 10M	3/20/07 15:36	63.0
Bay Area #2 10M	3/20/07 16:19	64.5
Bay Area #2 10M	3/20/07 16:38	64.0
Bay Area #2 10M	3/20/07 17:02	64.5
Bay Area #2 10M	3/20/07 17:51	65.5
Bay Area #2 10M	3/20/07 18:47	66.5
Bay Area #2 10M	3/20/07 19:10	66.0
Bay Area #2 10M	3/20/07 20:30	66.5
Bay Area #2 10M	3/21/07 7:40	66.5
Bay Area #2 10M	3/21/07 8:07	66.5
Bay Area #2 10M	3/21/07 8:08	66.5
Maximum		**66.5**
Minimum		**50.0**
Average		**62.3**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #2A 1Q	3/29/07 10:05	60.0	84.0	475.2	5.4
Bay Area #2A 1Q	3/29/07 10:28	60.8	88.1	484.0	5.5
Bay Area #2A 1Q	3/29/07 11:11	61.1	87.9	466.4	5.3
Bay Area #2A 1Q	3/29/07 11:55	60.8	87.5	475.2	5.4
Bay Area #2A 1Q	3/29/07 12:52	60.8	87.0	475.2	5.4
Bay Area #2A 1Q	3/29/07 13:45	60.8	87.7	475.2	5.4
Bay Area #2A 1Q	3/29/07 14:26	60.9	87.2	457.6	5.2
Bay Area #2A 1Q	3/29/07 15:11	60.8	85.0	475.2	5.4
Bay Area #2A 1Q	3/29/07 15:41	60.6	86.4	475.2	5.4
Bay Area #2A 1Q	3/29/07 16:13	61.1	85.6	484.0	5.5
Bay Area #2A 1Q	3/29/07 16:42	60.8	84.9	475.2	5.4
Bay Area #2A 1Q	3/29/07 17:11	61.1	85.3	475.2	5.4
Bay Area #2A 1Q	3/29/07 17:41	60.9	85.2	457.6	5.2
Bay Area #2A 1Q	3/29/07 19:01	60.8	86.7	475.2	5.4
Bay Area #2A 1Q	3/29/07 20:16	60.9	85.8	457.6	5.2
Bay Area #2A 1Q	3/30/07 7:40	60.6	84.5	466.4	5.3
Bay Area #2A 1Q	3/30/07 8:05	60.6	84.3	466.4	5.3
Bay Area #2A 1Q	3/30/07 8:46	60.4	83.5	457.6	5.2
Bay Area #2A 1Q	3/30/07 8:50	60.4	83.5	457.6	5.2
Maximum		**61.1**	**88.1**	**484.0**	**5.5**
Minimum		**60.0**	**83.5**	**457.6**	**5.2**
Average		**60.7**	**85.8**	**470.1**	**5.3**

Appendix C
Data Sheet: Test Slurry Temperature (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #2A 1Q	3/29/07 10:05	51.5
Bay Area #2A 1Q	3/29/07 10:28	52.5
Bay Area #2A 1Q	3/29/07 11:11	53.5
Bay Area #2A 1Q	3/29/07 11:55	54.5
Bay Area #2A 1Q	3/29/07 12:52	56.5
Bay Area #2A 1Q	3/29/07 13:45	58.5
Bay Area #2A 1Q	3/29/07 14:26	59.5
Bay Area #2A 1Q	3/29/07 15:11	60.0
Bay Area #2A 1Q	3/29/07 15:41	59.5
Bay Area #2A 1Q	3/29/07 16:13	60.5
Bay Area #2A 1Q	3/29/07 16:42	60.5
Bay Area #2A 1Q	3/29/07 17:11	61.5
Bay Area #2A 1Q	3/29/07 17:41	61.5
Bay Area #2A 1Q	3/29/07 19:01	61.5
Bay Area #2A 1Q	3/29/07 20:16	62.0
Bay Area #2A 1Q	3/30/07 7:40	62.5
Bay Area #2A 1Q	3/30/07 8:05	62.5
Bay Area #2A 1Q	3/30/07 8:46	62.5
Bay Area #2A 1Q	3/30/07 8:50	62.5
Maximum		**62.5**
Minimum		**51.5**
Average		**59.1**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #2A 1M	3/27/07 10:00	65.4	83.3	484.0	5.5
Bay Area #2A 1M	3/27/07 10:19	64.5	85.5	466.4	5.3
Bay Area #2A 1M	3/27/07 10:49	64.9	87.4	484.0	5.5
Bay Area #2A 1M	3/27/07 11:14	63.8	86.3	475.2	5.4
Bay Area #2A 1M	3/27/07 11:45	63.1	85.6	466.4	5.3
Bay Area #2A 1M	3/27/07 12:42	62.2	84.7	475.2	5.4
Bay Area #2A 1M	3/27/07 13:28	62.7	85.4	457.6	5.2
Bay Area #2A 1M	3/27/07 14:09	62.9	85.2	475.2	5.4
Bay Area #2A 1M	3/27/07 14:48	62.6	84.1	475.2	5.4
Bay Area #2A 1M	3/27/07 15:34	62.0	83.8	466.4	5.3
Bay Area #2A 1M	3/27/07 15:58	63.1	83.7	466.4	5.3
Bay Area #2A 1M	3/27/07 16:10	63.8	84.0	475.2	5.4
Bay Area #2A 1M	3/27/07 16:44	63.6	84.5	475.2	5.4
Bay Area #2A 1M	3/27/07 17:19	63.6	83.2	457.6	5.2
Bay Area #2A 1M	3/27/07 22:10	62.8	81.3	466.4	5.3
Bay Area #2A 1M	3/28/07 7:40	61.7	79.7	475.2	5.4
Bay Area #2A 1M	3/28/07 8:03	61.3	80.4	466.4	5.3
Bay Area #2A 1M	3/28/07 8:06	61.3	80.4	466.4	5.3
Maximum		**65.4**	**87.4**	**484.0**	**5.5**
Minimum		**61.3**	**79.7**	**457.6**	**5.2**
Average		**63.1**	**83.8**	**470.8**	**5.4**

Appendix C
Data Sheet: Test Slurry Temperature (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #2A 1M	3/27/07 10:00	51.5
Bay Area #2A 1M	3/27/07 10:19	53.0
Bay Area #2A 1M	3/27/07 10:49	56.0
Bay Area #2A 1M	3/27/07 11:14	57.0
Bay Area #2A 1M	3/27/07 11:45	58.5
Bay Area #2A 1M	3/27/07 12:42	61.0
Bay Area #2A 1M	3/27/07 13:28	64.0
Bay Area #2A 1M	3/27/07 14:09	65.0
Bay Area #2A 1M	3/27/07 14:48	66.0
Bay Area #2A 1M	3/27/07 15:34	67.5
Bay Area #2A 1M	3/27/07 15:58	68.0
Bay Area #2A 1M	3/27/07 16:10	68.5
Bay Area #2A 1M	3/27/07 16:44	68.5
Bay Area #2A 1M	3/27/07 17:19	69.0
Bay Area #2A 1M	3/27/07 22:10	70.5
Bay Area #2A 1M	3/28/07 7:40	73.0
Bay Area #2A 1M	3/28/07 8:03	73.5
Bay Area #2A 1M	3/28/07 8:06	73.5
Maximum		**73.5**
Minimum		**51.5**
Average		**64.7**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #2A 10Q	3/26/07 10:19	64.4	84.0	457.6	5.2
Bay Area #2A 10Q	3/26/07 10:40	62.4	86.0	457.6	5.2
Bay Area #2A 10Q	3/26/07 11:00	62.6	80.0	448.8	5.1
Bay Area #2A 10Q	3/26/07 11:47	63.5	86.3	448.8	5.1
Bay Area #2A 10Q	3/26/07 12:08	63.6	87.2	448.8	5.1
Bay Area #2A 10Q	3/26/07 12:18	63.5	86.6	448.8	5.1
Bay Area #2A 10Q	3/26/07 12:49	63.5	86.3	457.6	5.2
Bay Area #2A 10Q	3/26/07 13:37	63.5	86.3	457.6	5.2
Bay Area #2A 10Q	3/26/07 14:15	63.1	85.7	448.8	5.1
Bay Area #2A 10Q	3/26/07 14:45	63.1	85.2	448.8	5.1
Bay Area #2A 10Q	3/26/07 15:21	64.2	84.3	457.6	5.2
Bay Area #2A 10Q	3/26/07 15:54	65.4	84.1	457.6	5.2
Bay Area #2A 10Q	3/26/07 16:12	67.2	85.6	448.8	5.1
Bay Area #2A 10Q	3/26/07 16:30	67.1	86.0	466.4	5.3
Bay Area #2A 10Q	3/26/07 17:19	66.5	85.2	457.6	5.2
Bay Area #2A 10Q	3/26/07 17:50	66.5	84.9	457.6	5.2
Bay Area #2A 10Q	3/26/07 19:00	67.0	86.4	466.4	5.3
Bay Area #2A 10Q	3/26/07 20:15	65.6	82.6	448.8	5.1
Bay Area #2A 10Q	3/27/07 7:41	64.2	80.4	457.6	5.2
Bay Area #2A 10Q	3/27/07 8:15	63.5	79.8	448.8	5.1
Bay Area #2A 10Q	3/27/07 8:16	63.5	79.8	448.8	5.1
Maximum		**67.2**	**87.2**	**466.4**	**5.3**
Minimum		**62.4**	**79.8**	**448.8**	**5.1**
Average		**64.5**	**84.4**	**454.2**	**5.2**

Appendix C
Data Sheet: Test Slurry Temperature (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #2A 10Q	3/26/07 10:19	52.5
Bay Area #2A 10Q	3/26/07 10:40	52.5
Bay Area #2A 10Q	3/26/07 11:00	53.0
Bay Area #2A 10Q	3/26/07 11:47	54.5
Bay Area #2A 10Q	3/26/07 12:08	55.0
Bay Area #2A 10Q	3/26/07 12:18	54.5
Bay Area #2A 10Q	3/26/07 12:49	55.5
Bay Area #2A 10Q	3/26/07 13:37	56.0
Bay Area #2A 10Q	3/26/07 14:15	57.5
Bay Area #2A 10Q	3/26/07 14:45	58.5
Bay Area #2A 10Q	3/26/07 15:21	59.0
Bay Area #2A 10Q	3/26/07 15:54	60.5
Bay Area #2A 10Q	3/26/07 16:12	60.5
Bay Area #2A 10Q	3/26/07 16:30	60.5
Bay Area #2A 10Q	3/26/07 17:19	61.0
Bay Area #2A 10Q	3/26/07 17:50	61.5
Bay Area #2A 10Q	3/26/07 19:00	62.5
Bay Area #2A 10Q	3/26/07 20:15	64.5
Bay Area #2A 10Q	3/27/07 7:41	67.5
Bay Area #2A 10Q	3/27/07 8:15	67.5
Bay Area #2A 10Q	3/27/07 8:16	67.5
Maximum		**67.5**
Minimum		**52.5**
Average		**59.1**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Bay Area #2A 10M	3/28/07 9:47	61.1	74.1	457.6	5.2
Bay Area #2A 10M	3/28/07 10:02	62.7	84.2	448.8	5.1
Bay Area #2A 10M	3/28/07 10:32	62.9	86.4	457.6	5.2
Bay Area #2A 10M	3/28/07 10:53	62.6	86.1	457.6	5.2
Bay Area #2A 10M	3/28/07 11:38	62.4	86.5	457.6	5.2
Bay Area #2A 10M	3/28/07 12:08	62.0	86.2	440.0	5.0
Bay Area #2A 10M	3/28/07 12:50	61.7	86.4	457.6	5.2
Bay Area #2A 10M	3/28/07 13:20	61.5	85.7	448.8	5.1
Bay Area #2A 10M	3/28/07 13:58	61.5	85.5	457.6	5.2
Bay Area #2A 10M	3/28/07 14:38	63.3	87.4	466.4	5.3
Bay Area #2A 10M	3/28/07 15:35	63.3	88.7	457.6	5.2
Bay Area #2A 10M	3/28/07 16:00	64.0	88.7	466.4	5.3
Bay Area #2A 10M	3/28/07 17:55	63.5	88.6	475.2	5.4
Bay Area #2A 10M	3/28/07 18:30	63.5	88.8	457.6	5.2
Bay Area #2A 10M	3/28/07 19:06	63.8	87.6	475.2	5.4
Bay Area #2A 10M	3/28/07 21:10	63.9	86.7	466.4	5.3
Bay Area #2A 10M	3/29/07 7:25	63.6	79.4	475.2	5.4
Bay Area #2A 10M	3/29/07 7:37	62.9	81.1	466.4	5.3
Maximum		**64.0**	**88.8**	**475.2**	**5.4**
Minimum		**61.1**	**74.1**	**440.0**	**5.0**
Average		**62.8**	**85.5**	**460.5**	**5.2**

Appendix C
Date Sheet: Test Slurry Temperature (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Bay Area #2A 10M	3/28/07 9:47	52.5
Bay Area #2A 10M	3/28/07 10:02	54.0
Bay Area #2A 10M	3/28/07 10:32	55.5
Bay Area #2A 10M	3/28/07 10:53	57.0
Bay Area #2A 10M	3/28/07 11:38	59.5
Bay Area #2A 10M	3/28/07 12:08	60.5
Bay Area #2A 10M	3/28/07 12:50	62.5
Bay Area #2A 10M	3/28/07 13:20	63.5
Bay Area #2A 10M	3/28/07 13:58	64.5
Bay Area #2A 10M	3/28/07 14:38	66.0
Bay Area #2A 10M	3/28/07 15:35	68.0
Bay Area #2A 10M	3/28/07 16:00	68.0
Bay Area #2A 10M	3/28/07 17:55	69.5
Bay Area #2A 10M	3/28/07 18:30	70.0
Bay Area #2A 10M	3/28/07 19:06	71.5
Bay Area #2A 10M	3/28/07 21:10	69.5
Bay Area #2A 10M	3/29/07 7:25	68.5
Bay Area #2A 10M	3/29/07 7:37	68.5
Maximum		**71.5**
Minimum		**52.5**
Average		**63.8**

Appendix C
Data Sheet: Test Wind Tunnel Air Parameters (Area 4)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)	Humidity (%)	Air Flow (ft/min)	Air Flow (mi/hr)
Upland Area #4 ES	3/14/07 10:03	63.1	41.8	484.0	5.5
Upland Area #4 ES	3/14/07 10:12	63.1	42.1	457.6	5.2
Upland Area #4 ES	3/14/07 10:45	62.9	42.5	448.8	5.1
Upland Area #4 ES	3/14/07 11:15	62.9	42.5	457.6	5.2
Upland Area #4 ES	3/14/07 11:45	63.1	41.5	448.8	5.1
Upland Area #4 ES	3/14/07 12:11	62.9	41.9	448.8	5.1
Upland Area #4 ES	3/14/07 12:45	62.7	40.5	448.8	5.1
Upland Area #4 ES	3/14/07 13:14	64.2	39.0	457.6	5.2
Upland Area #4 ES	3/14/07 13:51	63.1	39.6	440.0	5.0
Upland Area #4 ES	3/14/07 14:20	63.5	39.1	457.6	5.2
Upland Area #4 ES	3/14/07 14:55	64.0	38.0	448.8	5.1
Upland Area #4 ES	3/14/07 15:40	63.1	37.1	457.6	5.2
Upland Area #4 ES	3/14/07 16:12	64.0	36.5	466.4	5.3
Upland Area #4 ES	3/14/07 16:34	63.6	36.7	466.4	5.3
Upland Area #4 ES	3/14/07 17:14	64.2	36.3	457.6	5.2
Upland Area #4 ES	3/14/07 17:56	65.3	35.1	466.4	5.3
Upland Area #4 ES	3/14/07 18:34	65.6	35.1	457.6	5.2
Upland Area #4 ES	3/14/07 19:00	64.9	35.0	457.6	5.2
Upland Area #4 ES	3/14/07 21:03	64.2	31.8	448.8	5.1
Upland Area #4 ES	3/15/07 7:46	64.2	32.0	440.0	5.0
Upland Area #4 ES	3/15/07 8:09	63.5	31.6	457.6	5.2
Upland Area #4 ES	3/15/07 8:10	63.5	31.6	457.6	5.2
Maximum		**65.6**	**42.5**	**484.0**	**5.5**
Minimum		**62.7**	**31.6**	**440.0**	**5.0**
Average		**63.7**	**37.6**	**456.0**	**5.18**

Appendix C
Data Sheet: Test Sediment Temperature (Area 4)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Date and Time	Temperature (^{O}F)
Upland Area #4 ES	3/14/07 11:20	59.5
Upland Area #4 ES	3/14/07 12:30	63.5
Upland Area #4 ES	3/14/07 12:45	65.0
Upland Area #4 ES	3/14/07 13:13	65.0
Upland Area #4 ES	3/14/07 13:51	65.0
Upland Area #4 ES	3/14/07 14:20	65.0
Upland Area #4 ES	3/14/07 14:55	65.5
Upland Area #4 ES	3/14/07 15:40	65.0
Upland Area #4 ES	3/14/07 16:12	65.5
Upland Area #4 ES	3/14/07 16:34	65.5
Upland Area #4 ES	3/14/07 17:14	65.5
Upland Area #4 ES	3/14/07 17:56	66.0
Upland Area #4 ES	3/14/07 18:34	65.5
Upland Area #4 ES	3/14/07 19:00	66.0
Upland Area #4 ES	3/14/07 21:03	66.0
Upland Area #4 ES	3/15/07 7:46	65.5
Upland Area #4 ES	3/15/07 8:09	65.5
Upland Area #4 ES	3/15/07 8:10	65.5
Maximum		**66.0**
Minimum		**59.5**
Average		**65.0**

Appendix C
Data Sheet: Sediment Percent Solids (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Sample ID Number	Date and Time	Container Tare Weight (g)	Container and Wet Sample Weight (g)	Container and Dry Sample Weight (g)	Percent Solids
Bay Area #1 ES	BA-ES-A	3/13/07 15:48	112.50	194.10	171.78	72.65
Bay Area #1 ES	BA-ES-B	3/13/07 15:48	113.43	186.19	167.91	74.88
Bay Area #1 ES	BA-ES-C	3/13/07 15:48	113.51	197.84	175.01	72.93
Average						**73.48**
Bay Area #1 ES	BA-ES-A	3/19/07 8:30	112.74	151.08	145.06	84.30
Bay Area #1 ES	BA-ES-B	3/19/07 8:30	114.10	154.86	148.12	83.46
Bay Area #1 ES	BA-ES-C	3/19/07 8:30	115.01	145.08	140.46	84.64
Average						**84.13**

Wind Tunnel Test Run	Sample ID Number	Date and Time	Container Tare Weight (g)	Container and Wet Sample Weight (g)	Container and Dry Sample Weight (g)	Percent Solids
Bay Area #1 10M	BA-10M-A	3/20/07 16:15	73.59	103.05	96.89	79.09
Bay Area #1 10M	BA-10M-B	3/20/07 16:15	74.59	95.47	91.13	79.21
Bay Area #1 10M	BA-10M-C	3/20/07 16:15	73.15	96.37	91.55	79.24
Average						**79.18**

Wind Tunnel Test Run	Sample ID Number	Date and Time	Container Tare Weight (g)	Container and Wet Sample Weight (g)	Container and Dry Sample Weight (g)	Percent Solids
Bay Area #1 10Q	BA-10Q-A	3/21/07 15:50	72.37	103.14	93.46	68.54
Bay Area #1 10Q	BA-10Q-B	3/21/07 15:50	73.87	94.06	89.25	76.18
Bay Area #1 10Q	BA-10Q-C	3/21/07 15:50	73.06	101.65	94.48	74.92
Average						**73.21**

Wind Tunnel Test Run	Sample ID Number	Date and Time	Container Tare Weight (g)	Container and Wet Sample Weight (g)	Container and Dry Sample Weight (g)	Percent Solids
Bay Area #1 1M	BA-1M-A	3/22/07 13:10	72.36	89.67	85.35	75.04
Bay Area #1 1M	BA-1M-B	3/22/07 13:10	73.84	92.17	87.8	76.16
Bay Area #1 1M	BA-1M-C	3/22/07 13:10	73.15	87.96	84.35	75.62
Average						**75.61**

Appendix C
Data Sheet: Sediment Percent Solids (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

SERVICE ENGINEERING GROUP

Wind Tunnel Test Run	Sample ID Number	Date and Time	Container Tare Weight (g)	Container and Wet Sample Weight (g)	Container and Dry Sample Weight (g)	Percent Solids
Bay Area #2 ES	BA2-ES-A	3/19/07 10:00	71.96	125.82	108.15	67.19
Bay Area #2 ES	BA2-ES-B	3/19/07 10:00	73.20	122.82	107.30	68.72
Bay Area #2 ES	BA2-ES-C	3/19/07 10:00	73.12	120.43	105.72	68.91
Average						**68.27**
Bay Area #2 ES	BA2-ES-A	3/20/07 8:30	73.03	92.74	88.11	76.51
Bay Area #2 ES	BA2-ES-B	3/20/07 8:30	74.16	91.08	87.12	76.60
Bay Area #2 ES	BA2-ES-C	3/20/07 8:30	74.02	108.62	99.97	75.00
Average						**76.04**
Bay Area #2 10M	BA2-10M-A	3/19/07 10:30	72.77	100.86	92.21	69.21
Bay Area #2 10M	BA2-10M-B	3/19/07 10:30	74.15	108.53	98.12	69.72
Bay Area #2 10M	BA2-10M-C	3/19/07 10:30	72.70	94.74	87.92	69.06
Average						**69.33**
Bay Area #2A 10Q	BA2A-10Q-A	3/26/07 8:30	72.33	85.17	76.71	34.11
Bay Area #2A 10Q	BA2A-10Q-B	3/26/07 8:30	73.94	87.30	78.56	34.58
Bay Area #2A 10Q	BA2A-10Q-C	3/26/07 8:30	73.17	92.88	80.84	38.91
Average						**35.87**

Appendix C
Data Sheet: Sediment Percent Solids (Area 4)
Ashland/Northern States Power Lakefront Superfund Site

Wind Tunnel Test Run	Sample ID Number	Date and Time	Container Tare Weight (g)	Container and Wet Sample Weight (g)	Container and Dry Sample Weight (g)	Percent Solids
Upland Area #4 ES	UL-ES-A	3/14/07 8:20	112.74	167.95	154.02	74.77
Upland Area #4 ES	UL-ES-B	3/14/07 8:20	113.59	174.31	158.53	74.01
Upland Area #4 ES	UL-ES-C	3/14/07 8:20	113.74	164.75	152.24	75.48
Average						**74.75**
Upland Area #4 ES	UL-ES-A	3/15/07 8:30	112.74	188.05	175.63	83.51
Upland Area #4 ES	UL-ES-B	3/14/07 8:20	114.10	191.50	177.36	81.73
Upland Area #4 ES	UL-ES-C	3/14/07 8:20	113.96	197.97	181.50	80.40
Average						**81.88**

APPENDIX D

Test Summary and Odor Sample List

Appendix D
Test Summary
Ashland/Northern States Power Lakefront Superfund Site

Run: Area 4 Sediment			
Date	Analysis	Sample Type	Media
14-Mar-07	PAH*, VOC*, TOC**, Grain Size	Pretest sediment	Soil
14-Mar-07	PAH, VOC	0-2 hr air	Air
14-Mar-07	PAH, VOC	2-6 hr air	Air
15-Mar-07	PAH, VOC	6-22 hr air	Air
15-Mar-07	PAH, TOC, VOC	Post test sediment	Soil
15-Mar-07	PAH, VOC	Post test decon	Water

Run: Area 1 Sediment			
Date	Analysis	Sample Type	Media
15-Mar-07	PAH*, VOC*, TOC**, Grain Size	Pretest sediment	Soil
15-Mar-07	PAH, VOC	0-2 hr air	Air
15-Mar-07	PAH, VOC	2-6 hr air	Air
16-Mar-07	PAH, VOC	6-22 hr air	Air
16-Mar-07	PAH, TOC, VOC	Post test sediment	Soil
16-Mar-07	PAH, VOC	Post test decon	Water

Run: Area 2 Sediment			
Date	Analysis	Sample Type	Media
19-Mar-07	PAH*, VOC*, TOC**, Grain Size	Pretest sediment	Soil
19-Mar-07	PAH, VOC	0-2 hr air	Air
19-Mar-07	PAH, VOC	2-6 hr air	Air
20-Mar-07	PAH, VOC	6-22 hr air	Air
20-Mar-07	PAH, TOC, VOC	Post test sediment	Soil

Run: Area 2 10% Solids Mixed Slurry			
Date	Analysis	Sample Type	Media
20-Mar-07	PAH, VOC	Pretest sediment	Soil
20-Mar-07	TSS, TOC	Pretest slurry	Slurry
20-Mar-07	PAH, VOC, Odor	0-2 hr air	Air
20-Mar-07	PAH, VOC, Odor	2-6 hr air	Air
21-Mar-07	PAH, VOC, Odor	6-22 hr air	Air
21-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
21-Mar-07	PAH, VOC	Post test sediment	Soil
21-Mar-07	PAH, VOC	Post test decon	Water

Footnotes:

* Matrix spike and matrix spike duplicate run

** Duplicate taken

Appendix D
Test Summary
Ashland/Northern States Power Lakefront Superfund Site

Run: Area 1 10% Solids Mixed Slurry			
Date	Analysis	Sample Type	Media
21-Mar-07	PAH, VOC	Pretest sediment	Soil
21-Mar-07	TSS, TOC	Pretest slurry	Slurry
21-Mar-07	PAH, VOC	0-2 hr air	Air
21-Mar-07	PAH, VOC	2-6 hr air	Air
22-Mar-07	PAH, VOC	6-22 hr air	Air
22-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
22-Mar-07	PAH, VOC	Post test sediment	Soil
22-Mar-07	PAH, VOC	Post test decon	Water

Run: Area 1 10% Solids Quiescent Slurry			
Date	Analysis	Sample Type	Media
22-Mar-07	TSS, TOC	Pretest slurry	Slurry
22-Mar-07	PAH, VOC	0-2 hr air	Air
22-Mar-07	PAH, VOC	2-6 hr air	Air
23-Mar-07	PAH, VOC	6-22 hr air	Air
23-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
23-Mar-07	PAH, VOC	Post test sediment	Soil
23-Mar-07	PAH, VOC	Post test decon	Water

Run: Area 1 1% Solids Mixed Slurry			
Date	Analysis	Sample Type	Media
23-Mar-07	PAH, VOC	Pretest sediment	Soil
23-Mar-07	TSS, TOC	Pretest slurry	Slurry
23-Mar-07	PAH, VOC	0-2 hr air	Air
23-Mar-07	PAH, VOC	2-6 hr air	Air
24-Mar-07	PAH, VOC	6-22 hr air	Air
24-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
24-Mar-07	PAH, VOC	Post test sediment	Soil
24-Mar-07	PAH, VOC	Post test decon	Water

Run: Area 2A 10% Solids Quiescent Slurry			
Date	Analysis	Sample Type	Media
26-Mar-07	PAH, VOC	Pretest sediment	Soil
26-Mar-07	TSS, TOC	Pretest slurry	Slurry
26-Mar-07	PAH, VOC	0-2 hr air	Air
26-Mar-07	PAH, VOC	2-6 hr air	Air
27-Mar-07	PAH, VOC	6-22 hr air	Air
27-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
27-Mar-07	PAH, VOC	Post test sediment	Soil
27-Mar-07	PAH, VOC	Post test decon	Water

Footnotes:

* Matrix spike and matrix spike duplicate run

** Duplicate taken

Appendix D
Test Summary
Ashland/Northern States Power Lakefront Superfund Site

Run: Area 2A 1% Solids Mixed Slurry			
Date	Analysis	Sample Type	Media
27-Mar-07	PAH, VOC	Pretest sediment	Soil
27-Mar-07	TSS, TOC	Pretest slurry	Slurry
27-Mar-07	PAH, VOC	0-2 hr air	Air
27-Mar-07	PAH, VOC	2-6 hr air	Air
28-Mar-07	PAH, VOC	6-22 hr air	Air
28-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
28-Mar-07	PAH, VOC	Post test sediment	Soil
28-Mar-07	PAH, VOC	Post test decon	Water

Run: Area 2A 10% Solids Mixed Slurry			
Date	Analysis	Sample Type	Media
28-Mar-07	PAH, VOC, TOC	Pretest sediment	Soil
28-Mar-07	PAH, VOC, Odor	0-2 hr air	Air
28-Mar-07	PAH, VOC, Odor	2-6 hr air	Air
29-Mar-07	PAH, VOC, Odor	6-22 hr air	Air
29-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
29-Mar-07	PAH, VOC	Post test sediment	Soil

Run: Area 2A 1% Solids Quiescent Slurry			
Date	Analysis	Sample Type	Media
29-Mar-07	TSS, TOC	Pretest slurry	Slurry
29-Mar-07	PAH, VOC	0-2 hr air	Air
29-Mar-07	PAH, VOC	2-6 hr air	Air
30-Mar-07	PAH, VOC	6-22 hr air	Air
30-Mar-07	PAH, VOC, TOC, DOC, TSS	Post test slurry	Slurry
30-Mar-07	PAH, VOC	Post test sediment	Soil

Footnotes:
* Matrix spike and matrix spike duplicate run
** Duplicate taken

Lab Methods Utilized:

TOC	EPA 415.1
TSS	EPA 160.2
Total Solids	EPA 160.3
DOC	EPA 415.1
PAH	NIOSH 5506 (Air), EPA 8270C (slurry, soil, water)
VOC	IHVOCS (Air), EPA 8260B (slurry, soil, water)
Odor	ASTM E544

Appendix D
Odor Sample List
Ashland/Northern States Power Lakefront Superfund Site

Date	Sample	Area	Period	Start time	End time
20-Mar-07	NSP-2-10M-ODOR-2-032007	2	0-2 hr	11:18	12:26
20-Mar-07	NSP-2-10M-ODOR-5-032007	2	2-6 hr	12:31	12:48
21-Mar-07	NSP-2-10M-ODOR-6-032107	2	6-22 hr	16:37	17:05
27-Mar-07	NSP-2A-10M-ODOR-2-032707	2A	0-2 hr	9:33	9:49
27-Mar-07	NSP-2A-10M-ODOR-5-032707	2A	2-6 hr	11:37	11:44
28-Mar-07	NSP-2A-10M-ODOR-6-032807	2A	6-22 hr	15:41	15:56

Sample Names Defined

(Client)-(Area #)-(% Sediment/Mixed or Quiescent)-(Analytical Type)-(Test Sequence #[1])-(Date)

1 Test Sequence #'s

1: Pretest sediment
2: 0-2 hour air
3: Post test sediment
4: Post test decontamination
5: 2-6 hour air
6: 6-22 hour air
7: Pretest slurry
8: Post test slurry

APPENDIX E

Summary of Sediment, Soil, and Slurry Concentration Tables

Appendix E
Summary of Sediment and Slurry Concentrations (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

	Area 1 (Exposed Sediment)				Area 1 (1% Mixed)										Area 1 (10% Mixed)										Area 1 (10% Quiescent)									
Compound	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**PreTest Slurry** mg/L	flags	**Post Test Slurry (PAH Dissolved)** ug/L	flags	**Post Test Slurry (total PAH)** ug/L	flags	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Pre Test Slurry** mg/L	flags	**Post Test Slurry (Dissolved)** ug/L	flags	**Post Test Slurry (PAH Total)** ug/L	flags	**Concentration in Bulk Sed. Sample[2]** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**PreTest Slurry** mg/L	flags	**Post Test Slurry (PAH Dissolved)** ug/L	flags	**Post Test Slurry (PAH Total)** ug/L	flags
PAHs																																		
% Solids	75.0		82.0		70.0		74.0								75.0		74.0										72							
1-Methylnaphthalene	100		81.0		56.0		9.10				1.0	U	4.2	J	84.0		100				1.90	J	180				79				140		690	
1-Methylphenanthrene	100		7.90		19.0		6.60				1.3	U	27		8.10		9.40				1.10	U	66.0				7.70				1.30	U	92.0	
2,3,5-Trimethylnaphthalene	14.0		16.0		12.0		1.80				2.3	U	9.6	J	16.0		15.0				2.60	J	2.80	U			10.0				2.30	U	76.0	
2,6-Dimethylnaphthalene	60.0		64.0		53.0		6.20				4.6		28		62.0		57.0				160		130				40.0				21.0		340	
2-Methylnaphthalene	230		180		170		9.90				1.6	U	4.4	J	190		230				1.90	J	11.0	J			110				3.20	J	230	
Acenaphthene	87.0		69.0		45.0		9.30				22		66		74.0		81.0				60.0		340				27.0				120		710	
Acenaphthylene	6.20		5.50		6.90		1.10				2.6		14		6.10		5.70				5.10	J	39.0				4.90				7.90	J	56.0	
Anthracene	46.0		51.0		32.0		5.90				0.83	U	32		48.0		45.0				1.10	J	160				27.0				0.830	U	290	
Benz(a)anthracene	15.0		14.0		14.0		2.60				2.8	U	28		14.0		16.0				2.40	U	86.0				11.0				2.80	U	89.0	
Benzo(a)pyrene	13.0		13.0		11.0		2.10				3.1	U	26		13.0		11.0				2.60	U	71.0				8.50				3.10	U	99.0	
Benzo(b)fluoranthene	7.70		8.90		5.30		1.10				1.7	U	30		8.10		5.70				1.40	U	49.0				4.40				1.70	U	59.0	
Benzo(e)pyrene	7.50		7.80		6.10		1.10				3.2	U	25		7.90		5.80				2.70	U	41.0				4.60				3.20	U	50.0	
Benzo(g,h,i)perylene	1.70		1.10		3.30		0.73				2.7	U	11		0.970		1.60				2.20	U	27.0				1.70				2.70	U	36.0	
Benzo(k)fluoranthene	9.20		9.60		8.00		1.40				3	U	18		9.80		7.30				2.50	U	44.0				5.70				3.00	U	58.0	
Biphenyl	13.0		11.0		14.0		1.50				1	U	1.5	J	14.0		15.0				3.30	J	26.0				11.0				10.0	J	90.0	
Chrysene	16.0		15.0		14.0		2.70				2.8	U	29		16.0		13.0				2.30	U	86.0				10.0				2.80	U	120	
Dibenz(a,h)anthracene	0.770		0.530		1.10	J	0.210	J			3.1	U	20	J	0.490		0.640	J			2.60	U	23.0	J			0.660	J			3.10	U	28.0	
Fluoranthene	46.0		53.0		34.0		6.50				1	U	55		47.0		40.0				0.86	U	190				28.0				1.00	U	300	
Fluorene	51.0		71.0		51.0		7.00				1.8	U	9.4	J	83.0		64.0				11.0		140				44.0				14.0		310	
Indeno(1,2,3-cd)pyrene	2.00		1.40		3.10		0.620	J			3.1	U	23	J	1.20		1.70				2.60	U	33.0				1.80				3.10	U	38.0	
Naphthalene	270		170		120		7.70				1.6		6.4	J	180		230				4.00	J	12.0	J			94.0				2.10	J	22.0	J
Perylene	1.90		1.90		1.60		0.340	J			1.1	U	3.7	J	1.90		1.60				0.950	U	9.70	J			1.20				1.10	U	13.0	J
Phenanthrene	160		170		130		19.0				0.82	U	20		160		170				4.70	J	420				110				5.40	J	860	
Pyrene	23.0		52.0		30.0		7.80				2.0	U	80		51.0		26.0				1.70	U	290				20.0				2.00	U	430	
PAHs, Total[1]	1281		1075		840		112				31		571		1097		1152				256		2474				662				324		5086	
Total Organic Carbon																																		
TOC	9810		5790						7.0	J			9.0 (mg/L)	J					16.0				8.8 (mg/L)						30.0				30 (mg/L)	J
VOCs																																		
% Solids					69.0		69.0										76.0										74.0							
1,2,3-Trimethylbenzene	3.40		4.50		4.00		0.160						4.20		4.90		0.890						28.0				1.80						60.0	
1,2,4-Trimethylbenzene	8.60		9.80		11.0		0.390						3.40		9.10		2.00						62.0				4.20						150	
1,3,5-Trimethylbenzene	2.40		2.70		3.10		0.12						2.20		0.330	U	0.590						15.0				0.130	U					33.0	
1,4-Dichlorobenzene	0.120	U	0.300	U	0.170	U	0.0087	U					0.051	U	0.400	U	0.039	U					0.051	U			0.160	U					0.100	U
Benzene	0.044	U	0.110	U	0.064	U	0.0032	U					0.042	U	0.150	U	0.014	U					10.0				0.060	U					12.0	
Carbon Tetrachloride	0.056	U	0.140	U	0.081	U	0.004	U					0.05	U	0.190	U	0.018	U					0.05	U			0.076	U					0.100	U
Ethyl Benzene	12.0		11.0		3.30		0.160						0.036	U	4.60		0.540						2.60				0.140	U					6.40	
m,p-Xylenes	9.10		8.20		7.60		0.200						1.80		7.50		1.20						110				2.60						290	
o-Xylene	4.70		4.20		4.10		0.099						1.40		3.90		0.650						74.0				0.190	U					180	
sec-Butylbenzene	0.042	U	0.100	U	0.061	U	0.003	U					0.027	U	0.140	U	0.014	U					0.027	U			0.057	U					0.054	U
Styrene	0.046	U	0.120	U	0.067	U	0.003	U					0.049	U	0.150	U	0.015	U					0.049	U			0.062	U					0.098	U
Toluene	3.20		0.430	U	0.25	U	0.012	U					0.048	U	0.580	U	0.056	U					19.0				0.230	U					32.0	
Trichloroethene	0.074	U	0.180	U	0.110	U	0.005	U					0.067	U	0.250	U	0.024	U					0.067	U			0.10	U					0.130	U
Xylenes Total	13.8		12.4		11.7		0.299						3.2		11.4		1.85						184				2.79	U					470	
VOCs, Total[1]	43		40		33		1						13		30.00		6						505				9						763	
TSS																																		
TSS (mg/L)									740				91						3500				380						4200				360	
Total Solids (mg/L)									750				510						4000				1100						4100				1500	
Dissolved Organic Carbon																																		
DOC (mg/L)													5.7										8.20										9.10	

Flags:
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnote:
[1] Totals do not include analytes not detected
[2] Pretest sediment samples not collected

Appendix E
Summary of Sediment and Slurry Concentrations (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

	Area 2 - Exposed Sediment				Area 2 - 10% Mixed									
Compound	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Pretest slurry** mg/L	flags	**Post Test Slurry (Dissolved)** ug/L	flags	**Post Test Slurry (PAH is Total)** ug/L	flags
PAHs														
% Solids	66.0		80.0		72.0		68.0							
1-Methylnaphthalene	320		350		310		160				200		4100	
1-Methylphenanthrene	44.0		43.0		64.0		16.0				18.0	J	530	
2,3,5-Trimethylnaphthalene	53.0		55.0		49.0		26.0				3.30	U	360	
2,6-Dimethylnaphthalene	170		200		170		95				270		2000	
2-Methylnaphthalene	450		490		440		230				200		6700	
Acenaphthene	280		320		270		140				76.0		4000	
Acenaphthylene	25.0		23.0		23.0		11.0				4.30	J	280	
Anthracene	130		150		130		76.0				3.80	J	1700	
Benz(a)anthracene	47.0		48.0		43.0		19.0				4.00	U	670	
Benzo(a)pyrene	39.0		40.0		35.0		18.0				4.40	U	670	
Benzo(b)fluoranthene	19.0		21.0		18.0		11.0				24.0	J	410	
Benzo(e)pyrene	23.0		23.0		21.0		10.0				4.60	U	290	
Benzo(g,h,i)perylene	11.0		9.20		9.60		3.30				3.80	U	230	
Benzo(k)fluoranthene	27.0		29.0		24.0		13.0				4.30	U	380	
Biphenyl	50.0		46.0		45.0		29.0				6.50	J	420	
Chrysene	50.0		50.0		45.0		23.0				4.00	U	700	
Dibenz(a,h)anthracene	4.10		3.50		3.60		1.30				4.50	U	110	
Fluoranthene	140		130		120		65.0				3.40	J	1600	
Fluorene	140		210		130		100				4.00	J	1300	
Indeno(1,2,3-cd)pyrene	10.0		8.60		8.80		3.40				4.40	U	180	
Naphthalene	530		510		520		280				730		5700	
Perylene	5.70		5.90		5.30		2.70				1.60	U	77.0	
Phenanthrene	370		420		360		210				11.0		5900	
Pyrene	110		81.0		97.0		89.0				5.40	J	2400	
PAHs, Total[1]	3048		3266		2941		1632				1556		40707	
Total Organic Carbon														
TOC	26,000		16,400						580				740 (mg/L)	
VOCs														
% Solids	69.0		78.0		72.0		58.0							
1,2,3-Trimethylbenzene	8.20		11.0		8.90		5.80						75.0	
1,2,4-Trimethylbenzene	19.0		28.0		21.0		11.0						180	
1,3,5-Trimethylbenzene	5.00		7.50		5.70		0.420	U					46.0	
1,4-Dichlorobenzene	0.440	U	0.380	U	0.420	U	0.510	U					0.100	U
Benzene	4.70		3.50		5.30		0.190	U					80.0	
Carbon Tetrachloride	0.200	U	0.180	U	0.190	U	0.240	U					0.100	U
Ethyl Benzene	39.0		48.0		43.0		18.0						630	
m,p-Xylenes	26.0		32.0		28.0		12.0						400	
o-Xylene	13.0		16.0		14.0		6.10						220	
sec-Butylbenzene	0.150	U	0.130	U	0.150	U	0.180	U					0.054	U
Styrene	0.170	U	0.150	U	0.160	U	0.200	U					0.098	U
Toluene	16.0		16.0		18.0		6.70						320	
Trichloroethene	0.270	U	0.240	U	0.260	U	0.320	U					0.130	U
Xylenes Total	39.0		48.0		42.0		18.1						620.0	
VOCs, Total[1]	131		162		144		60						1951	
TSS														
TSS (mg/L)									9900				2300	
Total Solids (mg/L)									9500					
Dissolved Organic Carbon														
DOC (mg/L)													12.0	

Flags:
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration
Footnote:
[1] Totals do not include analytes not detected

Appendix E
Summary of Sediment and Slurry Concentrations (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

	Area 2A - 1% Mixed										Area 2A - 10% Mixed								Area 2A - 1% Quiescent										Area 2A - 10% Quiescent									
Compound	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Pretest Slurry** mg/L	flags	**Post Test Slurry (PAH is Dissolved)** ug/L	flags	**Post Test Slurry (PAH is Total)** ug/L	flags	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Post Test Slurry (Dissolved)** ug/L	flags	**Post Test Slurry** (PAH is Total) ug/L	flags	**Concentration in Bulk Sed. Sample**[2] mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Pretest Slurry** ug/L	flags	**Post Test Slurry Dissolved** ug/L	flags	**Post Test Slurry** ug/L	flags	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flags	**Post Test Sediment** mg/kg (dry wt.)	flags	**Pre Test Slurry** mg/L	flags	**Post Test Slurry (PAH Dissolved)** ug/L	flags	**Post Test Slurry (PAH Total)** ug/L	flags
PAHs																																						
% Solids	49.0		37.0								53.0	U	27.0								31.0								48.0		18.0							
1-Methylnaphthalene	4800		110				4.20	J	140		250		1000		1300		210				440		540		240		240		330		1600				27000		220	
1-Methylphenanthrene	46.0		36.0				1.30	U	89.0		45.0		100		170		2.20	U			83.0		62.0		1.30	U	1.30	U	81.0		1600				2800		2.20	U
2,3,5-Trimethylnaphthalene	72.0		20.0				2.30	U	48.0		31.0		170		130		3.90	U			62.0		51.0		2.30	U	2.30	U	47.0		230				2000		3.90	U
2,6-Dimethylnaphthalene	870		82.0				7.50	J	210		110		530		680		9.20	J			230		240		27.0		27.0		210		820				10000		8.40	
2-Methylnaphthalene	2700		140				4.50	J	110		380		1500		2000		200				610		450		77.0		77.0		660		2300				22000		230	
Acenaphthene	850		87.0				25.0		390		91.0		780		1100		87.0				350		390		130		130		260		1200				20000		80.0	
Acenaphthylene	28.0		11.0				4.70	J	49.0		16.0		54.0		76.0		3.20	J			27.0		33.0		3.60	J	3.60		24.0		77.0				1200		3.50	
Anthracene	560		62.0				0.830	U	280		90.0		370		570		1.40	U			160		170		2.10	J	2.10		170		540				8700		1.40	U
Benz(a)anthracene	78.0		26.0				2.80	U	130		37.0		130		210		4.90	U			60.0		70.0		2.80	U	2.80	U	53.0		180				1800		4.90	U
Benzo(a)pyrene	60.0		23.0				3.10	U	110		36.0		86.0		170		5.30	U			43.0		58.0		3.10	U	3.10	U	44.0		140				2200		5.30	U
Benzo(b)fluoranthene	39.0		14.0				1.70	U	68.0		24.0		66.0		96.0		2.90	U			29.0		40.0		1.70	U	1.70	U	24.0		94.0				1400		2.90	U
Benzo(e)pyrene	34.0		13.0				3.20	U	56.0		20.0		110		86.0		5.50	U			28.0		32.0		3.20	U	3.20	U	380		88.0				1100		5.50	U
Benzo(g,h,i)perylene	6.60		6.90				2.70	U	37.0		7.60		22.0		55.0		4.60	U			14.0		19.0		2.70	U	2.70	U	18.0		14.0				860		4.60	U
Benzo(k)fluoranthene	40.0		18.0				3.00	U	61.0		27.0		62.0		120		5.20	U			31.0		38.0		3.00	U	3.00	U	32.0		95.0				710		5.20	U
Biphenyl	62.0		22.0				1.00	U	24.0	J	35.0		160		140		6.60	J			62.0		51.0		10.0	J	10.0		54.0		170				2400		6.70	
Chrysene	66.0		27.0				2.80	U	130		40.0		120		210		4.80	U			57.0		72.0		2.80	U	2.80	U	56.0		170				1700		4.80	U
Dibenz(a,h)anthracene	3.10	J	2.40	J			3.10	U	29.0		2.90		9.60		42.0		5.40	U			4.60		18.0		3.10	U	3.10	U	5.00	J	7.40				310		5.40	U
Fluoranthene	480		63.0				1.00	U	300		92.0		310		520		1.80	U			140		170		1.00	U	1.00	U	140		450				8000		1.80	U
Fluorene	860		87.0				1.80	U	110		110		510		520		3.80	J			220		140		21.0		21.0		210		810				6200		3.40	
Indeno(1,2,3-cd)pyrene	7.80		6.50				3.10	U	40.0		7.90		23.0		59.0		5.40	U			13.0		25.0		3.10	U	3.10	U	15.0		18.0				650		5.40	U
Naphthalene	3300		280.0				9.00	J	74.0		410		1600		1600		570				540		230		6.00	J	6.00		650		2600				9600		1100	
Perylene	8.40		3.80				1.10	U	14.0	J	5.80		13.0		20.0	J	2.00	U			6.50		7.80		1.10	U	1.10	U	6.70	J	21.0				330		2.00	U
Phenanthrene	1900		190				0.820	U	370		290		1200		1500		1.40	U			540		430		14.0		14.0		410		1700				21000		1.40	U
Pyrene	8.40		65.0				2.00	U	410		66.0		420		550		3.50	U			130		250		2.00	U	2.00	U	160		260				10000		3.50	U
PAHs, Total[1]	16879		1396				55		3279		2224		9346		11924		1090				3880		3587		531		531		4040		15184				161960		1652	
Total Organic Carbon																																						
TOC					18.0				8.0 (mg/L)		105000						31.0	(mg/L)			16 (mg/L)						31 (mg/L)						150				41 (mg/L)	
VOCs																																						
% Solids	52.0		37.0								38.0		23.0								28.0								50.0									
1,2,3-Trimethylbenzene	14.0		5.70						19.0		11.0		12.0				81.0				8.10						28.0		13.0		13.0				100			
1,2,4-Trimethylbenzene	47.0		18.0						48.0		40.0		39.0				200				23.0						87.0		30.0		45.0				320			
1,3,5-Trimethylbenzene	12.0		4.40						13.0		9.90		9.80				42.0				5.80						21.0		7.30		11.0				70.0			
1,4-Dichlorobenzene	0.2	U	0.160	U					0.051	U	0.160	U	0.260	U			2.00	U			0.420	U					0.100	U	0.600	U	0.280	U			0.510	U		
Benzene	3.20		0.059	U					21.0		7.00		6.40				250				0.160	U					20.0		0.220	U	7.80				530			
Carbon Tetrachloride	0.110	U	0.075	U					0.050	U	0.073	U	0.120	U			2.00	U			0.200	U					0.100	U	0.280	U	0.13	U			0.500	U		
Ethyl Benzene	62.0		21.0						9.30		58.0		49.0				270				18.0						0.072	U	49.0		75.0				1000			
m,p-Xylenes	42.0		15.0						72.0		43.0		39.0				410				19.0						110		34.0		52.0				850			
o-Xylene	24.0		8.30						50.0		24.0		22.0				260				10.0						72.0		18.0		28.0				500			
sec-Butylbenzene	0.1	U	0.057	U					0.027	U	0.055	U	0.091	U			1.10	U			0.150	U					0.054	U	0.210	U	0.098	U			0.270	U		
Styrene	0.1	U	0.062	U					0.049	U	0.06	U	0.099	U			2.00	U			0.160	U					0.054	U	0.230	U	0.110	U			0.490	U		
Toluene	14.0		5.30						41.0		19.0		18.0				410				6.70						13.0		14.0		27.0				950			
Trichloroethene	0.140	U	0.10	U					0.067	U	0.096	U	0.160	U			2.70	U			0.260	U					0.130	U	0.370	U	0.170	U			0.670	U		
Xylenes Total	66.0		23.3						122		67.0		61.0				670				29.0						182		52.0		80.0				1350			
VOCs, Total[1]	218		78						273		212		195				1923				91						351		165		259				4320			
TSS																																						
TSS (mg/L)					2500				140								680						1600				130						14000				2300	
Total Solids (mg/L)					2900				890								1600						2200				730						15000				2400	
Dissolved Organic Carbon																																						
DOC (mg/L)									8.40								10.0	(mg/L)					30.0				30.0										8.70	

Flags:
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnote:
[1] Totals do not include analytes not detected
[2] Pretest sediment samples not collected

Appendix E
Summary of Sediment and Slurry Concentrations (Area 4)
Ashland/Northern States Power Lakefront Superfund Site

	Area 4 - Exposed Soil			
Compound	**Concentration in Bulk Sed. Sample** mg/kg (dry wt.)	flag	**Post Test Sediment** mg/kg (dry wt.)	flag
PAHs				
% Solids	75.0		83.0	
1-Methylnaphthalene	62.0		78.0	
1-Methylphenanthrene	11.0		7.80	
2,3,5-Trimethylnaphthalene	5.70		7.30	
2,6-Dimethylnaphthalene	29.0		38.0	
2-Methylnaphthalene	100		130	
Acenaphthene	9.80		12.0	
Acenaphthylene	39.0		42.0	
Anthracene	26.0		31.0	
Benz(a)anthracene	13.0		15.0	
Benzo(a)pyrene	13.0		16.0	
Benzo(b)fluoranthene	5.70		7.60	
Benzo(e)pyrene	7.60		9.20	
Benzo(g,h,i)perylene	4.80		5.70	
Benzo(k)fluoranthene	8.30		9.20	
Biphenyl	15.0		17.0	
Chrysene	14.0		17.0	
Dibenz(a,h)anthracene	1.30		1.50	
Fluoranthene	34.0		46.0	
Fluorene	36.0		31.0	
Indeno(1,2,3-cd)pyrene	4.00		4.80	
Naphthalene	230		420	
Perylene	1.90		2.20	
Phenanthrene	68.0		96.0	
Pyrene	35.0		38.0	
PAHs, Total[1]	774		1082	
Total Organic Carbon				
TOC	8950		7430	
VOCs				
% Solids				
1,2,3-Trimethylbenzene	11.0		13.0	
1,2,4-Trimethylbenzene	35.0		42.0	
1,3,5-Trimethylbenzene	9.80		12.0	
1,4-Dichlorobenzene	0.120	U	0.120	U
Benzene	82.0		91.0	
Carbon Tetrachloride	0.056	U	0.056	U
Ethyl Benzene	98.0		93.0	
m,p-Xylenes	95.0		110	
o-Xylene	38.0		45.0	
sec-Butylbenzene	0.042	U	0.042	U
Styrene	23.0		26.0	
Toluene	140		130	
Trichloroethene	0.074	U	0.074	U
Xylenes Total	133		155	
VOCs, Total[1]	532		562	
TSS				
TSS (mg/L)				
Total Solids (mg/L)				
Dissolved Organic Carbon				
DOC (mg/L)				

Flags:
U=Analyte not detected

Footnote:
[1] Totals do not include analytes not detected

APPENDIX F

Braun Intertec Laboratory Reports for Air and Sediment Analysis

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

April 30, 2007

Work Order #: 0701451
(Revised)

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 15, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Qualifiers and Abbreviations

A5	The Laboratory Control Sample and Laboratory Control Sample Duplicate had recoveries of 44.2% and 38.0% which are below the laboratory limits of 70-130%.
A1a	The closing calibration check solution failed high (117%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
A1b	The closing calibration check solution failed high (118%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
A1c	The Laboratory Control Sample Duplicate had a recovery of 59.6%, which is below the laboratory limits of 70-130%.
A1d	The Laboratory Control Sample Duplicate had a recovery of 66.7%, which is below the laboratory limits of 70-130%.
A1e	The Laboratory Control Sample recovery for the filter was 68.6%, which is below the laboratory limits of 70%-130%.
A2	The Laboratory Control Sample and Laboratory Control Sample Duplicate had recoveries of 44.4% and 36.1%, which is below the laboratory limits of 70-130%.
A3	The Laboratory Control Sample Duplicate had a recovery of 68.7%, which is below the laboratory limits of 70-130%.
A1	The closing calibration check solution failed high (116%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
A4a	The Laboratory Control Sample Duplicate had a recovery of 69.9% which is below the laboratory limits of 70-130%.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
A5a	The MDL value for this analyte is an estimated value; no statistical value has been determined.
B	Analyte is found in the associated blank as well as in the sample (CLP B-flag).
go	The laboratory control sample recovery is outside of laboratory control limits.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
ib	Unidentified compounds are present in the sample.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
qn	The spike recovery is outside of laboratory control limits for the matrix spike (MS) and/or the matrix spike duplicate (MSD).
ts	This analysis was performed by a subcontract laboratory.
A4	The Laboratory Control Sample and Control Sample Duplicate are 61.4% and 66.5% for the filters, which is below the laboratory limits of 70%-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-4-ES-1-VOC-031407	0701451-01	Soil	03/14/07 09:00	03/15/07 12:04
NSP-4-ES-PAH-1-031407	0701451-02	Soil	03/14/07 08:40	03/15/07 12:04
NSP-4-ES-TOC-1-031407	0701451-03	Soil	03/14/07 08:40	03/15/07 12:04
NSP-4-ES-PAH-2-031407 front	0701451-04	Air Tube	03/14/07 12:03	03/15/07 12:04
NSP-4-ES-VOC-2-031407 Front	0701451-05	Air Tube	03/14/07 12:03	03/15/07 12:04
NSP-4-ES-PAH-5-031407 Front	0701451-06	Air Tube	03/14/07 16:07	03/15/07 12:04
NSP-4-ES-VOC-5-031407 Front	0701451-07	Air Tube	03/14/07 16:07	03/15/07 12:04
NSP-4-ES-PAH-6-031507 Front	0701451-08	Air Tube	03/15/07 08:11	03/15/07 12:04
NSP-4-ES-VOC-6-031507 Front	0701451-09	Air Tube	03/15/07 08:11	03/15/07 12:04
NSP-4-ES-PAH-3-031507	0701451-10	Soil	03/15/07 08:20	03/15/07 12:04
NSP-4-ES-VOC-3-031507	0701451-11	Soil	03/15/07 08:30	03/15/07 12:04
NSP-4-ES-TOC-3-031507	0701451-12	Soil	03/15/07 08:20	03/15/07 12:04
NSP-4-ES-PAH-4-031507	0701451-13	Water	03/15/07 09:10	03/15/07 12:04
NSP-4-ES-VOC-4-031507	0701451-14	Water	03/15/07 09:20	03/15/07 12:04
NSP-1-ES-PAH-1-031507	0701451-15	Soil	03/15/07 09:45	03/15/07 12:04
NSP-4-ES-TOC-1-031407-Dup	0701451-16	Soil	03/14/07 08:40	03/15/07 12:04
NSP-1-ES-VOC-1-031507	0701451-17	Soil	03/15/07 09:50	03/15/07 12:04
NSP-1-ES-TOC-1-031507	0701451-18	Soil	03/15/07 09:45	03/15/07 12:04
NSP-1-ES-TOC-1-031507-Dup	0701451-19	Soil	03/15/07 09:45	03/15/07 12:04
Trip Blanks	0701451-20	Water	03/14/07 00:00	03/15/07 12:04

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	3.9 °C	**Received on Ice:**	No	**Preservation Confirmed:**	No
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	No
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-1-VOC-031407

0701451-01 (Soil)

3/14/07 9:00

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**11**	1.0	0.032	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,2,4-Trimethylbenzene	**35**	1.0	0.070	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,3,5-Trimethylbenzene	**9.8**	1.0	0.098	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.12	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Benzene	**82**	1.0	0.044	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.056	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Ethylbenzene	**98**	1.0	0.11	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
m,p-Xylenes	**95**	1.0	0.13	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
o-Xylene	**38**	1.0	0.14	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.042	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Styrene	**23**	1.0	0.046	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Toluene	**140**	10	1.7	mg/kg	B7C0412	3/23/07	3/25/07	EPA 8260B	
Trichloroethene	ND	1.0	0.074	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*95.6 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*116 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*106 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*104 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-PAH-1-031407

0701451-02 (Soil)

3/14/07 8:40

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**75**			% Wt	B7C0263	3/16/07	3/19/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**62**	6.7	1.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**11**	1.3	0.16	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**5.7**	1.3	0.16	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**29**	1.3	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**100**	6.7	2.3	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**9.8**	1.3	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**39**	1.3	0.14	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Anthracene	**26**	1.3	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**13**	1.3	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(a)pyrene	**13**	1.3	0.16	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(b)fluoranthene	**5.7**	1.3	0.34	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(e)pyrene	**7.6**	1.3	0.20	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5a
Benzo(g,h,i)perylene	**4.8**	1.3	0.12	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(k)fluoranthene	**8.3**	1.3	0.28	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Biphenyl	**15**	1.3	0.24	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Chrysene	**14**	1.3	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Dibenz(a,h)anthracene	**1.3**	1.3	0.42	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluoranthene	**34**	1.3	0.14	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**36**	1.3	0.080	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**4.0**	1.3	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Naphthalene	**230**	6.7	0.50	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**1.9**	1.3	0.22	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Phenanthrene	**68**	6.7	0.80	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**35**	1.3	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*71.3 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*65.3 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*63.5 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-TOC-1-031407

0701451-03 (Soil)

3/14/07 8:40

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**8950**	500	500	mg/kg	B7C0304	3/19/07	3/19/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-PAH-2-031407 front

0701451-04 (Air Tube)

3/14/07 12:03

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1d
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1e, A2, gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A3
Chrysene	ND	5.96		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4a
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4, A5
Fluoranthene	ND	11.4		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1c, gp
Naphthalene	**23.3**	5.52		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-VOC-2-031407 Front

0701451-05 (Air Tube)

3/14/07 12:03

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	20.1		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1a
1,2,4-Trimethylbenzene	ND	19.7		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1b
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
1,4-Dichlorobenzene	ND	23.1		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1a
Benzene	ND	9.87		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Carbon Tetrachloride	ND	102		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Ethyl Benzene	ND	9.76		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1
Styrene	ND	13.0		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Toluene	ND	10.0		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Xylenes, Total	ND	9.94		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-PAH-5-031407 Front

0701451-06 (Air Tube)

3/14/07 16:07

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1d
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1e, A2, gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A3
Chrysene	ND	2.98		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4a
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4, A5
Fluoranthene	ND	5.68		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1c, gp
Naphthalene	**19.9**	2.76		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-VOC-5-031407 Front

0701451-07 (Air Tube)

3/14/07 16:07

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1a
1,2,4-Trimethylbenzene	ND	9.85		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1b
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1a
Benzene	**5.82**	4.94		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Carbon Tetrachloride	ND	50.8		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Ethyl Benzene	ND	4.88		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	A1
Styrene	ND	6.51		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Toluene	**7.61**	5.02		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Trichloroethene	ND	4.97		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	
Xylenes, Total	ND	4.97		ug/m³	[CALC]	3/27/07	3/27/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-PAH-6-031507 Front

0701451-08 (Air Tube)

3/15/07 8:11

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	0.662		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
2-Methylnaphthalene	ND	0.658		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1d
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1e, A2, gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A3
Chrysene	ND	0.746		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4a
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4, A5
Fluoranthene	ND	1.42		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1c, gp
Naphthalene	**9.09**	0.689		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-VOC-6-031507 Front

0701451-09 (Air Tube)

3/15/07 8:11

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	2.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**6.01**	2.46		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	**2.13**	1.20		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	2.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**14.8**	1.23		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	63.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Ethyl Benzene	**5.70**	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	**2.34**	1.63		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**30.2**	1.25		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**24.2**	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-PAH-3-031507

0701451-10 (Soil)

3/15/07 8:20

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**83**			% Wt	B7C0263	3/16/07	3/19/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**78**	6.0	0.99	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**7.8**	1.2	0.14	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**7.3**	1.2	0.14	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**38**	1.2	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**130**	6.0	2.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**12**	1.2	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**42**	1.2	0.13	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Anthracene	**31**	1.2	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**15**	1.2	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(a)pyrene	**16**	1.2	0.14	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(b)fluoranthene	**7.6**	1.2	0.31	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(e)pyrene	**9.2**	1.2	0.18	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5a
Benzo(g,h,i)perylene	**5.7**	1.2	0.11	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(k)fluoranthene	**9.2**	1.2	0.25	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Biphenyl	**17**	1.2	0.22	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Chrysene	**17**	1.2	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Dibenz(a,h)anthracene	**1.5**	1.2	0.38	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluoranthene	**46**	1.2	0.13	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**31**	6.0	0.36	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**4.8**	1.2	0.16	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Naphthalene	**420**	30	2.3	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**2.2**	1.2	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Phenanthrene	**96**	6.0	0.72	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**38**	1.2	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*101 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*82.0 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*86.7 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-VOC-3-031507

0701451-11 (Soil)

3/15/07 8:30

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**13**	1.0	0.032	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,2,4-Trimethylbenzene	**42**	1.0	0.070	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,3,5-Trimethylbenzene	**12**	1.0	0.098	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.12	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Benzene	**91**	10	0.44	mg/kg	B7C0412	3/23/07	3/25/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.056	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Ethylbenzene	**93**	10	1.1	mg/kg	B7C0412	3/23/07	3/25/07	EPA 8260B	
m,p-Xylenes	**110**	1.0	0.13	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
o-Xylene	**45**	1.0	0.14	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.042	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Styrene	**26**	1.0	0.046	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Toluene	**130**	10	1.7	mg/kg	B7C0412	3/23/07	3/25/07	EPA 8260B	
Trichloroethene	ND	1.0	0.074	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*95.2 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*112 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*104 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*104 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-TOC-3-031507

0701451-12 (Soil)

3/15/07 8:20

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**7430**	500	500	mg/kg	B7C0304	3/19/07	3/19/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-PAH-4-031507

0701451-13 (Water)

3/15/07 9:10

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**120**	55	39	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
1-Methylphenanthrene	ND	55	20	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	55	36	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
2,6-Dimethylnaphthalene	ND	55	38	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
2-Methylnaphthalene	**120**	55	3.1	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	go
Acenaphthene	**14**	11	2.1	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	B
Acenaphthylene	4.0 J	11	2.3	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Anthracene	ND	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Benz(a)anthracene	ND	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Benzo(a)pyrene	ND	11	2.3	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Benzo(b)fluoranthene	ND	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Benzo(e)pyrene	ND	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	11	6.2	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Benzo(k)fluoranthene	ND	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Biphenyl	ND	55	40	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Chrysene	ND	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	11	3.8	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Fluoranthene	**15**	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Fluorene	**41**	11	2.3	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	11	2.7	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Naphthalene	**1300**	550	21	ng/L	B7C0324	3/21/07	3/28/07	EPA 8270C	go, qn
Perylene	ND	22	13	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Phenanthrene	**63**	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	B
Pyrene	6.3 J	11	5.5	ng/L	B7C0324	3/21/07	3/27/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*76.4 %*	*Limits: 30-120%*			*B7C0324*	*3/21/07*	*3/27/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*101 %*	*Limits: 30-120%*			*B7C0324*	*3/21/07*	*3/27/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*116 %*	*Limits: 30-120%*			*B7C0324*	*3/21/07*	*3/27/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-VOC-4-031507

0701451-14 (Water)

3/15/07 9:20

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	10	0.030	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	10	0.039	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Benzene	**1.8**	1.0	0.042	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
m,p-Xylenes	ND	10	0.059	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
o-Xylene	ND	10	0.072	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
sec-Butylbenzene	ND	10	0.027	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Styrene	ND	10	0.049	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*110 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*96.0 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*102 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*97.2 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-1-031507

0701451-15 (Soil)

3/15/07 9:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**75**			% Wt	B7C0263	3/16/07	3/19/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**100**	3.3	0.54	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**100**	3.3	0.39	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**14**	0.66	0.079	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
2,6-Dimethylnaphthalene	**60**	3.3	0.49	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**230**	16	5.6	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**87**	3.3	0.49	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**6.2**	0.66	0.069	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Anthracene	**46**	3.3	0.49	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**15**	0.66	0.098	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(a)pyrene	**13**	0.66	0.079	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(b)fluoranthene	**7.7**	0.66	0.17	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(e)pyrene	**7.5**	0.66	0.098	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5a
Benzo(g,h,i)perylene	**1.7**	0.66	0.059	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(k)fluoranthene	**9.2**	0.66	0.14	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Biphenyl	**13**	0.66	0.12	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Chrysene	**16**	0.66	0.098	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Dibenz(a,h)anthracene	**0.77**	0.66	0.21	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Fluoranthene	**46**	3.3	0.34	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**51**	3.3	0.20	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**2.0**	0.66	0.088	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Naphthalene	**270**	16	1.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**1.9**	0.66	0.11	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Phenanthrene	**160**	16	2.0	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**23**	0.66	0.098	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*84.1 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*82.9 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*89.0 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-4-ES-TOC-1-031407-Dup

0701451-16 (Soil)

3/14/07 8:40

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**9340**	500	500	mg/kg	B7C0304	3/19/07	3/19/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-VOC-1-031507

0701451-17 (Soil)

3/15/07 9:50

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**3.4**	1.0	0.032	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
1,2,4-Trimethylbenzene	**8.6**	1.0	0.070	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
1,3,5-Trimethylbenzene	**2.4**	1.0	0.098	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.12	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
Benzene	ND	1.0	0.044	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.056	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
Ethylbenzene	**12**	1.0	0.11	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
m,p-Xylenes	**9.1**	1.0	0.13	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
o-Xylene	**4.7**	1.0	0.14	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.042	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
Styrene	ND	1.0	0.046	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
Toluene	**3.2**	1.0	0.17	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
Trichloroethene	ND	1.0	0.074	mg/kg	B7C0439	3/23/07	3/23/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*96.8 %*	*Limits: 80-120%*			*B7C0439*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*110 %*	*Limits: 80-120%*			*B7C0439*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*103 %*	*Limits: 80-120%*			*B7C0439*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*106 %*	*Limits: 80-120%*			*B7C0439*	*3/23/07*	*3/23/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-TOC-1-031507

0701451-18 (Soil)

3/15/07 9:45

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**9810**	500	500	mg/kg	B7C0304	3/19/07	3/19/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-TOC-1-031507-Dup

0701451-19 (Soil)

3/15/07 9:45

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**10600**	500	500	mg/kg	B7C0304	3/19/07	3/19/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Trip Blanks

0701451-20 (Water)

3/14/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	10	0.030	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	10	0.039	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
m,p-Xylenes	ND	10	0.059	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
o-Xylene	ND	10	0.072	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
sec-Butylbenzene	ND	10	0.027	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Styrene	ND	10	0.049	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0306	3/15/07	3/15/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*112 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*94.0 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*100 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*98.4 %*	*Limits: 80-120%*			*B7C0306*	*3/15/07*	*3/15/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Classical Chemistry Parameters - Quality Control

Batch B7C0263 - Default Prep GenChem

Method Blank (B7C0263-BLK1) Prepared: 03/16/07 Analyzed: 03/19/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	0.0276			% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7C0263-SRM1) Prepared: 03/16/07 Analyzed: 03/19/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	90.9			% Wt	88.8	NA	102	90-110	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Method Blank (B7C0383-BLK1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0423 J	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.0743	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5a
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.248	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.813*			mg/kg	*0.833*	*NA*	*97.6*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.692*			mg/kg	*0.833*	*NA*	*83.1*	*30-90*			
Surrogate: Terphenyl-d14	*0.969*			mg/kg	*0.833*	*NA*	*116*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Laboratory Control Sample (B7C0383-BS1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	NA	NA	
Pyrene	1.35	0.067	0.010	mg/kg	1.67	NA	80.8	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.706*			mg/kg	*0.833*	*NA*	*84.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.588*			mg/kg	*0.833*	*NA*	*70.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.804*			mg/kg	*0.833*	*NA*	*96.5*	*30-115*			

Laboratory Control Sample Duplicate (B7C0383-BSD1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.25	0.067	0.010	mg/kg	1.66	NA	75.3	50-115	0.797	25	
Pyrene	1.32	0.067	0.010	mg/kg	1.66	NA	79.5	50-130	2.25	25	
Surrogate: 2-Fluorobiphenyl	*0.682*			mg/kg	*0.832*	*NA*	*82.0*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.521*			mg/kg	*0.832*	*NA*	*62.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.795*			mg/kg	*0.832*	*NA*	*95.6*	*30-115*			

Matrix Spike (B7C0383-MS1) **Source: 0701451-02** Prepared: 03/23/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	66300000	0.13	0.020	mg/kg dry	3.32	9.8	NR	30-115	NA	NA	
Pyrene	66300000	0.13	0.020	mg/kg dry	3.32	35	NR	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.00*			mg/kg dry	*1.66*	*NA*	*NA*	*30-104*			
Surrogate: Nitrobenzene-d5	*5.54*			mg/kg dry	*1.66*	*NA*	*334*	*30-90*			
Surrogate: Terphenyl-d14	*2.05*			mg/kg dry	*1.66*	*NA*	*123*	*30-115*			

Matrix Spike (B7C0383-MS2) **Source: 0701451-15** Prepared: 03/23/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	66100000	0.13	0.020	mg/kg dry	3.30	87	NR	30-115	NA	NA	
Pyrene	66100000	0.13	0.020	mg/kg dry	3.30	23	NR	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.00*			mg/kg dry	*1.65*	*NA*	*NA*	*30-104*			
Surrogate: Nitrobenzene-d5	*5.53*			mg/kg dry	*1.65*	*NA*	*335*	*30-90*			
Surrogate: Terphenyl-d14	*1.38*			mg/kg dry	*1.65*	*NA*	*83.6*	*30-115*			

Matrix Spike Duplicate (B7C0383-MSD1) **Source: 0701451-02** Prepared: 03/23/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	69500000	0.14	0.021	mg/kg dry	3.48	9.8	NR	30-115	4.71	30	
Pyrene	69500000	0.14	0.021	mg/kg dry	3.48	35	NR	30-130	4.71	35	
Surrogate: 2-Fluorobiphenyl	*0.00*			mg/kg dry	*1.74*	*NA*	*NA*	*30-104*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Matrix Spike Duplicate (B7C0383-MSD1) **Source: 0701451-02** Prepared: 03/23/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Surrogate: Nitrobenzene-d5	*69500000*			mg/kg dry	*1.74*	*NA*	*NR*	*30-90*			
Surrogate: Terphenyl-d14	*1.55*			mg/kg dry	*1.74*	*NA*	*89.1*	*30-115*			

Matrix Spike Duplicate (B7C0383-MSD2) **Source: 0701451-15** Prepared: 03/23/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	65600000	0.13	0.020	mg/kg dry	3.28	87	NR	30-115	0.759	30	
Pyrene	65600000	0.13	0.020	mg/kg dry	3.28	23	NR	30-130	0.759	35	
Surrogate: 2-Fluorobiphenyl	*0.00*			mg/kg dry	*1.64*	*NA*	*NA*	*30-104*			
Surrogate: Nitrobenzene-d5	*4.06*			mg/kg dry	*1.64*	*NA*	*248*	*30-90*			
Surrogate: Terphenyl-d14	*1.98*			mg/kg dry	*1.64*	*NA*	*121*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Method Blank (B7C0324-BLK1) Prepared: 03/21/07 Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	4.28	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	10.6	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	3.04	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	12.8	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	10.7	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*166*			ng/L	*250*	*NA*	*66.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*223*			ng/L	*250*	*NA*	*89.2*	*30-120*			
Surrogate: Terphenyl-d14	*264*			ng/L	*250*	*NA*	*106*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Laboratory Control Sample (B7C0324-BS1) Prepared: 03/21/07 Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	363	50	36	ng/L	500	NA	72.6	70-130	NA	NA	
1-Methylphenanthrene	456	50	18	ng/L	500	NA	91.2	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	380	50	32	ng/L	500	NA	76.0	70-130	NA	NA	
2,6-Dimethylnaphthalene	376	50	35	ng/L	500	NA	75.2	70-130	NA	NA	
2-Methylnaphthalene	331	50	2.8	ng/L	500	NA	66.2	70-130	NA	NA	
Acenaphthene	364	10	1.9	ng/L	500	NA	72.8	43-120	NA	NA	
Acenaphthylene	353	10	2.1	ng/L	500	NA	70.6	70-130	NA	NA	
Anthracene	431	10	5.0	ng/L	500	NA	86.2	70-130	NA	NA	
Benz(a)anthracene	436	10	5.0	ng/L	500	NA	87.2	70-130	NA	NA	
Benzo(a)pyrene	456	10	2.1	ng/L	500	NA	91.2	75-148	NA	NA	
Benzo(b)fluoranthene	435	10	5.0	ng/L	500	NA	87.0	70-130	NA	NA	
Benzo(e)pyrene	450	10	5.0	ng/L	500	NA	90.0	70-130	NA	NA	
Benzo(g,h,i)perylene	491	10	5.6	ng/L	500	NA	98.2	70-130	NA	NA	
Benzo(k)fluoranthene	451	10	5.0	ng/L	500	NA	90.2	70-130	NA	NA	
Biphenyl	374	50	36	ng/L	500	NA	74.8	70-130	NA	NA	
Chrysene	423	10	5.0	ng/L	500	NA	84.6	70-130	NA	NA	
Dibenz(a,h)anthracene	426	10	3.5	ng/L	500	NA	85.2	70-130	NA	NA	
Fluoranthene	468	10	5.0	ng/L	500	NA	93.6	67-130	NA	NA	
Fluorene	386	10	2.1	ng/L	500	NA	77.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	496	10	2.5	ng/L	500	NA	99.2	70-130	NA	NA	
Naphthalene	333	50	1.9	ng/L	500	NA	66.6	70-130	NA	NA	
Perylene	451	20	11	ng/L	500	NA	90.2	70-130	NA	NA	
Phenanthrene	388	10	5.0	ng/L	500	NA	77.6	70-130	NA	NA	
Pyrene	477	10	5.0	ng/L	500	NA	95.4	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*155*			ng/L	*250*	*NA*	*62.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*232*			ng/L	*250*	*NA*	*92.8*	*30-120*			
Surrogate: Terphenyl-d14	*282*			ng/L	*250*	*NA*	*113*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0324-BSD1) Prepared: 03/21/07 Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	378	50	36	ng/L	500	NA	75.6	70-130	4.05	20	
1-Methylphenanthrene	446	50	18	ng/L	500	NA	89.2	70-130	2.22	20	
2,3,5-Trimethylnaphthalene	376	50	32	ng/L	500	NA	75.2	70-130	1.06	20	
2,6-Dimethylnaphthalene	390	50	35	ng/L	500	NA	78.0	70-130	3.66	20	
2-Methylnaphthalene	350	50	2.8	ng/L	500	NA	70.0	70-130	5.58	20	
Acenaphthene	363	10	1.9	ng/L	500	NA	72.6	43-120	0.275	20	
Acenaphthylene	353	10	2.1	ng/L	500	NA	70.6	70-130	0.00	20	
Anthracene	415	10	5.0	ng/L	500	NA	83.0	70-130	3.78	20	
Benz(a)anthracene	460	10	5.0	ng/L	500	NA	92.0	70-130	5.36	20	
Benzo(a)pyrene	481	10	2.1	ng/L	500	NA	96.2	75-148	5.34	20	
Benzo(b)fluoranthene	468	10	5.0	ng/L	500	NA	93.6	70-130	7.31	20	
Benzo(e)pyrene	475	10	5.0	ng/L	500	NA	95.0	70-130	5.41	20	
Benzo(g,h,i)perylene	536	10	5.6	ng/L	500	NA	107	70-130	8.76	20	
Benzo(k)fluoranthene	481	10	5.0	ng/L	500	NA	96.2	70-130	6.44	20	
Biphenyl	389	50	36	ng/L	500	NA	77.8	70-130	3.93	20	
Chrysene	450	10	5.0	ng/L	500	NA	90.0	70-130	6.19	20	
Dibenz(a,h)anthracene	480	10	3.5	ng/L	500	NA	96.0	70-130	11.9	20	
Fluoranthene	472	10	5.0	ng/L	500	NA	94.4	67-130	0.851	20	
Fluorene	379	10	2.1	ng/L	500	NA	75.8	70-130	1.83	20	
Indeno(1,2,3-cd)pyrene	544	10	2.5	ng/L	500	NA	109	70-130	9.23	20	
Naphthalene	349	50	1.9	ng/L	500	NA	69.8	70-130	4.69	20	
Perylene	474	20	11	ng/L	500	NA	94.8	70-130	4.97	20	
Phenanthrene	376	10	5.0	ng/L	500	NA	75.2	70-130	3.14	20	
Pyrene	480	10	5.0	ng/L	500	NA	96.0	70-130	0.627	20	
Surrogate: 2-Fluorobiphenyl	*171*			ng/L	*250*	*NA*	*68.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*246*			ng/L	*250*	*NA*	*98.4*	*30-120*			
Surrogate: Terphenyl-d14	*291*			ng/L	*250*	*NA*	*116*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Matrix Spike (B7C0324-MS1) **Source: 0701451-13** Prepared: 03/21/07 Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	588	56	40	ng/L	556	120	84.2	70-130	NA	NA	
1-Methylphenanthrene	536	56	20	ng/L	556	ND	96.4	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	487	56	36	ng/L	556	ND	87.6	70-130	NA	NA	
2,6-Dimethylnaphthalene	519	56	39	ng/L	556	ND	93.3	70-130	NA	NA	
2-Methylnaphthalene	539	56	3.1	ng/L	556	120	75.4	70-130	NA	NA	
Acenaphthene	458	11	2.1	ng/L	556	14	79.9	43-120	NA	NA	
Acenaphthylene	447	11	2.3	ng/L	556	4.0	79.7	70-130	NA	NA	
Anthracene	442	11	5.6	ng/L	556	ND	79.5	70-130	NA	NA	
Benz(a)anthracene	528	11	5.6	ng/L	556	ND	95.0	70-130	NA	NA	
Benzo(a)pyrene	438	11	2.3	ng/L	556	ND	78.8	75-148	NA	NA	
Benzo(b)fluoranthene	544	11	5.6	ng/L	556	ND	97.8	70-130	NA	NA	
Benzo(e)pyrene	520	11	5.6	ng/L	556	ND	93.5	70-130	NA	NA	
Benzo(g,h,i)perylene	651	11	6.2	ng/L	556	ND	117	70-130	NA	NA	
Benzo(k)fluoranthene	501	11	5.6	ng/L	556	ND	90.1	70-130	NA	NA	
Biphenyl	525	56	40	ng/L	556	ND	94.4	70-130	NA	NA	
Chrysene	499	11	5.6	ng/L	556	ND	89.7	70-130	NA	NA	
Dibenz(a,h)anthracene	619	11	3.9	ng/L	556	ND	111	70-130	NA	NA	
Fluoranthene	564	11	5.6	ng/L	556	15	98.7	67-130	NA	NA	
Fluorene	529	11	2.3	ng/L	556	41	87.8	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	697	11	2.8	ng/L	556	ND	125	70-130	NA	NA	
Naphthalene	1660	56	2.1	ng/L	556	1300	64.7	70-130	NA	NA	
Perylene	478	22	13	ng/L	556	ND	86.0	70-130	NA	NA	
Phenanthrene	497	11	5.6	ng/L	556	63	78.1	70-130	NA	NA	
Pyrene	565	11	5.6	ng/L	556	6.3	100	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*204*			ng/L	*278*	*NA*	*73.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*328*			ng/L	*278*	*NA*	*118*	*30-120*			
Surrogate: Terphenyl-d14	*339*			ng/L	*278*	*NA*	*122*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Matrix Spike Duplicate (B7C0324-MSD1) **Source: 0701451-13** Prepared: 03/21/07 Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	616	57	41	ng/L	568	120	87.3	70-130	4.65	20	
1-Methylphenanthrene	557	57	20	ng/L	568	ND	98.1	70-130	3.84	20	
2,3,5-Trimethylnaphthalene	501	57	37	ng/L	568	ND	88.2	70-130	2.83	20	
2,6-Dimethylnaphthalene	524	57	40	ng/L	568	ND	92.3	70-130	0.959	20	
2-Methylnaphthalene	598	57	3.2	ng/L	568	120	84.2	70-130	10.4	20	
Acenaphthene	470	11	2.2	ng/L	568	14	80.3	43-120	2.59	20	
Acenaphthylene	463	11	2.4	ng/L	568	4.0	80.8	70-130	3.52	20	
Anthracene	480	11	5.7	ng/L	568	ND	84.5	70-130	8.24	20	
Benz(a)anthracene	556	11	5.7	ng/L	568	ND	97.9	70-130	5.17	20	
Benzo(a)pyrene	497	11	2.4	ng/L	568	ND	87.5	75-148	12.6	20	
Benzo(b)fluoranthene	560	11	5.7	ng/L	568	ND	98.6	70-130	2.90	20	
Benzo(e)pyrene	540	11	5.7	ng/L	568	ND	95.1	70-130	3.77	20	
Benzo(g,h,i)perylene	656	11	6.4	ng/L	568	ND	115	70-130	0.765	20	
Benzo(k)fluoranthene	517	11	5.7	ng/L	568	ND	91.0	70-130	3.14	20	
Biphenyl	527	57	41	ng/L	568	ND	92.8	70-130	0.380	20	
Chrysene	512	11	5.7	ng/L	568	ND	90.1	70-130	2.57	20	
Dibenz(a,h)anthracene	627	11	4.0	ng/L	568	ND	110	70-130	1.28	20	
Fluoranthene	594	11	5.7	ng/L	568	15	102	67-130	5.18	20	
Fluorene	541	11	2.4	ng/L	568	41	88.0	70-130	2.24	20	
Indeno(1,2,3-cd)pyrene	704	11	2.8	ng/L	568	ND	124	70-130	0.999	20	
Naphthalene	2010	57	2.2	ng/L	568	1300	125	70-130	19.1	20	
Perylene	511	23	13	ng/L	568	ND	90.0	70-130	6.67	20	
Phenanthrene	533	11	5.7	ng/L	568	63	82.7	70-130	6.99	20	
Pyrene	579	11	5.7	ng/L	568	6.3	101	70-130	2.45	20	
Surrogate: 2-Fluorobiphenyl	*235*			ng/L	*284*	*NA*	*82.7*	*30-120*			
Surrogate: Nitrobenzene-d5	*323*			ng/L	*284*	*NA*	*114*	*30-120*			
Surrogate: Terphenyl-d14	*350*			ng/L	*284*	*NA*	*123*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0306 - EPA 5030B

Method Blank (B7C0306-BLK1)

Prepared & Analyzed: 03/15/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	10	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	10	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	10	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	10	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	10	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	10	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*28.0*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.3*			ug/L	*25.0*	*NA*	*93.2*	*80-120*			
Surrogate: Dibromofluoromethane	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: Toluene-d8	*24.4*			ug/L	*25.0*	*NA*	*97.6*	*80-120*			

Laboratory Control Sample (B7C0306-BS1)

Prepared & Analyzed: 03/15/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	24.4	10	0.030	ug/L	25.0	NA	97.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	23.9	10	0.039	ug/L	25.0	NA	95.6	75-125	NA	NA	
1,4-Dichlorobenzene	24.6	1.0	0.051	ug/L	25.0	NA	98.4	75-125	NA	NA	
Benzene	27.4	1.0	0.042	ug/L	25.0	NA	110	75-125	NA	NA	
Carbon Tetrachloride	27.1	1.0	0.050	ug/L	25.0	NA	108	75-125	NA	NA	
Ethylbenzene	28.6	1.0	0.036	ug/L	25.0	NA	114	75-125	NA	NA	
m,p-Xylenes	47.1	10	0.059	ug/L	50.0	NA	94.2	75-125	NA	NA	
o-Xylene	24.0	10	0.072	ug/L	25.0	NA	96.0	75-125	NA	NA	
sec-Butylbenzene	24.3	10	0.027	ug/L	25.0	NA	97.2	75-125	NA	NA	
Styrene	23.6	10	0.049	ug/L	25.0	NA	94.4	75-125	NA	NA	
Toluene	25.8	1.0	0.048	ug/L	25.0	NA	103	75-125	NA	NA	
Trichloroethene	27.4	1.0	0.067	ug/L	25.0	NA	110	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Dibromofluoromethane	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: Toluene-d8	*24.4*			ug/L	*25.0*	*NA*	*97.6*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0306 - EPA 5030B

Laboratory Control Sample Duplicate (B7C0306-BSD1)

Prepared & Analyzed: 03/15/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.7	10	0.030	ug/L	25.0	NA	90.8	75-125	7.22	20	
1,3,5-Trimethylbenzene	22.6	10	0.039	ug/L	25.0	NA	90.4	75-125	5.59	20	
1,4-Dichlorobenzene	23.0	1.0	0.051	ug/L	25.0	NA	92.0	75-125	6.72	20	
Benzene	25.4	1.0	0.042	ug/L	25.0	NA	102	75-125	7.58	20	
Carbon Tetrachloride	25.6	1.0	0.050	ug/L	25.0	NA	102	75-125	5.69	20	
Ethylbenzene	27.0	1.0	0.036	ug/L	25.0	NA	108	75-125	5.76	20	
m,p-Xylenes	44.2	10	0.059	ug/L	50.0	NA	88.4	75-125	6.35	20	
o-Xylene	22.6	10	0.072	ug/L	25.0	NA	90.4	75-125	6.01	20	
sec-Butylbenzene	22.5	10	0.027	ug/L	25.0	NA	90.0	75-125	7.69	20	
Styrene	22.5	10	0.049	ug/L	25.0	NA	90.0	75-125	4.77	20	
Toluene	24.2	1.0	0.048	ug/L	25.0	NA	96.8	75-125	6.40	20	
Trichloroethene	26.0	1.0	0.067	ug/L	25.0	NA	104	75-125	5.24	20	
Surrogate: 1,2-Dichloroethane-d4	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.0*			ug/L	*25.0*	*NA*	*104*	*80-120*			
Surrogate: Dibromofluoromethane	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: Toluene-d8	*24.0*			ug/L	*25.0*	*NA*	*96.0*	*80-120*			

Batch B7C0412 - EPA 5035

Method Blank (B7C0412-BLK1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.12	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*23.8*			ug/L	*25.0*	*NA*	*95.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*26.1*			ug/L	*25.0*	*NA*	*104*	*80-120*			
Surrogate: Toluene-d8	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0412 - EPA 5035

Laboratory Control Sample (B7C0412-BS1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.20	0.050	0.0035	mg/kg	1.25	NA	96.0	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.19	0.050	0.0049	mg/kg	1.25	NA	95.2	75-125	NA	NA	
1,4-Dichlorobenzene	1.31	0.050	0.0060	mg/kg	1.25	NA	105	75-125	NA	NA	
Benzene	1.05	0.050	0.0022	mg/kg	1.25	NA	84.0	75-125	NA	NA	
Carbon Tetrachloride	1.28	0.12	0.0028	mg/kg	1.25	NA	102	75-125	NA	NA	
Ethylbenzene	1.36	0.050	0.0053	mg/kg	1.25	NA	109	75-125	NA	NA	
m,p-Xylenes	2.84	0.050	0.0063	mg/kg	2.50	NA	114	75-125	NA	NA	
o-Xylene	1.41	0.050	0.0070	mg/kg	1.25	NA	113	75-125	NA	NA	
sec-Butylbenzene	1.19	0.050	0.0021	mg/kg	1.25	NA	95.2	75-125	NA	NA	
Styrene	1.41	0.050	0.0023	mg/kg	1.25	NA	113	75-125	NA	NA	
Toluene	1.29	0.050	0.0086	mg/kg	1.25	NA	103	75-125	NA	NA	
Trichloroethene	1.40	0.050	0.0037	mg/kg	1.25	NA	112	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*23.4*			ug/L	*25.0*	*NA*	*93.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*28.6*			ug/L	*25.0*	*NA*	*114*	*80-120*			
Surrogate: Dibromofluoromethane	*26.3*			ug/L	*25.0*	*NA*	*105*	*80-120*			
Surrogate: Toluene-d8	*26.4*			ug/L	*25.0*	*NA*	*106*	*80-120*			

Laboratory Control Sample Duplicate (B7C0412-BSD1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.15	0.050	0.0035	mg/kg	1.25	NA	92.0	75-125	4.26	20	
1,3,5-Trimethylbenzene	1.15	0.050	0.0049	mg/kg	1.25	NA	92.0	75-125	3.42	20	
1,4-Dichlorobenzene	1.27	0.050	0.0060	mg/kg	1.25	NA	102	75-125	3.10	20	
Benzene	1.03	0.050	0.0022	mg/kg	1.25	NA	82.4	75-125	1.92	20	
Carbon Tetrachloride	1.24	0.12	0.0028	mg/kg	1.25	NA	99.2	75-125	3.17	20	
Ethylbenzene	1.31	0.050	0.0053	mg/kg	1.25	NA	105	75-125	3.75	20	
m,p-Xylenes	2.74	0.050	0.0063	mg/kg	2.50	NA	110	75-125	3.58	20	
o-Xylene	1.34	0.050	0.0070	mg/kg	1.25	NA	107	75-125	5.09	20	
sec-Butylbenzene	1.15	0.050	0.0021	mg/kg	1.25	NA	92.0	75-125	3.42	20	
Styrene	1.36	0.050	0.0023	mg/kg	1.25	NA	109	75-125	3.61	20	
Toluene	1.25	0.050	0.0086	mg/kg	1.25	NA	100	75-125	3.15	20	
Trichloroethene	1.37	0.050	0.0037	mg/kg	1.25	NA	110	75-125	2.17	20	
Surrogate: 1,2-Dichloroethane-d4	*23.8*			ug/L	*25.0*	*NA*	*95.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*28.4*			ug/L	*25.0*	*NA*	*114*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*26.2*			ug/L	*25.0*	*NA*	*105*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0412 - EPA 5035

Matrix Spike (B7C0412-MS1) **Source: 0701451-01** Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1610			ug/L	1250	350	101	75-125	NA	NA	
1,3,5-Trimethylbenzene	1340			ug/L	1250	98	99.4	75-125	NA	NA	
1,4-Dichlorobenzene	1340			ug/L	1250	ND	107	75-125	NA	NA	
Benzene	2030			ug/L	1250	820	96.8	75-125	NA	NA	
Carbon Tetrachloride	1310			ug/L	1250	ND	105	75-125	NA	NA	
Ethylbenzene	2530			ug/L	1250	980	124	75-125	NA	NA	
m,p-Xylenes	4010			ug/L	2500	950	122	75-125	NA	NA	
o-Xylene	1870			ug/L	1250	380	119	75-125	NA	NA	
sec-Butylbenzene	1200			ug/L	1250	ND	96.0	75-125	NA	NA	
Styrene	1700			ug/L	1250	230	118	75-125	NA	NA	
Toluene	2970			ug/L	1250	1400	126	75-125	NA	NA	
Trichloroethene	1450			ug/L	1250	ND	116	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*23.9*			ug/L	*25.0*	*NA*	*95.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*28.2*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*27.4*			ug/L	*25.0*	*NA*	*110*	*80-120*			

Matrix Spike Duplicate (B7C0412-MSD1) **Source: 0701451-01** Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1570			ug/L	1250	350	97.6	75-125	2.52	20	
1,3,5-Trimethylbenzene	1290			ug/L	1250	98	95.4	75-125	3.80	20	
1,4-Dichlorobenzene	1300			ug/L	1250	ND	104	75-125	3.03	20	
Benzene	2010			ug/L	1250	820	95.2	75-125	0.990	20	
Carbon Tetrachloride	1280			ug/L	1250	ND	102	75-125	2.32	20	
Ethylbenzene	2440			ug/L	1250	980	117	75-125	3.62	20	
m,p-Xylenes	3830			ug/L	2500	950	115	75-125	4.59	20	
o-Xylene	1780			ug/L	1250	380	112	75-125	4.93	20	
sec-Butylbenzene	1170			ug/L	1250	ND	93.6	75-125	2.53	20	
Styrene	1640			ug/L	1250	230	113	75-125	3.59	20	
Toluene	2900			ug/L	1250	1400	120	75-125	2.39	20	
Trichloroethene	1390			ug/L	1250	ND	111	75-125	4.23	20	
Surrogate: 1,2-Dichloroethane-d4	*24.2*			ug/L	*25.0*	*NA*	*96.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Dibromofluoromethane	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Toluene-d8	*27.7*			ug/L	*25.0*	*NA*	*111*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0439 - EPA 5035

Method Blank (B7C0439-BLK1)

Prepared: 03/23/07 Analyzed: 03/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.2*			ug/L	*25.0*	*NA*	*96.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.3*			ug/L	*25.0*	*NA*	*105*	*80-120*			
Surrogate: Dibromofluoromethane	*26.5*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Toluene-d8	*27.1*			ug/L	*25.0*	*NA*	*108*	*80-120*			

Laboratory Control Sample (B7C0439-BS1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.19	0.050	0.0035	mg/kg	1.25	NA	95.2	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.19	0.050	0.0049	mg/kg	1.25	NA	95.2	75-125	NA	NA	
1,4-Dichlorobenzene	1.30	0.050	0.0060	mg/kg	1.25	NA	104	75-125	NA	NA	
Benzene	1.15	0.050	0.0022	mg/kg	1.25	NA	92.0	75-125	NA	NA	
Carbon Tetrachloride	1.26	0.050	0.0028	mg/kg	1.25	NA	101	75-125	NA	NA	
Ethylbenzene	1.35	0.050	0.0053	mg/kg	1.25	NA	108	75-125	NA	NA	
m,p-Xylenes	2.76	0.050	0.0063	mg/kg	2.50	NA	110	75-125	NA	NA	
o-Xylene	1.36	0.050	0.0070	mg/kg	1.25	NA	109	75-125	NA	NA	
sec-Butylbenzene	1.19	0.050	0.0021	mg/kg	1.25	NA	95.2	75-125	NA	NA	
Styrene	1.37	0.050	0.0023	mg/kg	1.25	NA	110	75-125	NA	NA	
Toluene	1.30	0.050	0.0086	mg/kg	1.25	NA	104	75-125	NA	NA	
Trichloroethene	1.39	0.050	0.0037	mg/kg	1.25	NA	111	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.0*			ug/L	*25.0*	*NA*	*96.0*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*28.0*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*26.2*			ug/L	*25.0*	*NA*	*105*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0439 - EPA 5035

Laboratory Control Sample Duplicate (B7C0439-BSD1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.18	0.050	0.0035	mg/kg	1.25	NA	94.4	75-125	0.844	20	
1,3,5-Trimethylbenzene	1.18	0.050	0.0049	mg/kg	1.25	NA	94.4	75-125	0.844	20	
1,4-Dichlorobenzene	1.29	0.050	0.0060	mg/kg	1.25	NA	103	75-125	0.772	20	
Benzene	1.13	0.050	0.0022	mg/kg	1.25	NA	90.4	75-125	1.75	20	
Carbon Tetrachloride	1.24	0.050	0.0028	mg/kg	1.25	NA	99.2	75-125	1.60	20	
Ethylbenzene	1.33	0.050	0.0053	mg/kg	1.25	NA	106	75-125	1.49	20	
m,p-Xylenes	2.70	0.050	0.0063	mg/kg	2.50	NA	108	75-125	2.20	20	
o-Xylene	1.34	0.050	0.0070	mg/kg	1.25	NA	107	75-125	1.48	20	
sec-Butylbenzene	1.18	0.050	0.0021	mg/kg	1.25	NA	94.4	75-125	0.844	20	
Styrene	1.34	0.050	0.0023	mg/kg	1.25	NA	107	75-125	2.21	20	
Toluene	1.29	0.050	0.0086	mg/kg	1.25	NA	103	75-125	0.772	20	
Trichloroethene	1.38	0.050	0.0037	mg/kg	1.25	NA	110	75-125	0.722	20	
Surrogate: 1,2-Dichloroethane-d4	*24.2*			ug/L	*25.0*	*NA*	*96.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.7*			ug/L	*25.0*	*NA*	*111*	*80-120*			
Surrogate: Dibromofluoromethane	*27.1*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*26.3*			ug/L	*25.0*	*NA*	*105*	*80-120*			

Matrix Spike (B7C0439-MS1)

Source: 0701451-17 Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1280			ug/L	1250	86	95.5	75-125	NA	NA	
1,3,5-Trimethylbenzene	1230			ug/L	1250	24	96.5	75-125	NA	NA	
1,4-Dichlorobenzene	1320			ug/L	1250	ND	106	75-125	NA	NA	
Benzene	1180			ug/L	1250	ND	94.4	75-125	NA	NA	
Carbon Tetrachloride	1290			ug/L	1250	ND	103	75-125	NA	NA	
Ethylbenzene	1500			ug/L	1250	120	110	75-125	NA	NA	
m,p-Xylenes	2890			ug/L	2500	91	112	75-125	NA	NA	
o-Xylene	1400			ug/L	1250	47	108	75-125	NA	NA	
sec-Butylbenzene	1200			ug/L	1250	ND	96.0	75-125	NA	NA	
Styrene	1380			ug/L	1250	ND	110	75-125	NA	NA	
Toluene	1400			ug/L	1250	32	109	75-125	NA	NA	
Trichloroethene	1420			ug/L	1250	ND	114	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.3*			ug/L	*25.0*	*NA*	*97.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.4*			ug/L	*25.0*	*NA*	*110*	*80-120*			
Surrogate: Dibromofluoromethane	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*26.8*			ug/L	*25.0*	*NA*	*107*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0439 - EPA 5035

Matrix Spike Duplicate (B7C0439-MSD1) **Source: 0701451-17** Prepared: 03/23/07 Analyzed: 03/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1250			ug/L	1250	86	93.1	75-125	2.37	20	
1,3,5-Trimethylbenzene	1200			ug/L	1250	24	94.1	75-125	2.47	20	
1,4-Dichlorobenzene	1280			ug/L	1250	ND	102	75-125	3.08	20	
Benzene	1160			ug/L	1250	ND	92.8	75-125	1.71	20	
Carbon Tetrachloride	1270			ug/L	1250	ND	102	75-125	1.56	20	
Ethylbenzene	1460			ug/L	1250	120	107	75-125	2.70	20	
m,p-Xylenes	2800			ug/L	2500	91	108	75-125	3.16	20	
o-Xylene	1360			ug/L	1250	47	105	75-125	2.90	20	
sec-Butylbenzene	1160			ug/L	1250	ND	92.8	75-125	3.39	20	
Styrene	1330			ug/L	1250	ND	106	75-125	3.69	20	
Toluene	1360			ug/L	1250	32	106	75-125	2.90	20	
Trichloroethene	1390			ug/L	1250	ND	111	75-125	2.14	20	
Surrogate: 1,2-Dichloroethane-d4	*24.3*			ug/L	*25.0*	*NA*	*97.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*27.1*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample (B7C0442-BS1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	89500	2940	2940	ug/m³	110000	NA	81.4	75-125	NA	NA	
Xylenes, Total	284000	2990	2990	ug/m³	337000	NA	84.3	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	101000	2970	2970	ug/m³	99100	NA	102	75-125	NA	NA	
Styrene	104000	3920	3920	ug/m³	131000	NA	79.4	75-125	NA	NA	
Toluene	102000	3020	3020	ug/m³	101000	NA	101	75-125	NA	NA	
Trichloroethene	102000	2990	2990	ug/m³	99800	NA	102	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	84100	6050	6050	ug/m³	90200	NA	93.2	75-125	NA	NA	
1,2,4-Trimethylbenzene	87700	5930	5930	ug/m³	91600	NA	95.7	75-125	NA	NA	
1,3,5-Trimethylbenzene	85900	2880	2880	ug/m³	94100	NA	91.3	75-125	NA	NA	
1,4-Dichlorobenzene	60200	6940	6940	ug/m³	65400	NA	92.0	75-125	NA	NA	
Carbon Tetrachloride	92000	30600	3060	ug/m³	102000	NA	90.2	75-125	NA	NA	
sec-Butylbenzene	96200	2940	2940	ug/m³	97000	NA	99.2	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7C0442-BSD1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	2940	2940	ug/m³	110000	NA	90.0	75-125	10.1	20	
Xylenes, Total	317000	2990	2990	ug/m³	337000	NA	94.1	75-125	11.0	20	

Laboratory Control Sample Duplicate (B7C0442-BSD2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	104000	2970	2970	ug/m³	99100	NA	105	75-125	2.93	20	
Styrene	121000	3920	3920	ug/m³	131000	NA	92.4	75-125	15.1	20	
Toluene	104000	3020	3020	ug/m³	101000	NA	103	75-125	1.94	20	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	1.94	20	

Laboratory Control Sample Duplicate (B7C0442-BSD3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	96100	6050	6050	ug/m³	90200	NA	107	75-125	13.3	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7C0442-BSD3)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	98800	5930	5930	ug/m³	91600	NA	108	75-125	11.9	20	
1,3,5-Trimethylbenzene	95500	2880	2880	ug/m³	94100	NA	101	75-125	10.6	20	
1,4-Dichlorobenzene	68900	6940	6940	ug/m³	65400	NA	105	75-125	13.5	20	
Carbon Tetrachloride	108000	30600	3060	ug/m³	102000	NA	106	75-125	16.0	20	
sec-Butylbenzene	107000	2940	2940	ug/m³	97000	NA	110	75-125	10.6	20	

Batch B7C0475 - AIRTUBES Prep

Laboratory Control Sample (B7C0475-BS1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27900	0.00		ug/m³	28200	NA	98.9	70-130	NA	NA	
2-Methylnaphthalene filter	28100	0.00		ug/m³	28200	NA	99.6	70-130	NA	NA	
Acenaphthene filter	25900	0.00		ug/m³	26000	NA	99.6	70-130	NA	NA	
Acenaphthylene filter	26000	0.00		ug/m³	25700	NA	101	70-130	NA	NA	
Anthracene filter	26200	0.00		ug/m³	25100	NA	104	70-130	NA	NA	
Benz(a)anthracene filter	25800	0.00		ug/m³	25600	NA	101	70-130	NA	NA	
Benzo(a)pyrene filter	25100	0.00		ug/m³	25300	NA	99.2	70-130	NA	NA	
Benzo(b)fluoranthene filter	25700	0.00		ug/m³	25300	NA	102	70-130	NA	NA	
Benzo(g,h,i)perylene filter	17700	0.00		ug/m³	25800	NA	68.6	70-130	NA	NA	
Benzo(k)fluoranthene filter	24500	0.00		ug/m³	25400	NA	96.5	70-130	NA	NA	
Chrysene filter	23400	0.00		ug/m³	25400	NA	92.1	70-130	NA	NA	
Dibenz(a,h)anthracene filter	15400	0.00		ug/m³	25100	NA	61.4	70-130	NA	NA	
Fluoranthene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	27300	0.00		ug/m³	26800	NA	102	70-130	NA	NA	
Naphthalene filter	26200	0.00		ug/m³	28100	NA	93.2	70-130	NA	NA	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Pyrene filter	26500	0.00		ug/m³	25600	NA	104	70-130	NA	NA	
1-Methylnaphthalene	25100	1590		ug/m³	26600	NA	94.4	70-130	NA	NA	
2-Methylnaphthalene	25100	1590		ug/m³	26400	NA	95.1	70-130	NA	NA	
Acenaphthene	25500	3310		ug/m³	27600	NA	92.4	70-130	NA	NA	
Acenaphthylene	23800	3050		ug/m³	25500	NA	93.3	70-130	NA	NA	
Anthracene	26100	3300		ug/m³	27500	NA	94.9	70-130	NA	NA	
Benz(a)anthracene	25600	1790		ug/m³	29800	NA	85.9	70-130	NA	NA	
Benzo(a)pyrene	24700	1890		ug/m³	31500	NA	78.4	70-130	NA	NA	
Benzo(b)fluoranthene	26000	1870		ug/m³	31200	NA	83.3	70-130	NA	NA	
Benzo(g,h,i)perylene	17100	4620		ug/m³	38500	NA	44.4	70-130	NA	NA	
Benzo(k)fluoranthene	24200	1890		ug/m³	31600	NA	76.6	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0475 - AIRTUBES Prep

Laboratory Control Sample (B7C0475-BS1)

Prepared: 03/29/07 Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chrysene	22300	1800		ug/m³	29900	NA	74.6	70-130	NA	NA	
Dibenz(a,h)anthracene	14200	19300		ug/m³	32100	NA	44.2	70-130	NA	NA	
Fluoranthene	26000	3420		ug/m³	28500	NA	91.2	70-130	NA	NA	
Fluorene	25800	3250		ug/m³	27100	NA	95.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	24700	2030		ug/m³	33900	NA	72.9	70-130	NA	NA	
Naphthalene	25500	1660		ug/m³	27700	NA	92.1	70-130	NA	NA	
Phenanthrene	25900	3320		ug/m³	27700	NA	93.5	70-130	NA	NA	
Pyrene	25800	3480		ug/m³	29000	NA	89.0	70-130	NA	NA	

Laboratory Control Sample Duplicate (B7C0475-BSD1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27300	0.00		ug/m³	28200	NA	96.8	70-130	2.17	20	
2-Methylnaphthalene filter	27400	0.00		ug/m³	28200	NA	97.2	70-130	2.52	20	
Acenaphthene filter	25600	0.00		ug/m³	26000	NA	98.5	70-130	1.17	20	
Acenaphthylene filter	25800	0.00		ug/m³	25700	NA	100	70-130	0.772	20	
Anthracene filter	26000	0.00		ug/m³	25100	NA	104	70-130	0.766	20	
Benz(a)anthracene filter	25900	0.00		ug/m³	25600	NA	101	70-130	0.387	20	
Benzo(a)pyrene filter	25300	0.00		ug/m³	25300	NA	100	70-130	0.794	20	
Benzo(b)fluoranthene filter	25800	0.00		ug/m³	25300	NA	102	70-130	0.388	20	
Benzo(g,h,i)perylene filter	18700	0.00		ug/m³	25800	NA	72.5	70-130	5.49	20	
Benzo(k)fluoranthene filter	24900	0.00		ug/m³	25400	NA	98.0	70-130	1.62	20	
Chrysene filter	23800	0.00		ug/m³	25400	NA	93.7	70-130	1.69	20	
Dibenz(a,h)anthracene filter	16700	0.00		ug/m³	25100	NA	66.5	70-130	8.10	20	
Fluoranthene filter	26400	0.00		ug/m³	25500	NA	104	70-130	0.380	20	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	0.00	20	
Indeno(1,2,3-cd)pyrene filter	27300	0.00		ug/m³	26800	NA	102	70-130	0.00	20	
Naphthalene filter	25500	0.00		ug/m³	28100	NA	90.7	70-130	2.71	20	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	0.00	20	
Pyrene filter	26400	0.00		ug/m³	25600	NA	103	70-130	0.378	20	
1-Methylnaphthalene	24800	1590		ug/m³	26600	NA	93.2	70-130	1.20	20	
2-Methylnaphthalene	24900	1590		ug/m³	26400	NA	94.3	70-130	0.800	20	
Acenaphthene	24900	3310		ug/m³	27600	NA	90.2	70-130	2.38	20	
Acenaphthylene	23500	3050		ug/m³	25500	NA	92.2	70-130	1.27	20	
Anthracene	25100	3300		ug/m³	27500	NA	91.3	70-130	3.91	20	
Benz(a)anthracene	23600	1790		ug/m³	29800	NA	79.2	70-130	8.13	20	
Benzo(a)pyrene	21000	1890		ug/m³	31500	NA	66.7	70-130	16.2	20	
Benzo(b)fluoranthene	22900	1870		ug/m³	31200	NA	73.4	70-130	12.7	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0475 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7C0475-BSD1) Prepared: 03/29/07 Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzo(g,h,i)perylene	13900	4620		ug/m³	38500	NA	36.1	70-130	20.6	20	
Benzo(k)fluoranthene	21700	1890		ug/m³	31600	NA	68.7	70-130	10.9	20	
Chrysene	20900	1800		ug/m³	29900	NA	69.9	70-130	6.48	20	
Dibenz(a,h)anthracene	12200	19300		ug/m³	32100	NA	38.0	70-130	15.2	20	
Fluoranthene	24600	3420		ug/m³	28500	NA	86.3	70-130	5.53	20	
Fluorene	25200	3250		ug/m³	27100	NA	93.0	70-130	2.35	20	
Indeno(1,2,3-cd)pyrene	20200	2030		ug/m³	33900	NA	59.6	70-130	20.0	20	
Naphthalene	25500	1660		ug/m³	27700	NA	92.1	70-130	0.00	20	
Phenanthrene	25000	3320		ug/m³	27700	NA	90.3	70-130	3.54	20	
Pyrene	24100	3480		ug/m³	29000	NA	83.1	70-130	6.81	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701451

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquiries:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ___ Yes ___ No
Rush / Quote # _____

Page 1 of 3

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS
Mailing Address 700 3rd St. South, Suite 600
City, State, Zip Minneapolis, MN 55415
Telephone # (612) 370-0700 Fax # (612) 373-6800
E-mail hubert_huls@urscorp.com

Project ID/Name Ashland NSP
P.O. #/Project # 25688375.75000

SEND INVOICE TO
Contact Name Hubert Huls Company URS Corp
Address 700 Third St S
City, State, Zip Minneapolis, MN 55415
Telephone # (612) 370-0700 Fax # (612) 373-6800

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	VOC	PAH	Grainsize	TOC							FOR LAB USE ONLY
1	~~NSP-4-ES-VOC-031407~~																	
2	NSP-4-ES-1-VOC-031407	3/14/07	9:00	Soil		2	N	X										0701451-1
3	NSP-4-ES-1-VOC-031407-MS					2	N	X										-1
4	NSP-4-ES-1-VOC-031407-MSD					2	N	X										-1
5	NSP-4-ES-PAH-1-031407		8:40			2	N		X									-2
6	NSP-4-ES-PAH-1-031407-MS					2	N		X									-2
7	NSP-4-ES-PAH-1-031407-MSD					2	N		X									-2
8	NSP-4-ES-GS-1-031407					1	N			X		Jim Strecke						~~-3~~
9	NSP-4-ES-TOC-1-031407				1	1	N				X						0701451	-3
10	NSP-4-ES-PAH-2-031407	03/14/07	12:03	Air	301.2 L	3	N		X									-4
11	NSP-4-ES-VOC-2-031407	03/14/07	12:03	Air	301.2 L	2	N	X										-5
12	NSP-4-ES-PAH-5-031407	"	16:07	Air	602.4 L	3	N		X									-6
13	NSP-4-ES-VOC-5-031407	"	16:07	Air	602.4 L	2	N	X										-7
14	NSP-4-ES-PAH-6-031507	03/15/07	08:11	Air	2409.6 L	3	N		X									-8
15	NSP-4-ES-VOC-6-031507	"	08:11	Air	2409.6 L	2	N	X										-9

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 3/15/07 1200
Received by: Date/Time
Relinquished by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: [signature] Date/Time 3/15/07 1204
Comments:

Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☐ Yes ☑ No ON BLUE ICE
Temp Blank ☐ Yes ☑ No
Temp: 3.9 °C

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701451

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquiries:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ___ Yes ___ No
Rush / Quote # _____

Page 2 of 3

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS Corp
Mailing Address: 700 3rd St. South, Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: (612) 370-0700 Fax #: (612) 373-6800
E-mail: hubert-huls@urscorp.com

Project ID/Name: Ashland NSP
P.O. #/Project #: 25688375.75000

SEND INVOICE TO
Contact Name:
Company: URS Corp
Address: Same
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAHs	VOC	TOC	Grain Size						FOR LAB USE ONLY
1	NSP-4-ES-PAH-3-031507	03/15/07	08:20	Soil		2	N	X									0701451-10
2	NSP-4-ES-VOC-3-031507		08:30			2			X								-11
3	NSP-4-ES-TOC-3-031507		08:20			1				X							-12
4	NSP-4-ES-PAH-4-031507		09:18	water		3		X									-13
5	NSP-4-ES-VOC-4-031507		09:20	water		3			X								-14
6	NSP-1-ES-PAH-1-031507		09:45	Soil		2		X									-15
7	NSP-1-ES-PAH-1-031507-MS		09:45			2		X									-15
8	NSP-1-ES-PAH-1-031507-MSD	03/15/07	09:45			2		X									-15
9	NSP-4-ES-TOC-1-031407-Dup	03/14/07	08:40			1				X							-16
10	NSP-1-ES-VOC-1-031507	03/15/07	09:50			2			X								-17
11	NSP-1-ES-VOC-1-031507-MS		09:50			2			X								-17
12	NSP-1-ES-VOC-1-031507-MSD		09:50			2			X								-17
13	NSP-1-ES-TOC-1-031507		09:45			1				X							-18
14	NSP-1-ES-TOC-1-031507-Dup		09:45			1				X							-19
15	NSP-1-ES-GS-1-031507	03/15/07	09:45	Soil		1	N				X				Jim Stroede		N/A

CHAIN OF CUSTODY
Collected by: (Print) William C. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 3/15/07 1200
Relinquished by: Date/Time
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: [signature] Date/Time 3/15/07 1204
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☐ Yes ☑ No ON BLUE ICE
Temp Blank ☐ Yes ☑ No
Temp: 3.9 °C

Form # CS02.02 F:/Groups/QA-QC/Forms/clientservices/COC-CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701451
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701451

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 3 of 3

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS Corp
Mailing Address 700 3rd St. So., Suite 600
City, State, Zip Minneapolis, MN 55415
Telephone # (612) 370-0700 Fax # (612) 373-6800
E-mail hubert_huls@urscorp.com

Project ID/Name Ashland NSP
P.O. #/Project # 25688375.75000

SEND INVOICE TO
Contact Name
Company
Address
City, State, Zip Same
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	VOC									FOR LAB USE ONLY
1	Trip Blanks			W		5		X									0701451-20
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr
Relinquished by: [signature] Date/Time 3/15/07 1200
Relinquished by: Date/Time
Collector's Signature: [signature]
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: [signature] Date/Time 3/15/07 1204
Comments:

Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☐ Yes ☒ No ON BLUE ICE
Temp Blank ☐ Yes ☒ No
Temp: 3.9 °C

Form # CS02.02 F:/Groups/QA-QC/Forms/clientservices/COC-CS02 Effective Date: 11/17/06

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

April 30, 2007

Work Order #: 0701477
(Revised)

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 16, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Qualifiers and Abbreviations

A4	The Laboratory Control Sample and Control Sample Duplicate are 61.4% and 66.5% for the filters, which is below the laboratory limits of 70%-130%.
A1a	The closing calibration check solution failed high (116%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
A1b	The closing calibration check solution failed high (117%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
A1c	The closing calibration check solution failed high (118%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
A1d	The Laboratory Control Sample Duplicate for the filters is 134%, which is outside the laboratory limits of 70-130%.
A1e	The Laboratory Control Sample Duplicate had a recovery of 59.6%, which is below the laboratory limits of 70-130%.
A1f	The Laboratory Control Sample Duplicate had a recovery of 66.7%, which is below the laboratory limits of 70-130%.
A1g	The Laboratory Control Sample recovery for the filter was 68.6%, which is below the laboratory limits of 70%-130%.
A2	The Laboratory Control Sample and Laboratory Control Sample Duplicate had recoveries of 44.4% and 36.1%, which is below the laboratory limits of 70-130%.
A1	The calibration check solutions failed high (118,138,&126%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
A3	The Laboratory Control Sample Duplicate had a recovery of 68.7%, which is below the laboratory limits of 70-130%.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
A4a	The Laboratory Control Sample Duplicate had a recovery of 69.9% which is below the laboratory limits of 70-130%.
A5	The Laboratory Control Sample and Laboratory Control Sample Duplicate had recoveries of 44.2% and 38.0% which are below the laboratory limits of 70-130%.
A5a	The MDL value for this analyte is an estimated value; no statistical value has been determined.
go	The laboratory control sample recovery is outside of laboratory control limits.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
ib	Unidentified compounds are present in the sample.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
ts	This analysis was performed by a subcontract laboratory.
A2a	The Laboratory Control Sample Duplicate recovery is 68.4%, which is outside the laboratory limits of 70-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-1-ES-PAH-2-031507 sample A	0701477-01	Air Tube	03/15/07 12:08	03/16/07 10:20
NSP-1-ES-VOC-2-031507 Front	0701477-02	Air Tube	03/15/07 12:08	03/16/07 10:20
NSP-1-ES-PAH-5-031507 Front	0701477-03	Air Tube	03/15/07 16:11	03/16/07 10:20
NSP-1-ES-VOC-5-031507 Front	0701477-04	Air Tube	03/15/07 16:11	03/16/07 10:20
NSP-1-ES-PAH-6-031607 Sample A	0701477-05	Air Tube	03/16/07 08:16	03/16/07 10:20
NSP-1-ES-VOC-6-031607 Sample A	0701477-06	Air Tube	03/16/07 08:16	03/16/07 10:20
NSP-1-ES-PAH-3-031607	0701477-07	Soil	03/16/07 08:25	03/16/07 10:20
NSP-1-ES-TOC-3-031607	0701477-08	Soil	03/16/07 08:25	03/16/07 10:20
NSP-1-ES-VOC-3-031607	0701477-09	Soil	03/16/07 08:30	03/16/07 10:20
NSP-1-ES-PAH-4-031607	0701477-10	Water	03/16/07 09:05	03/16/07 10:20
NSP-1-ES-VOC-4-031607	0701477-11	Water	03/16/07 09:05	03/16/07 10:20
Trip Blank (MeOH)	0701477-12	Soil	03/16/07 00:00	03/16/07 10:20
Trip Blanks (HCL)	0701477-13	Water	03/16/07 00:00	03/16/07 10:20
NSP-1-ES-PAH-2-031507 sample B	0701477-14	Air Tube	03/15/07 12:08	03/16/07 10:20
NSP-1-ES-PAH-6-031607 Sample B	0701477-18	Air Tube	03/16/07 08:16	03/16/07 10:20
NSP-1-ES-VOC-6-031607 Sample B	0701477-19	Air Tube	03/16/07 08:16	03/16/07 10:20

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	2.5 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	No
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	No
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-2-031507 sample A

0701477-01 (Air Tube)

3/15/07 12:08

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1f
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1g, A2, gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A3
Chrysene	ND	5.96		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4a
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4, A5
Fluoranthene	ND	11.4		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1e, gp
Naphthalene	**24.4**	5.52		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-VOC-2-031507 Front

0701477-02 (Air Tube)

3/15/07 12:08

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	20.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**23.1**	19.7		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	23.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**60.1**	9.87		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	**1000**	508		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**23.0**	9.76		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**120**	10.0		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**91.8**	9.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-5-031507 Front

0701477-03 (Air Tube)

3/15/07 16:11

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1f
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1g, A2, gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A3
Chrysene	ND	2.98		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4a
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4, A5
Fluoranthene	ND	5.68		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1e, gp
Naphthalene	**21.9**	2.76		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-VOC-5-031507 Front

0701477-04 (Air Tube)

3/15/07 16:11

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**14.3**	9.85		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**28.8**	4.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	**298**	254		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**13.0**	4.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**73.0**	5.02		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	4.97		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**55.6**	4.97		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-6-031607 Sample A

0701477-05 (Air Tube)

3/16/07 8:16

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	0.662		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
2-Methylnaphthalene	ND	0.658		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1f
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1g, A2, gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A3
Chrysene	ND	0.746		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4a
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4, A5
Fluoranthene	ND	1.42		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1e, gp
Naphthalene	**7.47**	0.689		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-VOC-6-031607 Sample A

0701477-06 (Air Tube)

3/16/07 8:16

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	2.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1b
1,2,4-Trimethylbenzene	ND	2.46		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1c
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	2.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1c
Benzene	ND	1.23		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	63.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	ND	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1a
Styrene	ND	1.63		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	ND	1.25		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	ND	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-3-031607

0701477-07 (Soil)

3/16/07 8:25

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**82**	0.050	0.010	% Wt	B7C0361	3/22/07	3/22/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**81**	2.0	0.33	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**7.9**	0.41	0.049	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**16**	2.0	0.24	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**64**	2.0	0.30	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**180**	10	3.5	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**69**	2.0	0.30	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**5.5**	0.41	0.043	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Anthracene	**51**	2.0	0.30	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**14**	0.41	0.061	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(a)pyrene	**13**	0.41	0.049	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(b)fluoranthene	**8.9**	0.41	0.10	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(e)pyrene	**7.8**	0.41	0.061	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5a
Benzo(g,h,i)perylene	**1.1**	0.41	0.036	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(k)fluoranthene	**9.6**	0.41	0.085	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Biphenyl	**11**	0.41	0.073	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Chrysene	**15**	0.41	0.061	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Dibenz(a,h)anthracene	**0.53**	0.41	0.13	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Fluoranthene	**53**	2.0	0.21	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**71**	10	0.61	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**1.4**	0.41	0.055	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Naphthalene	**170**	10	0.76	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**1.9**	0.41	0.067	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Phenanthrene	**170**	10	1.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**52**	2.0	0.30	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*80.5 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*72.0 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*94.6 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-TOC-3-031607

0701477-08 (Soil)

3/16/07 8:25

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**5790**	500		mg/kg	B7C0470	3/28/07	3/28/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-VOC-3-031607

0701477-09 (Soil)

3/16/07 8:30

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**4.5**	2.5	0.080	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
1,2,4-Trimethylbenzene	**9.8**	2.5	0.18	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
1,3,5-Trimethylbenzene	**2.7**	2.5	0.24	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
1,4-Dichlorobenzene	ND	2.5	0.30	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
Benzene	ND	2.5	0.11	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
Carbon Tetrachloride	ND	6.2	0.14	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
Ethylbenzene	**11**	2.5	0.26	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
m,p-Xylenes	**8.2**	2.5	0.32	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
o-Xylene	**4.2**	2.5	0.35	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
sec-Butylbenzene	ND	2.5	0.10	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
Styrene	ND	2.5	0.12	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
Toluene	ND	2.5	0.43	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
Trichloroethene	ND	2.5	0.18	mg/kg	B7C0412	3/23/07	3/27/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*96.8 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/27/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*104 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*106 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*104 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/27/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-4-031607

0701477-10 (Water)

3/16/07 9:05

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1800**	570	410	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
1-Methylphenanthrene	ND	57	20	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	57	37	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
2,6-Dimethylnaphthalene	**210**	57	40	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
2-Methylnaphthalene	**2000**	570	32	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	go
Acenaphthene	**490**	11	2.2	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Acenaphthylene	**35**	11	2.4	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Anthracene	**24**	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Benz(a)anthracene	ND	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Benzo(a)pyrene	ND	11	2.4	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Benzo(b)fluoranthene	ND	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Benzo(e)pyrene	ND	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	11	6.4	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Benzo(k)fluoranthene	ND	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Biphenyl	**160**	57	42	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Chrysene	ND	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	11	4.0	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Fluoranthene	**44**	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Fluorene	**180**	11	2.4	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	11	2.9	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Naphthalene	**5700**	570	22	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	go
Perylene	ND	23	13	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Phenanthrene	**240**	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Pyrene	**25**	11	5.7	ng/L	B7C0324	3/21/07	3/29/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*81.5 %*	*Limits: 30-120%*			*B7C0324*	*3/21/07*	*3/29/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*110 %*	*Limits: 30-120%*			*B7C0324*	*3/21/07*	*3/29/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*120 %*	*Limits: 30-120%*			*B7C0324*	*3/21/07*	*3/29/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-VOC-4-031607

0701477-11 (Water)

3/16/07 9:05

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Benzene	**1.2**	1.0	0.042	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*99.6 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*104 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*108 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*106 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Trip Blank (MeOH)

0701477-12 (Soil)

3/16/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Carbon Tetrachloride	ND	0.12	0.0028	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7C0412	3/23/07	3/23/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*93.2 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*107 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*103 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*109 %*	*Limits: 80-120%*			*B7C0412*	*3/23/07*	*3/23/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Trip Blanks (HCL)

0701477-13 (Water)

3/16/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0447	3/26/07	3/26/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*98.4 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*104 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*106 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*106 %*	*Limits: 80-120%*			*B7C0447*	*3/26/07*	*3/26/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-2-031507 sample B

0701477-14 (Air Tube)

3/15/07 12:08

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1f
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1g, A2, gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A3
Chrysene	ND	5.96		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4a
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A4, A5
Fluoranthene	ND	11.4		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	A1e, gp
Naphthalene	ND	5.52		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	3/29/07	3/30/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-PAH-6-031607 Sample B

0701477-18 (Air Tube)

3/16/07 8:16

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	0.662		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
2-Methylnaphthalene	ND	0.658		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Chrysene	ND	0.746		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	A1d, gp
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	A2a, gp
Naphthalene	ND	0.689		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-ES-VOC-6-031607 Sample B

0701477-19 (Air Tube)

3/16/07 8:16

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**2.76**	2.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**10.0**	2.46		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	2.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**14.1**	1.23		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	63.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**7.14**	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	**5.27**	1.63		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**48.7**	1.25		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	**2.12**	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**37.0**	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Classical Chemistry Parameters - Quality Control

Batch B7C0361 - Default Prep GenChem

Method Blank (B7C0361-BLK1) Prepared & Analyzed: 03/22/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	0.0542	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7C0361-SRM1) Prepared & Analyzed: 03/22/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	90.5			% Wt	88.8	NA	102	90-110	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Method Blank (B7C0383-BLK1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0423 J	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.0743	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5a
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.248	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.813*			mg/kg	*0.833*	*NA*	*97.6*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.692*			mg/kg	*0.833*	*NA*	*83.1*	*30-90*			
Surrogate: Terphenyl-d14	*0.969*			mg/kg	*0.833*	*NA*	*116*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Laboratory Control Sample (B7C0383-BS1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	NA	NA	
Pyrene	1.35	0.067	0.010	mg/kg	1.67	NA	80.8	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.706*			mg/kg	*0.833*	*NA*	*84.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.588*			mg/kg	*0.833*	*NA*	*70.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.804*			mg/kg	*0.833*	*NA*	*96.5*	*30-115*			

Laboratory Control Sample Duplicate (B7C0383-BSD1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.25	0.067	0.010	mg/kg	1.66	NA	75.3	50-115	0.797	25	
Pyrene	1.32	0.067	0.010	mg/kg	1.66	NA	79.5	50-130	2.25	25	
Surrogate: 2-Fluorobiphenyl	*0.682*			mg/kg	*0.832*	*NA*	*82.0*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.521*			mg/kg	*0.832*	*NA*	*62.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.795*			mg/kg	*0.832*	*NA*	*95.6*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Method Blank (B7C0324-BLK1) Prepared: 03/21/07 Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	4.28	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	10.6	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	3.04	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	12.8	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	10.7	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*166*			ng/L	*250*	*NA*	*66.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*223*			ng/L	*250*	*NA*	*89.2*	*30-120*			
Surrogate: Terphenyl-d14	*264*			ng/L	*250*	*NA*	*106*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Laboratory Control Sample (B7C0324-BS1) Prepared: 03/21/07 Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	363	50	36	ng/L	500	NA	72.6	70-130	NA	NA	
1-Methylphenanthrene	456	50	18	ng/L	500	NA	91.2	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	380	50	32	ng/L	500	NA	76.0	70-130	NA	NA	
2,6-Dimethylnaphthalene	376	50	35	ng/L	500	NA	75.2	70-130	NA	NA	
2-Methylnaphthalene	331	50	2.8	ng/L	500	NA	66.2	70-130	NA	NA	
Acenaphthene	364	10	1.9	ng/L	500	NA	72.8	43-120	NA	NA	
Acenaphthylene	353	10	2.1	ng/L	500	NA	70.6	70-130	NA	NA	
Anthracene	431	10	5.0	ng/L	500	NA	86.2	70-130	NA	NA	
Benz(a)anthracene	436	10	5.0	ng/L	500	NA	87.2	70-130	NA	NA	
Benzo(a)pyrene	456	10	2.1	ng/L	500	NA	91.2	75-148	NA	NA	
Benzo(b)fluoranthene	435	10	5.0	ng/L	500	NA	87.0	70-130	NA	NA	
Benzo(e)pyrene	450	10	5.0	ng/L	500	NA	90.0	70-130	NA	NA	
Benzo(g,h,i)perylene	491	10	5.6	ng/L	500	NA	98.2	70-130	NA	NA	
Benzo(k)fluoranthene	451	10	5.0	ng/L	500	NA	90.2	70-130	NA	NA	
Biphenyl	374	50	36	ng/L	500	NA	74.8	70-130	NA	NA	
Chrysene	423	10	5.0	ng/L	500	NA	84.6	70-130	NA	NA	
Dibenz(a,h)anthracene	426	10	3.5	ng/L	500	NA	85.2	70-130	NA	NA	
Fluoranthene	468	10	5.0	ng/L	500	NA	93.6	67-130	NA	NA	
Fluorene	386	10	2.1	ng/L	500	NA	77.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	496	10	2.5	ng/L	500	NA	99.2	70-130	NA	NA	
Naphthalene	333	50	1.9	ng/L	500	NA	66.6	70-130	NA	NA	
Perylene	451	20	11	ng/L	500	NA	90.2	70-130	NA	NA	
Phenanthrene	388	10	5.0	ng/L	500	NA	77.6	70-130	NA	NA	
Pyrene	477	10	5.0	ng/L	500	NA	95.4	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*155*			ng/L	*250*	*NA*	*62.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*232*			ng/L	*250*	*NA*	*92.8*	*30-120*			
Surrogate: Terphenyl-d14	*282*			ng/L	*250*	*NA*	*113*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0324 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0324-BSD1) Prepared: 03/21/07 Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	378	50	36	ng/L	500	NA	75.6	70-130	4.05	20	
1-Methylphenanthrene	446	50	18	ng/L	500	NA	89.2	70-130	2.22	20	
2,3,5-Trimethylnaphthalene	376	50	32	ng/L	500	NA	75.2	70-130	1.06	20	
2,6-Dimethylnaphthalene	390	50	35	ng/L	500	NA	78.0	70-130	3.66	20	
2-Methylnaphthalene	350	50	2.8	ng/L	500	NA	70.0	70-130	5.58	20	
Acenaphthene	363	10	1.9	ng/L	500	NA	72.6	43-120	0.275	20	
Acenaphthylene	353	10	2.1	ng/L	500	NA	70.6	70-130	0.00	20	
Anthracene	415	10	5.0	ng/L	500	NA	83.0	70-130	3.78	20	
Benz(a)anthracene	460	10	5.0	ng/L	500	NA	92.0	70-130	5.36	20	
Benzo(a)pyrene	481	10	2.1	ng/L	500	NA	96.2	75-148	5.34	20	
Benzo(b)fluoranthene	468	10	5.0	ng/L	500	NA	93.6	70-130	7.31	20	
Benzo(e)pyrene	475	10	5.0	ng/L	500	NA	95.0	70-130	5.41	20	
Benzo(g,h,i)perylene	536	10	5.6	ng/L	500	NA	107	70-130	8.76	20	
Benzo(k)fluoranthene	481	10	5.0	ng/L	500	NA	96.2	70-130	6.44	20	
Biphenyl	389	50	36	ng/L	500	NA	77.8	70-130	3.93	20	
Chrysene	450	10	5.0	ng/L	500	NA	90.0	70-130	6.19	20	
Dibenz(a,h)anthracene	480	10	3.5	ng/L	500	NA	96.0	70-130	11.9	20	
Fluoranthene	472	10	5.0	ng/L	500	NA	94.4	67-130	0.851	20	
Fluorene	379	10	2.1	ng/L	500	NA	75.8	70-130	1.83	20	
Indeno(1,2,3-cd)pyrene	544	10	2.5	ng/L	500	NA	109	70-130	9.23	20	
Naphthalene	349	50	1.9	ng/L	500	NA	69.8	70-130	4.69	20	
Perylene	474	20	11	ng/L	500	NA	94.8	70-130	4.97	20	
Phenanthrene	376	10	5.0	ng/L	500	NA	75.2	70-130	3.14	20	
Pyrene	480	10	5.0	ng/L	500	NA	96.0	70-130	0.627	20	
Surrogate: 2-Fluorobiphenyl	*171*			ng/L	*250*	*NA*	*68.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*246*			ng/L	*250*	*NA*	*98.4*	*30-120*			
Surrogate: Terphenyl-d14	*291*			ng/L	*250*	*NA*	*116*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0412 - EPA 5035

Method Blank (B7C0412-BLK1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.12	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*23.8*			ug/L	*25.0*	*NA*	*95.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*26.1*			ug/L	*25.0*	*NA*	*104*	*80-120*			
Surrogate: Toluene-d8	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			

Laboratory Control Sample (B7C0412-BS1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.20	0.050	0.0035	mg/kg	1.25	NA	96.0	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.19	0.050	0.0049	mg/kg	1.25	NA	95.2	75-125	NA	NA	
1,4-Dichlorobenzene	1.31	0.050	0.0060	mg/kg	1.25	NA	105	75-125	NA	NA	
Benzene	1.05	0.050	0.0022	mg/kg	1.25	NA	84.0	75-125	NA	NA	
Carbon Tetrachloride	1.28	0.12	0.0028	mg/kg	1.25	NA	102	75-125	NA	NA	
Ethylbenzene	1.36	0.050	0.0053	mg/kg	1.25	NA	109	75-125	NA	NA	
m,p-Xylenes	2.84	0.050	0.0063	mg/kg	2.50	NA	114	75-125	NA	NA	
o-Xylene	1.41	0.050	0.0070	mg/kg	1.25	NA	113	75-125	NA	NA	
sec-Butylbenzene	1.19	0.050	0.0021	mg/kg	1.25	NA	95.2	75-125	NA	NA	
Styrene	1.41	0.050	0.0023	mg/kg	1.25	NA	113	75-125	NA	NA	
Toluene	1.29	0.050	0.0086	mg/kg	1.25	NA	103	75-125	NA	NA	
Trichloroethene	1.40	0.050	0.0037	mg/kg	1.25	NA	112	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*23.4*			ug/L	*25.0*	*NA*	*93.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*28.6*			ug/L	*25.0*	*NA*	*114*	*80-120*			
Surrogate: Dibromofluoromethane	*26.3*			ug/L	*25.0*	*NA*	*105*	*80-120*			
Surrogate: Toluene-d8	*26.4*			ug/L	*25.0*	*NA*	*106*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0412 - EPA 5035

Laboratory Control Sample Duplicate (B7C0412-BSD1)

Prepared & Analyzed: 03/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.15	0.050	0.0035	mg/kg	1.25	NA	92.0	75-125	4.26	20	
1,3,5-Trimethylbenzene	1.15	0.050	0.0049	mg/kg	1.25	NA	92.0	75-125	3.42	20	
1,4-Dichlorobenzene	1.27	0.050	0.0060	mg/kg	1.25	NA	102	75-125	3.10	20	
Benzene	1.03	0.050	0.0022	mg/kg	1.25	NA	82.4	75-125	1.92	20	
Carbon Tetrachloride	1.24	0.12	0.0028	mg/kg	1.25	NA	99.2	75-125	3.17	20	
Ethylbenzene	1.31	0.050	0.0053	mg/kg	1.25	NA	105	75-125	3.75	20	
m,p-Xylenes	2.74	0.050	0.0063	mg/kg	2.50	NA	110	75-125	3.58	20	
o-Xylene	1.34	0.050	0.0070	mg/kg	1.25	NA	107	75-125	5.09	20	
sec-Butylbenzene	1.15	0.050	0.0021	mg/kg	1.25	NA	92.0	75-125	3.42	20	
Styrene	1.36	0.050	0.0023	mg/kg	1.25	NA	109	75-125	3.61	20	
Toluene	1.25	0.050	0.0086	mg/kg	1.25	NA	100	75-125	3.15	20	
Trichloroethene	1.37	0.050	0.0037	mg/kg	1.25	NA	110	75-125	2.17	20	
Surrogate: 1,2-Dichloroethane-d4	*23.8*			ug/L	*25.0*	*NA*	*95.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*28.4*			ug/L	*25.0*	*NA*	*114*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*26.2*			ug/L	*25.0*	*NA*	*105*	*80-120*			

Batch B7C0447 - EPA 5030B

Method Blank (B7C0447-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.6*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Dibromofluoromethane	*27.3*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Toluene-d8	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0447 - EPA 5030B

Laboratory Control Sample (B7C0447-BS1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.1	1.0	0.030	ug/L	25.0	NA	88.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	22.1	1.0	0.039	ug/L	25.0	NA	88.4	75-125	NA	NA	
1,4-Dichlorobenzene	24.5	1.0	0.051	ug/L	25.0	NA	98.0	75-125	NA	NA	
Benzene	23.1	1.0	0.042	ug/L	25.0	NA	92.4	75-125	NA	NA	
Carbon Tetrachloride	23.3	2.5	0.050	ug/L	25.0	NA	93.2	75-125	NA	NA	
Ethylbenzene	25.3	1.0	0.036	ug/L	25.0	NA	101	75-125	NA	NA	
m,p-Xylenes	51.5	1.0	0.059	ug/L	50.0	NA	103	75-125	NA	NA	
o-Xylene	25.4	1.0	0.072	ug/L	25.0	NA	102	75-125	NA	NA	
sec-Butylbenzene	22.3	1.0	0.027	ug/L	25.0	NA	89.2	75-125	NA	NA	
Styrene	25.5	1.0	0.049	ug/L	25.0	NA	102	75-125	NA	NA	
Toluene	24.7	1.0	0.048	ug/L	25.0	NA	98.8	75-125	NA	NA	
Trichloroethene	26.6	1.0	0.067	ug/L	25.0	NA	106	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.5*			ug/L	*25.0*	*NA*	*110*	*80-120*			
Surrogate: Dibromofluoromethane	*27.4*			ug/L	*25.0*	*NA*	*110*	*80-120*			
Surrogate: Toluene-d8	*25.7*			ug/L	*25.0*	*NA*	*103*	*80-120*			

Laboratory Control Sample Duplicate (B7C0447-BSD1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	21.7	1.0	0.030	ug/L	25.0	NA	86.8	75-125	1.83	20	
1,3,5-Trimethylbenzene	21.6	1.0	0.039	ug/L	25.0	NA	86.4	75-125	2.29	20	
1,4-Dichlorobenzene	23.7	1.0	0.051	ug/L	25.0	NA	94.8	75-125	3.32	20	
Benzene	22.9	1.0	0.042	ug/L	25.0	NA	91.6	75-125	0.870	20	
Carbon Tetrachloride	23.3	2.5	0.050	ug/L	25.0	NA	93.2	75-125	0.00	20	
Ethylbenzene	24.8	1.0	0.036	ug/L	25.0	NA	99.2	75-125	2.00	20	
m,p-Xylenes	50.6	1.0	0.059	ug/L	50.0	NA	101	75-125	1.76	20	
o-Xylene	25.0	1.0	0.072	ug/L	25.0	NA	100	75-125	1.59	20	
sec-Butylbenzene	21.9	1.0	0.027	ug/L	25.0	NA	87.6	75-125	1.81	20	
Styrene	25.3	1.0	0.049	ug/L	25.0	NA	101	75-125	0.787	20	
Toluene	24.0	1.0	0.048	ug/L	25.0	NA	96.0	75-125	2.87	20	
Trichloroethene	26.3	1.0	0.067	ug/L	25.0	NA	105	75-125	1.13	20	
Surrogate: 1,2-Dichloroethane-d4	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.7*			ug/L	*25.0*	*NA*	*111*	*80-120*			
Surrogate: Dibromofluoromethane	*27.4*			ug/L	*25.0*	*NA*	*110*	*80-120*			
Surrogate: Toluene-d8	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample (B7C0442-BS1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	89500	2940	2940	ug/m³	110000	NA	81.4	75-125	NA	NA	
Xylenes, Total	284000	2990	2990	ug/m³	337000	NA	84.3	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	101000	2970	2970	ug/m³	99100	NA	102	75-125	NA	NA	
Styrene	104000	3920	3920	ug/m³	131000	NA	79.4	75-125	NA	NA	
Toluene	102000	3020	3020	ug/m³	101000	NA	101	75-125	NA	NA	
Trichloroethene	102000	2990	2990	ug/m³	99800	NA	102	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	84100	6050	6050	ug/m³	90200	NA	93.2	75-125	NA	NA	
1,2,4-Trimethylbenzene	87700	5930	5930	ug/m³	91600	NA	95.7	75-125	NA	NA	
1,3,5-Trimethylbenzene	85900	2880	2880	ug/m³	94100	NA	91.3	75-125	NA	NA	
1,4-Dichlorobenzene	60200	6940	6940	ug/m³	65400	NA	92.0	75-125	NA	NA	
Carbon Tetrachloride	92000	30600	3060	ug/m³	102000	NA	90.2	75-125	NA	NA	
sec-Butylbenzene	96200	2940	2940	ug/m³	97000	NA	99.2	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7C0442-BSD1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	2940	2940	ug/m³	110000	NA	90.0	75-125	10.1	20	
Xylenes, Total	317000	2990	2990	ug/m³	337000	NA	94.1	75-125	11.0	20	

Laboratory Control Sample Duplicate (B7C0442-BSD2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	104000	2970	2970	ug/m³	99100	NA	105	75-125	2.93	20	
Styrene	121000	3920	3920	ug/m³	131000	NA	92.4	75-125	15.1	20	
Toluene	104000	3020	3020	ug/m³	101000	NA	103	75-125	1.94	20	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	1.94	20	

Laboratory Control Sample Duplicate (B7C0442-BSD3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	96100	6050	6050	ug/m³	90200	NA	107	75-125	13.3	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7C0442-BSD3)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	98800	5930	5930	ug/m³	91600	NA	108	75-125	11.9	20	
1,3,5-Trimethylbenzene	95500	2880	2880	ug/m³	94100	NA	101	75-125	10.6	20	
1,4-Dichlorobenzene	68900	6940	6940	ug/m³	65400	NA	105	75-125	13.5	20	
Carbon Tetrachloride	108000	30600	3060	ug/m³	102000	NA	106	75-125	16.0	20	
sec-Butylbenzene	107000	2940	2940	ug/m³	97000	NA	110	75-125	10.6	20	

Batch B7C0475 - AIRTUBES Prep

Laboratory Control Sample (B7C0475-BS1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27900	0.00		ug/m³	28200	NA	98.9	70-130	NA	NA	
2-Methylnaphthalene filter	28100	0.00		ug/m³	28200	NA	99.6	70-130	NA	NA	
Acenaphthene filter	25900	0.00		ug/m³	26000	NA	99.6	70-130	NA	NA	
Acenaphthylene filter	26000	0.00		ug/m³	25700	NA	101	70-130	NA	NA	
Anthracene filter	26200	0.00		ug/m³	25100	NA	104	70-130	NA	NA	
Benz(a)anthracene filter	25800	0.00		ug/m³	25600	NA	101	70-130	NA	NA	
Benzo(a)pyrene filter	25100	0.00		ug/m³	25300	NA	99.2	70-130	NA	NA	
Benzo(b)fluoranthene filter	25700	0.00		ug/m³	25300	NA	102	70-130	NA	NA	
Benzo(g,h,i)perylene filter	17700	0.00		ug/m³	25800	NA	68.6	70-130	NA	NA	
Benzo(k)fluoranthene filter	24500	0.00		ug/m³	25400	NA	96.5	70-130	NA	NA	
Chrysene filter	23400	0.00		ug/m³	25400	NA	92.1	70-130	NA	NA	
Dibenz(a,h)anthracene filter	15400	0.00		ug/m³	25100	NA	61.4	70-130	NA	NA	
Fluoranthene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	27300	0.00		ug/m³	26800	NA	102	70-130	NA	NA	
Naphthalene filter	26200	0.00		ug/m³	28100	NA	93.2	70-130	NA	NA	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Pyrene filter	26500	0.00		ug/m³	25600	NA	104	70-130	NA	NA	
1-Methylnaphthalene	25100	1590		ug/m³	26600	NA	94.4	70-130	NA	NA	
2-Methylnaphthalene	25100	1590		ug/m³	26400	NA	95.1	70-130	NA	NA	
Acenaphthene	25500	3310		ug/m³	27600	NA	92.4	70-130	NA	NA	
Acenaphthylene	23800	3050		ug/m³	25500	NA	93.3	70-130	NA	NA	
Anthracene	26100	3300		ug/m³	27500	NA	94.9	70-130	NA	NA	
Benz(a)anthracene	25600	1790		ug/m³	29800	NA	85.9	70-130	NA	NA	
Benzo(a)pyrene	24700	1890		ug/m³	31500	NA	78.4	70-130	NA	NA	
Benzo(b)fluoranthene	26000	1870		ug/m³	31200	NA	83.3	70-130	NA	NA	
Benzo(g,h,i)perylene	17100	4620		ug/m³	38500	NA	44.4	70-130	NA	NA	
Benzo(k)fluoranthene	24200	1890		ug/m³	31600	NA	76.6	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0475 - AIRTUBES Prep

Laboratory Control Sample (B7C0475-BS1)

Prepared: 03/29/07 Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chrysene	22300	1800		ug/m³	29900	NA	74.6	70-130	NA	NA	
Dibenz(a,h)anthracene	14200	19300		ug/m³	32100	NA	44.2	70-130	NA	NA	
Fluoranthene	26000	3420		ug/m³	28500	NA	91.2	70-130	NA	NA	
Fluorene	25800	3250		ug/m³	27100	NA	95.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	24700	2030		ug/m³	33900	NA	72.9	70-130	NA	NA	
Naphthalene	25500	1660		ug/m³	27700	NA	92.1	70-130	NA	NA	
Phenanthrene	25900	3320		ug/m³	27700	NA	93.5	70-130	NA	NA	
Pyrene	25800	3480		ug/m³	29000	NA	89.0	70-130	NA	NA	

Laboratory Control Sample Duplicate (B7C0475-BSD1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27300	0.00		ug/m³	28200	NA	96.8	70-130	2.17	20	
2-Methylnaphthalene filter	27400	0.00		ug/m³	28200	NA	97.2	70-130	2.52	20	
Acenaphthene filter	25600	0.00		ug/m³	26000	NA	98.5	70-130	1.17	20	
Acenaphthylene filter	25800	0.00		ug/m³	25700	NA	100	70-130	0.772	20	
Anthracene filter	26000	0.00		ug/m³	25100	NA	104	70-130	0.766	20	
Benz(a)anthracene filter	25900	0.00		ug/m³	25600	NA	101	70-130	0.387	20	
Benzo(a)pyrene filter	25300	0.00		ug/m³	25300	NA	100	70-130	0.794	20	
Benzo(b)fluoranthene filter	25800	0.00		ug/m³	25300	NA	102	70-130	0.388	20	
Benzo(g,h,i)perylene filter	18700	0.00		ug/m³	25800	NA	72.5	70-130	5.49	20	
Benzo(k)fluoranthene filter	24900	0.00		ug/m³	25400	NA	98.0	70-130	1.62	20	
Chrysene filter	23800	0.00		ug/m³	25400	NA	93.7	70-130	1.69	20	
Dibenz(a,h)anthracene filter	16700	0.00		ug/m³	25100	NA	66.5	70-130	8.10	20	
Fluoranthene filter	26400	0.00		ug/m³	25500	NA	104	70-130	0.380	20	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	0.00	20	
Indeno(1,2,3-cd)pyrene filter	27300	0.00		ug/m³	26800	NA	102	70-130	0.00	20	
Naphthalene filter	25500	0.00		ug/m³	28100	NA	90.7	70-130	2.71	20	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	0.00	20	
Pyrene filter	26400	0.00		ug/m³	25600	NA	103	70-130	0.378	20	
1-Methylnaphthalene	24800	1590		ug/m³	26600	NA	93.2	70-130	1.20	20	
2-Methylnaphthalene	24900	1590		ug/m³	26400	NA	94.3	70-130	0.800	20	
Acenaphthene	24900	3310		ug/m³	27600	NA	90.2	70-130	2.38	20	
Acenaphthylene	23500	3050		ug/m³	25500	NA	92.2	70-130	1.27	20	
Anthracene	25100	3300		ug/m³	27500	NA	91.3	70-130	3.91	20	
Benz(a)anthracene	23600	1790		ug/m³	29800	NA	79.2	70-130	8.13	20	
Benzo(a)pyrene	21000	1890		ug/m³	31500	NA	66.7	70-130	16.2	20	
Benzo(b)fluoranthene	22900	1870		ug/m³	31200	NA	73.4	70-130	12.7	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0475 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7C0475-BSD1)

Prepared: 03/29/07 Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzo(g,h,i)perylene	13900	4620		ug/m³	38500	NA	36.1	70-130	20.6	20	
Benzo(k)fluoranthene	21700	1890		ug/m³	31600	NA	68.7	70-130	10.9	20	
Chrysene	20900	1800		ug/m³	29900	NA	69.9	70-130	6.48	20	
Dibenz(a,h)anthracene	12200	19300		ug/m³	32100	NA	38.0	70-130	15.2	20	
Fluoranthene	24600	3420		ug/m³	28500	NA	86.3	70-130	5.53	20	
Fluorene	25200	3250		ug/m³	27100	NA	93.0	70-130	2.35	20	
Indeno(1,2,3-cd)pyrene	20200	2030		ug/m³	33900	NA	59.6	70-130	20.0	20	
Naphthalene	25500	1660		ug/m³	27700	NA	92.1	70-130	0.00	20	
Phenanthrene	25000	3320		ug/m³	27700	NA	90.3	70-130	3.54	20	
Pyrene	24100	3480		ug/m³	29000	NA	83.1	70-130	6.81	20	

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample (B7D0057-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27600	0.00		ug/m³	28200	NA	97.9	70-130	NA	NA	
2-Methylnaphthalene filter	27700	0.00		ug/m³	28200	NA	98.2	70-130	NA	NA	
Acenaphthene filter	25000	0.00		ug/m³	26000	NA	96.2	70-130	NA	NA	
Acenaphthylene filter	24900	0.00		ug/m³	25700	NA	96.9	70-130	NA	NA	
Anthracene filter	24600	0.00		ug/m³	25100	NA	98.0	70-130	NA	NA	
Benz(a)anthracene filter	24600	0.00		ug/m³	25600	NA	96.1	70-130	NA	NA	
Benzo(a)pyrene filter	24400	0.00		ug/m³	25300	NA	96.4	70-130	NA	NA	
Benzo(b)fluoranthene filter	24300	0.00		ug/m³	25300	NA	96.0	70-130	NA	NA	
Benzo(g,h,i)perylene filter	26900	0.00		ug/m³	25800	NA	104	70-130	NA	NA	
Benzo(k)fluoranthene filter	24600	0.00		ug/m³	25400	NA	96.9	70-130	NA	NA	
Chrysene filter	23800	0.00		ug/m³	25400	NA	93.7	70-130	NA	NA	
Dibenz(a,h)anthracene filter	32700	0.00		ug/m³	25100	NA	130	70-130	NA	NA	
Fluoranthene filter	24500	0.00		ug/m³	25500	NA	96.1	70-130	NA	NA	
Fluorene filter	24500	0.00		ug/m³	25600	NA	95.7	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	25800	0.00		ug/m³	26800	NA	96.3	70-130	NA	NA	
Naphthalene filter	26700	0.00		ug/m³	28100	NA	95.0	70-130	NA	NA	
Phenanthrene filter	24400	0.00		ug/m³	25500	NA	95.7	70-130	NA	NA	
Pyrene filter	24600	0.00		ug/m³	25600	NA	96.1	70-130	NA	NA	
1-Methylnaphthalene	25700	1590		ug/m³	26600	NA	96.6	70-130	NA	NA	
2-Methylnaphthalene	25700	1590		ug/m³	26400	NA	97.3	70-130	NA	NA	
Acenaphthene	26100	3310		ug/m³	27600	NA	94.6	70-130	NA	NA	
Acenaphthylene	26600	3050		ug/m³	25500	NA	104	70-130	NA	NA	
Anthracene	26400	3300		ug/m³	27500	NA	96.0	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample (B7D0057-BS1) Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benz(a)anthracene	27200	1790		ug/m³	29800	NA	91.3	70-130	NA	NA	
Benzo(a)pyrene	27200	1890		ug/m³	31500	NA	86.3	70-130	NA	NA	
Benzo(b)fluoranthene	27600	1870		ug/m³	31200	NA	88.5	70-130	NA	NA	
Benzo(g,h,i)perylene	36600	4620		ug/m³	38500	NA	95.1	70-130	NA	NA	
Benzo(k)fluoranthene	28100	1890		ug/m³	31600	NA	88.9	70-130	NA	NA	
Chrysene	26400	1800		ug/m³	29900	NA	88.3	70-130	NA	NA	
Dibenz(a,h)anthracene	37400	19300		ug/m³	32100	NA	117	70-130	NA	NA	
Fluoranthene	26500	3420		ug/m³	28500	NA	93.0	70-130	NA	NA	
Fluorene	25800	3250		ug/m³	27100	NA	95.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	28600	2030		ug/m³	33900	NA	84.4	70-130	NA	NA	
Naphthalene	26100	1660		ug/m³	27700	NA	94.2	70-130	NA	NA	
Phenanthrene	26100	3320		ug/m³	27700	NA	94.2	70-130	NA	NA	
Pyrene	26000	3480		ug/m³	29000	NA	89.7	70-130	NA	NA	

Laboratory Control Sample Duplicate (B7D0057-BSD1) Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27800	0.00		ug/m³	28200	NA	98.6	70-130	0.722	20	
2-Methylnaphthalene filter	27900	0.00		ug/m³	28200	NA	98.9	70-130	0.719	20	
Acenaphthene filter	25400	0.00		ug/m³	26000	NA	97.7	70-130	1.59	20	
Acenaphthylene filter	24800	0.00		ug/m³	25700	NA	96.5	70-130	0.402	20	
Anthracene filter	25300	0.00		ug/m³	25100	NA	101	70-130	2.81	20	
Benz(a)anthracene filter	25300	0.00		ug/m³	25600	NA	98.8	70-130	2.81	20	
Benzo(a)pyrene filter	25000	0.00		ug/m³	25300	NA	98.8	70-130	2.43	20	
Benzo(b)fluoranthene filter	24900	0.00		ug/m³	25300	NA	98.4	70-130	2.44	20	
Benzo(g,h,i)perylene filter	28400	0.00		ug/m³	25800	NA	110	70-130	5.42	20	
Benzo(k)fluoranthene filter	25100	0.00		ug/m³	25400	NA	98.8	70-130	2.01	20	
Chrysene filter	24400	0.00		ug/m³	25400	NA	96.1	70-130	2.49	20	
Dibenz(a,h)anthracene filter	33700	0.00		ug/m³	25100	NA	134	70-130	3.01	20	
Fluoranthene filter	25100	0.00		ug/m³	25500	NA	98.4	70-130	2.42	20	
Fluorene filter	25100	0.00		ug/m³	25600	NA	98.0	70-130	2.42	20	
Indeno(1,2,3-cd)pyrene filter	26400	0.00		ug/m³	26800	NA	98.5	70-130	2.30	20	
Naphthalene filter	26900	0.00		ug/m³	28100	NA	95.7	70-130	0.746	20	
Phenanthrene filter	25100	0.00		ug/m³	25500	NA	98.4	70-130	2.83	20	
Pyrene filter	25300	0.00		ug/m³	25600	NA	98.8	70-130	2.81	20	
1-Methylnaphthalene	24400	1590		ug/m³	26600	NA	91.7	70-130	5.19	20	
2-Methylnaphthalene	24500	1590		ug/m³	26400	NA	92.8	70-130	4.78	20	
Acenaphthene	24400	3310		ug/m³	27600	NA	88.4	70-130	6.73	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0057-BSD1) Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthylene	24800	3050		ug/m³	25500	NA	97.3	70-130	7.00	20	
Anthracene	24300	3300		ug/m³	27500	NA	88.4	70-130	8.28	20	
Benz(a)anthracene	24000	1790		ug/m³	29800	NA	80.5	70-130	12.5	20	
Benzo(a)pyrene	22600	1890		ug/m³	31500	NA	71.7	70-130	18.5	20	
Benzo(b)fluoranthene	23700	1870		ug/m³	31200	NA	76.0	70-130	15.2	20	
Benzo(g,h,i)perylene	29700	4620		ug/m³	38500	NA	77.1	70-130	20.8	20	
Benzo(k)fluoranthene	24100	1890		ug/m³	31600	NA	76.3	70-130	15.3	20	
Chrysene	23200	1800		ug/m³	29900	NA	77.6	70-130	12.9	20	
Dibenz(a,h)anthracene	29900	19300		ug/m³	32100	NA	93.1	70-130	22.3	20	
Fluoranthene	24200	3420		ug/m³	28500	NA	84.9	70-130	9.07	20	
Fluorene	24400	3250		ug/m³	27100	NA	90.0	70-130	5.58	20	
Indeno(1,2,3-cd)pyrene	23200	2030		ug/m³	33900	NA	68.4	70-130	20.8	20	
Naphthalene	25000	1660		ug/m³	27700	NA	90.3	70-130	4.31	20	
Phenanthrene	24200	3320		ug/m³	27700	NA	87.4	70-130	7.55	20	
Pyrene	23000	3480		ug/m³	29000	NA	79.3	70-130	12.2	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701477
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701477

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of 1

REPORT RESULTS TO
Contact Name Hubert Huls
Project ID/Name Ashland NSP
P.O. #/Project #
Company URS Corp.
Mailing Address 700 3rd St. So. Suite 600
City, State, Zip Minneapolis, MN
Telephone # (612) 370-0700
Fax # (612) 373-6800
E-mail hubert_huls@urscorp.com

SEND INVOICE TO
Contact Name
Company
Address Same
City, State, Zip
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAHs SIM	VOCs	TOC	FOR LAB USE ONLY
1	NSP-1-ES-PAH-2-031507	03/15/07	12:08	Air	301.2 L	3	N	X			0701477-1
2	NSP-1-ES-VOC-2-031507		12:08		301.2 L	2	N		X		-2
3	NSP-1-ES-PAH-5-031507		16:11		602.4 L	3	N	X			-3
4	NSP-1-ES-VOC-5-031507	03/15/07	16:11		602.4 L	2	N		X		-4
5	NSP-1-ES-PAH-6-031607	03/16/07	08:16		2409.6 L	3	N	X			-5
6	NSP-1-ES-VOC-6-031607	03/16/07	08:16	Air	2409.6 L	2	N		X		-6
7	NSP-1-ES-PAH-3-031607	~~03/16/07~~ 03/15/07	08:25	Soil		2	N	X			-7
8	NSP-1-ES-TOC-3-031607	03/16/07	08:25	Soil		1	N			X	-8
9	NSP-1-ES-VOC-3-031607		08:30	Soil		2	N		X		-9
10	NSP-1-ES-PAH-4-031607		09:05	water		3	N	X			-10
11	NSP-1-ES-VOC-4-031607	03/16/07	09:05	Water		3	N		X		-11
12	Trip Blank (MeOH)					1					-12
13	Trip Blanks (HCl)					2					-13
14	Temperature Blank					1					
15											

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/16/07 09:15
Received by: [signature] Date/Time 3/16/07 0915
Relinquished by: [signature] Date/Time 03/16/07 1020
Received Contents Not Verified: [signature] Date/Time 3/16/07 10:20
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☒ Yes ☐ No
Temp Blank ☒ Yes ☐ No
Temp: 2.5 °C
Comments:

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC CS02 Effective Date: 11/17/06

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

April 30, 2007

Work Order #: 0701544
(Revised)

RE: Ashland/NSP
25688375.75000

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 20, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Qualifiers and Abbreviations

vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
ts	This analysis was performed by a subcontract laboratory.
sk	The surrogate recovery is outside of laboratory control limits due to matrix interference.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
ib	Unidentified compounds are present in the sample.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
A5	The MDL value for this analyte is an estimated value; no statistical value has been determined.
A2	The Laboratory Control Sample Duplicate has a recovery of 68.4%, which is below the laboratory limtis of 70-130%.
A1a	The Laboratory Control Sample Duplicate for the filters was 134%, which is outside the laboratory limits of 70-130%.
A1	The calibration check solutions failed high (118,138,&126%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit
NA	Not Applicable
ND	Analyte NOT DETECTED
NR	Not Reported
%Rec	Percent Recovery
RPD	Relative Percent Difference
VOC	Volatile Organic Compound

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-2-ES-PAH-1-031907	0701544-01	Soil	03/19/07 10:00	03/20/07 12:43
NSP-2-ES-TOC-1-031907	0701544-02	Soil	03/19/07 10:00	03/20/07 12:43
NSP-2-ES-TOC-1-031907-Dup	0701544-03	Soil	03/19/07 10:00	03/20/07 12:43
NSP-2-ES-VOC-1-031907	0701544-04	Soil	03/19/07 10:10	03/20/07 12:43
NSP-2-ES-PAH-2-031907 Front	0701544-05	Air Tube	03/19/07 12:07	03/20/07 12:43
NSP-2-ES-VOC-2-031907 Front	0701544-07	Air Tube	03/19/07 12:07	03/20/07 12:43
NSP-2-ES-PAH-5-031907 Front	0701544-09	Air Tube	03/19/07 16:10	03/20/07 12:43
NSP-2-ES-VOC-5-031907 Front	0701544-11	Air Tube	03/19/07 16:10	03/20/07 12:43
NSP-2-ES-PAH-6-032007 Front	0701544-13	Air Tube	03/20/07 08:15	03/20/07 12:43
NSP-2-ES-VOC-6-032007 Front	0701544-15	Air Tube	03/20/07 08:15	03/20/07 12:43
NSP-2-ES-TOC-3-032007	0701544-17	Soil	03/20/07 08:25	03/20/07 12:43
NSP-2-ES-PAH-3-032007	0701544-18	Soil	03/20/07 08:25	03/20/07 12:43
NSP-2-ES-VOC-3-032007	0701544-19	Soil	03/20/07 08:25	03/20/07 12:43
NSP-2-10M-PAH-1-032007	0701544-20	Soil	03/20/07 09:45	03/20/07 12:43
NSP-2-10M-VOC-1-032007	0701544-21	Soil	03/20/07 10:00	03/20/07 12:43
NSP-2-10M-TSS-7-032007	0701544-22	Slurry	03/20/07 10:25	03/20/07 12:43
NSP-2-10M-TOC-7-032007	0701544-23	Slurry	03/20/07 10:25	03/20/07 12:43
Trip Blank	0701544-24	Soil	03/19/07 00:00	03/20/07 12:43

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	2.9 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-PAH-1-031907

0701544-01 (Soil)

3/19/07 10:00

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**66**	0.050	0.010	% Wt	B7C0419	3/26/07	3/26/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**320**	19	3.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**44**	3.8	0.45	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**53**	3.8	0.45	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**170**	19	2.8	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**450**	19	6.5	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**280**	19	2.8	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**25**	3.8	0.39	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Anthracene	**130**	3.8	0.56	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**47**	3.8	0.56	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(a)pyrene	**39**	3.8	0.45	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(b)fluoranthene	**19**	3.8	0.96	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(e)pyrene	**23**	3.8	0.56	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**11**	3.8	0.34	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(k)fluoranthene	**27**	3.8	0.79	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Biphenyl	**50**	3.8	0.67	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Chrysene	**50**	3.8	0.56	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Dibenz(a,h)anthracene	**4.1**	3.8	1.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluoranthene	**140**	3.8	0.39	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**140**	3.8	0.22	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**10**	3.8	0.51	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Naphthalene	**530**	19	1.4	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**5.7**	3.8	0.62	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Phenanthrene	**370**	19	2.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**110**	3.8	0.56	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*101 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*66.3 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*67.4 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-TOC-1-031907

0701544-02 (Soil)

3/19/07 10:00

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**26000**	500		mg/kg	B7C0470	3/28/07	3/28/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-TOC-1-031907-Dup

0701544-03 (Soil)

3/19/07 10:00

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**18200**	500		mg/kg	B7C0470	3/28/07	3/28/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-VOC-1-031907

0701544-04 (Soil)

3/19/07 10:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**69**	0.050	0.010	% Wt	B7C0419	3/26/07	3/26/07	EPA 3545, 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**8.2**	3.6	0.12	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**19**	3.6	0.26	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	**5.0**	3.6	0.36	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	3.6	0.44	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Benzene	**4.7**	3.6	0.16	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	3.6	0.20	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Ethylbenzene	**39**	3.6	0.39	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
m,p-Xylenes	**26**	3.6	0.46	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
o-Xylene	**13**	3.6	0.51	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	3.6	0.15	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Styrene	ND	3.6	0.17	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Toluene	**16**	3.6	0.63	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Trichloroethene	ND	3.6	0.27	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*99.2 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*106 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*108 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-PAH-2-031907 Front

0701544-05 (Air Tube)

3/19/07 12:07

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Chrysene	ND	5.96		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	A1a, gp
Fluoranthene	ND	11.4		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	A2, gp
Naphthalene	ND	5.52		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-VOC-2-031907 Front

0701544-07 (Air Tube)

3/19/07 12:07

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	20.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	ND	19.7		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	23.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**34.3**	9.87		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	508		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**15.4**	9.76		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**84.6**	10.0		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**64.7**	9.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-PAH-5-031907 Front

0701544-09 (Air Tube)

3/19/07 16:10

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Chrysene	ND	2.98		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	A1a, gp
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	A2, gp
Naphthalene	**5.50**	2.76		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/3/07	4/3/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-VOC-5-031907 Front

0701544-11 (Air Tube)

3/19/07 16:10

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	ND	9.85		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**13.3**	4.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	254		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**5.81**	4.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**35.4**	5.02		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	4.97		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**26.4**	4.97		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-PAH-6-032007 Front

0701544-13 (Air Tube)

3/20/07 8:15

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	0.662		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
2-Methylnaphthalene	ND	0.658		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Chrysene	ND	0.746		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A1a, gp
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A2, gp
Naphthalene	**6.04**	0.689		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-VOC-6-032007 Front

0701544-15 (Air Tube)

3/20/07 8:15

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**2.85**	2.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**9.14**	2.46		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	**3.00**	1.20		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	2.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**12.7**	1.23		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	63.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**6.38**	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	**3.69**	1.63		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**37.0**	1.25		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**32.2**	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-TOC-3-032007

0701544-17 (Soil)

3/20/07 8:25

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**16400**	500		mg/kg	B7C0470	3/28/07	3/28/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-PAH-3-032007

0701544-18 (Soil)

3/20/07 8:25

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**80**	0.050	0.010	% Wt	B7C0419	3/26/07	3/26/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**350**	21	3.4	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**43**	2.1	0.25	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**55**	2.1	0.25	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**200**	21	3.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**490**	21	7.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**320**	21	3.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**23**	2.1	0.22	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Anthracene	**150**	21	3.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**48**	2.1	0.31	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(a)pyrene	**40**	2.1	0.25	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(b)fluoranthene	**21**	2.1	0.53	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(e)pyrene	**23**	2.1	0.31	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**9.2**	2.1	0.19	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(k)fluoranthene	**29**	2.1	0.44	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Biphenyl	**46**	2.1	0.38	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Chrysene	**50**	2.1	0.31	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Dibenz(a,h)anthracene	**3.5**	2.1	0.66	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluoranthene	**130**	21	2.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**210**	21	1.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**8.6**	2.1	0.28	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Naphthalene	**510**	21	1.6	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**5.9**	2.1	0.34	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Phenanthrene	**420**	21	2.5	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**81**	2.1	0.31	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*109 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	*sk*
Surrogate: Nitrobenzene-d5	*72.8 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*73.8 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-ES-VOC-3-032007

0701544-19 (Soil)

3/20/07 8:25

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**78**	0.050	0.010	% Wt	B7C0419	3/26/07	3/26/07	EPA 3545, 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**11**	3.2	0.10	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**28**	3.2	0.22	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	**7.5**	3.2	0.31	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	3.2	0.38	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Benzene	**3.5**	3.2	0.14	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	3.2	0.18	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Ethylbenzene	**48**	3.2	0.34	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
m,p-Xylenes	**32**	3.2	0.40	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
o-Xylene	**16**	3.2	0.45	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	3.2	0.13	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Styrene	ND	3.2	0.15	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Toluene	**16**	3.2	0.55	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Trichloroethene	ND	3.2	0.24	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*105 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*108 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-10M-PAH-1-032007

0701544-20 (Soil)

3/20/07 9:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**72**	0.050	0.010	% Wt	B7C0419	3/26/07	3/26/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**310**	17	2.8	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**64**	3.5	0.41	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**49**	3.5	0.41	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**170**	17	2.6	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**440**	17	5.9	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**270**	17	2.6	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**23**	3.5	0.36	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Anthracene	**130**	3.5	0.52	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**43**	3.5	0.52	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(a)pyrene	**35**	3.5	0.41	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(b)fluoranthene	**18**	3.5	0.88	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(e)pyrene	**21**	3.5	0.52	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**9.6**	3.5	0.31	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(k)fluoranthene	**24**	3.5	0.72	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Biphenyl	**45**	3.5	0.62	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Chrysene	**45**	3.5	0.52	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Dibenz(a,h)anthracene	**3.6**	3.5	1.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluoranthene	**120**	3.5	0.36	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**130**	3.5	0.21	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**8.8**	3.5	0.46	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Naphthalene	**520**	17	1.3	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**5.3**	3.5	0.57	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Phenanthrene	**360**	17	2.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**97**	3.5	0.52	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*93.0 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*59.9 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*51.9 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-10M-VOC-1-032007

0701544-21 (Soil)

3/20/07 10:00

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**72**	0.050	0.010	% Wt	B7C0419	3/26/07	3/26/07	EPA 3545, 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**8.9**	3.5	0.11	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**21**	3.5	0.24	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	**5.7**	3.5	0.34	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	3.5	0.42	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Benzene	**5.3**	3.5	0.15	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	3.5	0.19	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Ethylbenzene	**43**	3.5	0.37	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
m,p-Xylenes	**28**	3.5	0.44	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
o-Xylene	**14**	3.5	0.49	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	3.5	0.15	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Styrene	ND	3.5	0.16	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Toluene	**18**	3.5	0.60	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Trichloroethene	ND	3.5	0.26	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*105 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*107 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-10M-TSS-7-032007

0701544-22 (Slurry)

3/20/07 10:25

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**9900**	10	3.6	mg/L	B7C0413	3/26/07	3/26/07	EPA 160.2	
Total Solids	**9500**	20	1.0	mg/L	B7C0438	3/27/07	3/27/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

NSP-2-10M-TOC-7-032007

0701544-23 (Slurry)

3/20/07 10:25

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**580**	1.0	1.0	mg/L	B7D0019	3/29/07	3/29/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Trip Blank

0701544-24 (Soil)

3/19/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*104 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*111 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Classical Chemistry Parameters - Quality Control

Batch B7C0413 - Default Prep GenChem

Method Blank (B7C0413-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7C0413-BS1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	255			mg/L	250	NA	102	80-120	NA	NA	

Batch B7C0419 - Default Prep GenChem

Method Blank (B7C0419-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7C0419-SRM1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	90.0			% Wt	88.8	NA	101	90-110	NA	NA	

Batch B7C0438 - Default Prep GenChem

Method Blank (B7C0438-BLK1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Method Blank (B7C0383-BLK1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0423 J	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.0743	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.248	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.813*			mg/kg	*0.833*	*NA*	*97.6*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.692*			mg/kg	*0.833*	*NA*	*83.1*	*30-90*			
Surrogate: Terphenyl-d14	*0.969*			mg/kg	*0.833*	*NA*	*116*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Laboratory Control Sample (B7C0383-BS1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	NA	NA	
Pyrene	1.35	0.067	0.010	mg/kg	1.67	NA	80.8	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.706*			mg/kg	*0.833*	*NA*	*84.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.588*			mg/kg	*0.833*	*NA*	*70.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.804*			mg/kg	*0.833*	*NA*	*96.5*	*30-115*			

Laboratory Control Sample Duplicate (B7C0383-BSD1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.25	0.067	0.010	mg/kg	1.66	NA	75.3	50-115	0.797	25	
Pyrene	1.32	0.067	0.010	mg/kg	1.66	NA	79.5	50-130	2.25	25	
Surrogate: 2-Fluorobiphenyl	*0.682*			mg/kg	*0.832*	*NA*	*82.0*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.521*			mg/kg	*0.832*	*NA*	*62.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.795*			mg/kg	*0.832*	*NA*	*95.6*	*30-115*			

Matrix Spike (B7C0383-MS3) **Source: 0701544-01** Prepared: 03/23/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	73000000	0.15	0.022	mg/kg dry	3.65	280	NR	30-115	NA	NA	
Pyrene	3.06	0.15	0.022	mg/kg dry	3.65	110	NR	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.00*			mg/kg dry	*1.82*	*NA*	*NA*	*30-104*			
Surrogate: Nitrobenzene-d5	*73000000*			mg/kg dry	*1.82*	*NA*	*NR*	*30-90*			
Surrogate: Terphenyl-d14	*0.0102*			mg/kg dry	*1.82*	*NA*	*0.560*	*30-115*			

Matrix Spike Duplicate (B7C0383-MSD3) **Source: 0701544-01** Prepared: 03/23/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	72300000	0.15	0.022	mg/kg dry	3.62	280	NR	30-115	0.964	30	
Pyrene	72300000	0.15	0.022	mg/kg dry	3.62	110	NR	30-130	200	35	
Surrogate: 2-Fluorobiphenyl	*0.00*			mg/kg dry	*1.81*	*NA*	*NA*	*30-104*			
Surrogate: Nitrobenzene-d5	*5.90*			mg/kg dry	*1.81*	*NA*	*326*	*30-90*			
Surrogate: Terphenyl-d14	*3.62*			mg/kg dry	*1.81*	*NA*	*200*	*30-115*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Method Blank (B7C0459-BLK1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.2*			ug/L	*25.0*	*NA*	*105*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*25.7*			ug/L	*25.0*	*NA*	*103*	*80-120*			

Laboratory Control Sample (B7C0459-BS1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.09	0.050	0.0035	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.09	0.050	0.0049	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,4-Dichlorobenzene	1.20	0.050	0.0060	mg/kg	1.25	NA	96.0	75-125	NA	NA	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	NA	NA	
Ethylbenzene	1.24	0.050	0.0053	mg/kg	1.25	NA	99.2	75-125	NA	NA	
m,p-Xylenes	2.49	0.050	0.0063	mg/kg	2.50	NA	99.6	75-125	NA	NA	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	NA	NA	
sec-Butylbenzene	1.10	0.050	0.0021	mg/kg	1.25	NA	88.0	75-125	NA	NA	
Styrene	1.24	0.050	0.0023	mg/kg	1.25	NA	99.2	75-125	NA	NA	
Toluene	1.21	0.050	0.0086	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Trichloroethene	1.33	0.050	0.0037	mg/kg	1.25	NA	106	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Laboratory Control Sample Duplicate (B7C0459-BSD1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.08	0.050	0.0035	mg/kg	1.25	NA	86.4	75-125	0.922	20	
1,3,5-Trimethylbenzene	1.07	0.050	0.0049	mg/kg	1.25	NA	85.6	75-125	1.85	20	
1,4-Dichlorobenzene	1.19	0.050	0.0060	mg/kg	1.25	NA	95.2	75-125	0.837	20	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	0.00	20	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	0.00	20	
Ethylbenzene	1.22	0.050	0.0053	mg/kg	1.25	NA	97.6	75-125	1.63	20	
m,p-Xylenes	2.45	0.050	0.0063	mg/kg	2.50	NA	98.0	75-125	1.62	20	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	0.00	20	
sec-Butylbenzene	1.09	0.050	0.0021	mg/kg	1.25	NA	87.2	75-125	0.913	20	
Styrene	1.22	0.050	0.0023	mg/kg	1.25	NA	97.6	75-125	1.63	20	
Toluene	1.20	0.050	0.0086	mg/kg	1.25	NA	96.0	75-125	0.830	20	
Trichloroethene	1.32	0.050	0.0037	mg/kg	1.25	NA	106	75-125	0.755	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Matrix Spike (B7C0459-MS1)

Source: 0701544-04 Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1260			ug/L	1250	130	90.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	1150			ug/L	1250	34	89.3	75-125	NA	NA	
1,4-Dichlorobenzene	1230			ug/L	1250	ND	98.4	75-125	NA	NA	
Benzene	1280			ug/L	1250	32	99.8	75-125	NA	NA	
Carbon Tetrachloride	1150			ug/L	1250	ND	92.0	75-125	NA	NA	
Ethylbenzene	1580			ug/L	1250	270	105	75-125	NA	NA	
m,p-Xylenes	2760			ug/L	2500	180	103	75-125	NA	NA	
o-Xylene	1370			ug/L	1250	88	103	75-125	NA	NA	
sec-Butylbenzene	1120			ug/L	1250	ND	89.6	75-125	NA	NA	
Styrene	1270			ug/L	1250	ND	102	75-125	NA	NA	
Toluene	1360			ug/L	1250	110	100	75-125	NA	NA	
Trichloroethene	1330			ug/L	1250	ND	106	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.3*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Dibromofluoromethane	*28.3*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Matrix Spike Duplicate (B7C0459-MSD1) **Source: 0701544-04** Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1260			ug/L	1250	130	90.4	75-125	0.00	20	
1,3,5-Trimethylbenzene	1150			ug/L	1250	34	89.3	75-125	0.00	20	
1,4-Dichlorobenzene	1230			ug/L	1250	ND	98.4	75-125	0.00	20	
Benzene	1300			ug/L	1250	32	101	75-125	1.55	20	
Carbon Tetrachloride	1140			ug/L	1250	ND	91.2	75-125	0.873	20	
Ethylbenzene	1560			ug/L	1250	270	103	75-125	1.27	20	
m,p-Xylenes	2720			ug/L	2500	180	102	75-125	1.46	20	
o-Xylene	1350			ug/L	1250	88	101	75-125	1.47	20	
sec-Butylbenzene	1120			ug/L	1250	ND	89.6	75-125	0.00	20	
Styrene	1250			ug/L	1250	ND	100	75-125	1.59	20	
Toluene	1360			ug/L	1250	110	100	75-125	0.00	20	
Trichloroethene	1330			ug/L	1250	ND	106	75-125	0.00	20	
Surrogate: 1,2-Dichloroethane-d4	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.1*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample (B7C0442-BS1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	89500	2940	2940	ug/m³	110000	NA	81.4	75-125	NA	NA	
Xylenes, Total	284000	2990	2990	ug/m³	337000	NA	84.3	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	101000	2970	2970	ug/m³	99100	NA	102	75-125	NA	NA	
Styrene	104000	3920	3920	ug/m³	131000	NA	79.4	75-125	NA	NA	
Toluene	102000	3020	3020	ug/m³	101000	NA	101	75-125	NA	NA	
Trichloroethene	102000	2990	2990	ug/m³	99800	NA	102	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	84100	6050	6050	ug/m³	90200	NA	93.2	75-125	NA	NA	
1,2,4-Trimethylbenzene	87700	5930	5930	ug/m³	91600	NA	95.7	75-125	NA	NA	
1,3,5-Trimethylbenzene	85900	2880	2880	ug/m³	94100	NA	91.3	75-125	NA	NA	
1,4-Dichlorobenzene	60200	6940	6940	ug/m³	65400	NA	92.0	75-125	NA	NA	
Carbon Tetrachloride	92000	30600	3060	ug/m³	102000	NA	90.2	75-125	NA	NA	
sec-Butylbenzene	96200	2940	2940	ug/m³	97000	NA	99.2	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7C0442-BSD1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	2940	2940	ug/m³	110000	NA	90.0	75-125	10.1	20	
Xylenes, Total	317000	2990	2990	ug/m³	337000	NA	94.1	75-125	11.0	20	

Laboratory Control Sample Duplicate (B7C0442-BSD2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	104000	2970	2970	ug/m³	99100	NA	105	75-125	2.93	20	
Styrene	121000	3920	3920	ug/m³	131000	NA	92.4	75-125	15.1	20	
Toluene	104000	3020	3020	ug/m³	101000	NA	103	75-125	1.94	20	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	1.94	20	

Laboratory Control Sample Duplicate (B7C0442-BSD3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	96100	6050	6050	ug/m³	90200	NA	107	75-125	13.3	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7C0442-BSD3)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	98800	5930	5930	ug/m³	91600	NA	108	75-125	11.9	20	
1,3,5-Trimethylbenzene	95500	2880	2880	ug/m³	94100	NA	101	75-125	10.6	20	
1,4-Dichlorobenzene	68900	6940	6940	ug/m³	65400	NA	105	75-125	13.5	20	
Carbon Tetrachloride	108000	30600	3060	ug/m³	102000	NA	106	75-125	16.0	20	
sec-Butylbenzene	107000	2940	2940	ug/m³	97000	NA	110	75-125	10.6	20	

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample (B7D0057-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27600	0.00		ug/m³	28200	NA	97.9	70-130	NA	NA	
2-Methylnaphthalene filter	27700	0.00		ug/m³	28200	NA	98.2	70-130	NA	NA	
Acenaphthene filter	25000	0.00		ug/m³	26000	NA	96.2	70-130	NA	NA	
Acenaphthylene filter	24900	0.00		ug/m³	25700	NA	96.9	70-130	NA	NA	
Anthracene filter	24600	0.00		ug/m³	25100	NA	98.0	70-130	NA	NA	
Benz(a)anthracene filter	24600	0.00		ug/m³	25600	NA	96.1	70-130	NA	NA	
Benzo(a)pyrene filter	24400	0.00		ug/m³	25300	NA	96.4	70-130	NA	NA	
Benzo(b)fluoranthene filter	24300	0.00		ug/m³	25300	NA	96.0	70-130	NA	NA	
Benzo(g,h,i)perylene filter	26900	0.00		ug/m³	25800	NA	104	70-130	NA	NA	
Benzo(k)fluoranthene filter	24600	0.00		ug/m³	25400	NA	96.9	70-130	NA	NA	
Chrysene filter	23800	0.00		ug/m³	25400	NA	93.7	70-130	NA	NA	
Dibenz(a,h)anthracene filter	32700	0.00		ug/m³	25100	NA	130	70-130	NA	NA	
Fluoranthene filter	24500	0.00		ug/m³	25500	NA	96.1	70-130	NA	NA	
Fluorene filter	24500	0.00		ug/m³	25600	NA	95.7	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	25800	0.00		ug/m³	26800	NA	96.3	70-130	NA	NA	
Naphthalene filter	26700	0.00		ug/m³	28100	NA	95.0	70-130	NA	NA	
Phenanthrene filter	24400	0.00		ug/m³	25500	NA	95.7	70-130	NA	NA	
Pyrene filter	24600	0.00		ug/m³	25600	NA	96.1	70-130	NA	NA	
1-Methylnaphthalene	25700	1590		ug/m³	26600	NA	96.6	70-130	NA	NA	
2-Methylnaphthalene	25700	1590		ug/m³	26400	NA	97.3	70-130	NA	NA	
Acenaphthene	26100	3310		ug/m³	27600	NA	94.6	70-130	NA	NA	
Acenaphthylene	26600	3050		ug/m³	25500	NA	104	70-130	NA	NA	
Anthracene	26400	3300		ug/m³	27500	NA	96.0	70-130	NA	NA	
Benz(a)anthracene	27200	1790		ug/m³	29800	NA	91.3	70-130	NA	NA	
Benzo(a)pyrene	27200	1890		ug/m³	31500	NA	86.3	70-130	NA	NA	
Benzo(b)fluoranthene	27600	1870		ug/m³	31200	NA	88.5	70-130	NA	NA	
Benzo(g,h,i)perylene	36600	4620		ug/m³	38500	NA	95.1	70-130	NA	NA	
Benzo(k)fluoranthene	28100	1890		ug/m³	31600	NA	88.9	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample (B7D0057-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chrysene	26400	1800		ug/m³	29900	NA	88.3	70-130	NA	NA	
Dibenz(a,h)anthracene	37400	19300		ug/m³	32100	NA	117	70-130	NA	NA	
Fluoranthene	26500	3420		ug/m³	28500	NA	93.0	70-130	NA	NA	
Fluorene	25800	3250		ug/m³	27100	NA	95.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	28600	2030		ug/m³	33900	NA	84.4	70-130	NA	NA	
Naphthalene	26100	1660		ug/m³	27700	NA	94.2	70-130	NA	NA	
Phenanthrene	26100	3320		ug/m³	27700	NA	94.2	70-130	NA	NA	
Pyrene	26000	3480		ug/m³	29000	NA	89.7	70-130	NA	NA	

Laboratory Control Sample Duplicate (B7D0057-BSD1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27800	0.00		ug/m³	28200	NA	98.6	70-130	0.722	20	
2-Methylnaphthalene filter	27900	0.00		ug/m³	28200	NA	98.9	70-130	0.719	20	
Acenaphthene filter	25400	0.00		ug/m³	26000	NA	97.7	70-130	1.59	20	
Acenaphthylene filter	24800	0.00		ug/m³	25700	NA	96.5	70-130	0.402	20	
Anthracene filter	25300	0.00		ug/m³	25100	NA	101	70-130	2.81	20	
Benz(a)anthracene filter	25300	0.00		ug/m³	25600	NA	98.8	70-130	2.81	20	
Benzo(a)pyrene filter	25000	0.00		ug/m³	25300	NA	98.8	70-130	2.43	20	
Benzo(b)fluoranthene filter	24900	0.00		ug/m³	25300	NA	98.4	70-130	2.44	20	
Benzo(g,h,i)perylene filter	28400	0.00		ug/m³	25800	NA	110	70-130	5.42	20	
Benzo(k)fluoranthene filter	25100	0.00		ug/m³	25400	NA	98.8	70-130	2.01	20	
Chrysene filter	24400	0.00		ug/m³	25400	NA	96.1	70-130	2.49	20	
Dibenz(a,h)anthracene filter	33700	0.00		ug/m³	25100	NA	134	70-130	3.01	20	
Fluoranthene filter	25100	0.00		ug/m³	25500	NA	98.4	70-130	2.42	20	
Fluorene filter	25100	0.00		ug/m³	25600	NA	98.0	70-130	2.42	20	
Indeno(1,2,3-cd)pyrene filter	26400	0.00		ug/m³	26800	NA	98.5	70-130	2.30	20	
Naphthalene filter	26900	0.00		ug/m³	28100	NA	95.7	70-130	0.746	20	
Phenanthrene filter	25100	0.00		ug/m³	25500	NA	98.4	70-130	2.83	20	
Pyrene filter	25300	0.00		ug/m³	25600	NA	98.8	70-130	2.81	20	
1-Methylnaphthalene	24400	1590		ug/m³	26600	NA	91.7	70-130	5.19	20	
2-Methylnaphthalene	24500	1590		ug/m³	26400	NA	92.8	70-130	4.78	20	
Acenaphthene	24400	3310		ug/m³	27600	NA	88.4	70-130	6.73	20	
Acenaphthylene	24800	3050		ug/m³	25500	NA	97.3	70-130	7.00	20	
Anthracene	24300	3300		ug/m³	27500	NA	88.4	70-130	8.28	20	
Benz(a)anthracene	24000	1790		ug/m³	29800	NA	80.5	70-130	12.5	20	
Benzo(a)pyrene	22600	1890		ug/m³	31500	NA	71.7	70-130	18.5	20	
Benzo(b)fluoranthene	23700	1870		ug/m³	31200	NA	76.0	70-130	15.2	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0057-BSD1) Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzo(g,h,i)perylene	29700	4620		ug/m³	38500	NA	77.1	70-130	20.8	20	
Benzo(k)fluoranthene	24100	1890		ug/m³	31600	NA	76.3	70-130	15.3	20	
Chrysene	23200	1800		ug/m³	29900	NA	77.6	70-130	12.9	20	
Dibenz(a,h)anthracene	29900	19300		ug/m³	32100	NA	93.1	70-130	22.3	20	
Fluoranthene	24200	3420		ug/m³	28500	NA	84.9	70-130	9.07	20	
Fluorene	24400	3250		ug/m³	27100	NA	90.0	70-130	5.58	20	
Indeno(1,2,3-cd)pyrene	23200	2030		ug/m³	33900	NA	68.4	70-130	20.8	20	
Naphthalene	25000	1660		ug/m³	27700	NA	90.3	70-130	4.31	20	
Phenanthrene	24200	3320		ug/m³	27700	NA	87.4	70-130	7.55	20	
Pyrene	23000	3480		ug/m³	29000	NA	79.3	70-130	12.2	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701544

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquiries:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of 2

REPORT RESULTS TO
Contact Name Hubert Huls
Project ID/Name Ashland NSP
P.O. #/Project # 25688375.75000
Company URS Corp
Mailing Address 700 3rd St. S Suite 600
City, State, Zip Minneapolis, MN 55415
Telephone #(612) 370-0700
Fax #(612) 373-6800
E-mail hubert_huls@urscorp.com

SEND INVOICE TO
Contact Name
Company
Address SAME
City, State, Zip
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH	TOC	Grain Size	VOC						FOR LAB USE ONLY
1	NSP-2-ES-PAH-1-031907	3/19/07	10:00	Soil		2	N	X									0701544-1
2	NSP-2-ES-PAH-1-031907-MS		10:00			2	N	X									-1
3	NSP-2-ES-PAH-1-031907-MSD		10:00			2	N	X									-1
4	NSP-2-ES-TOC-1-031907		10:00			1	N		X								-2
5	NSP-2-ES-TOC-1-031907-DUP		10:00			1	N		X								-2 3
6	NSP-2-ES-GS-1-031907		10:00			1	N			X							N/A
7	NSP-2-ES-VOC-1-031907		10:10			2	N				X						0701544-~~3~~ 4
8	NSP-2-ES-VOC-1-031907-MS		10:10			2	N				X						-~~3~~ 4
9	NSP-2-ES-VOC-1-031907-MSD		10:10			2	N				X						-~~3~~ 4
10	NSP-2-ES-PAH-2-031907		12:07	Air	301.2 L	3	N	X									-~~4~~ 5, 6
11	NSP-2-ES-VOC-2-031907		12:07		301.2 L	2	N				X						-~~4~~ 7,
12	NSP-2-ES-PAH-5-031907		16:10		602.4 L	3	N	X									-~~8~~ 9, 10
13	NSP-2-ES-VOC-5-031907	03/19/07	16:10		602.4 L	2	N				X						-~~10~~ 11, 12
14	NSP-2-ES-PAH-6-032007	03/20/07	08:15		2409.6 L	3	N	X									-~~12~~ 13, 14
15	NSP-2-ES-VOC-6-032007	03/20/07	08:15	Air	2409.6 L	2	N				X						-~~14~~ 15, 16

CHAIN OF CUSTODY
Collected by: (Print) William G. Flynn Jr
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/20/07 11:06
Received by: [signature] Date/Time 3/20/07 1106
Relinquished by: [signature] Date/Time 03/20/07 1240
Received Contents Not Verified: [signature] Date/Time 3/20/07 1243
Received Contents Verified: Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 2.9 °C

PLF 3/26/07

Form # CS02.02 F:\Groups\QA QC\Forms\Forms\CS02 Effective Date

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701544
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701544

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquiries:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS Corp
Mailing Address: 700 3rd St. S, Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: 612-370-0700 Fax #: 612-373-6800
E-mail: hubert_huls@urscorp.com

Project ID/Name: Ashland NSP
P.O. #/Project #: 25688375.75000

SEND INVOICE TO
Contact Name: Same
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	TOC	PAH	VOC	TSS	Percent Solids	FOR LAB USE ONLY
1	NSP-2-ES-TOC-3-032007	03/20/07	08:25	Soil		1	N	X					0701544-16
2	NSP-2-ES-PAH-3-032007		08:25			2	N		X				-17
3	NSP-2-ES-VOC-3-032007		08:25			2	N			X			-18
4	NSP-2-10M-PAH-1-032007		9:45			2	N		X				-19
5	NSP-2-10M-VOC-1-032007		10:00	Soil		2	N			X			-20
6	NSP-2-10M-TSS-7-032007		10:25	Slurry		1	N				X	X	-21
7	NSP-2-10M-TOC-7-032007	03/20/07	10:25	Slurry		1	N	X					-22
8	Trip Blank (MeOH)					2							-23
9	Temperature Blank					1							
10													
11													
12													
13													
14													
15													

17 18 19 20 21 22 23 24

3/20/07

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/20/07 11:06
Relinquished by: [signature] Date/Time 3/20/07 1:40
Received by: [signature] Date/Time 3/20/07 1:06
Received Contents Not Verified: [signature] Date/Time 3/20/07 1:43
Received Contents Verified: Date/Time

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 2.9 °C

Comments:

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC.doc Effective Date: 11/17/06

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

April 30, 2007

Work Order #: 0701575
(Revised)

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 21, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Qualifiers and Abbreviations

vn	The surrogate recovery is below the laboratory generated control limits.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
ts	This analysis was performed by a subcontract laboratory.
sk	The surrogate recovery is outside of laboratory control limits due to matrix interference.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
ib	Unidentified compounds are present in the sample.
gw	The sample was extracted 2 days past the method specified holding time.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
A5	The MDL value for this analyte is an estimated value; no statistical value has been determined.
A2	The Laboratory Control Sample Duplicate recovery is 68.4%, which is below the laboratory limits of 70-130%.
A1a	The Laboratory Control Sample Duplicate for the filters was at 134% recovery, which is outside the laboratory limits of 70-130%.
A1	The calibration check solutions failed high (118,138,&126%). Laboratory control limits are 85-115%. There may be a slight high bias in the data
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit
NA	Not Applicable
ND	Analyte NOT DETECTED
NR	Not Reported
%Rec	Percent Recovery
RPD	Relative Percent Difference
VOC	Volatile Organic Compound

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-2-10M-PAH-2-032007 Front	0701575-01	Air Tube	03/20/07 12:26	03/21/07 11:28
NSP-2-10M-VOC-2-032007 Front	0701575-03	Air Tube	03/20/07 12:26	03/21/07 11:28
NSP-2-10M-PAH-5-032007 Front	0701575-05	Air Tube	03/20/07 16:31	03/21/07 11:28
NSP-2-10M-VOC-5-032007 Front	0701575-07	Air Tube	03/20/07 16:31	03/21/07 11:28
NSP-2-10M-PAH-6-032107 Front	0701575-09	Air Tube	03/21/07 08:37	03/21/07 11:28
NSP-2-10M-VOC-6-032107 Front	0701575-11	Air Tube	03/21/07 08:37	03/21/07 11:28
NSP-2-10M-VOC-8-032107	0701575-13	Slurry	03/21/07 08:50	03/21/07 11:28
NSP-2-10M-PAH-8-032107 total	0701575-14	Water	03/21/07 08:50	03/21/07 11:28
NSP-2-10M-DOC-8-032107	0701575-15	Slurry	03/21/07 08:50	03/21/07 11:28
NSP-2-10M-TOC-8-032107	0701575-16	Slurry	03/21/07 08:50	03/21/07 11:28
NSP-2-10M-TSS-8-032107	0701575-17	Slurry	03/21/07 08:50	03/21/07 11:28
NSP-1-10M-PAH-1-032107	0701575-18	Soil	03/21/07 09:50	03/21/07 11:28
NSP-1-10M-VOC-1-032107	0701575-19	Soil	03/21/07 09:50	03/21/07 11:28
NSP-1-10M-TOC-7-032107	0701575-20	Slurry	03/21/07 09:55	03/21/07 11:28
NSP-1-10M-TSS-7-032107	0701575-21	Slurry	03/21/07 09:55	03/21/07 11:28
Trip Blank (MeOH)	0701575-22	Soil	03/21/07 00:00	03/21/07 11:28
Trip Blanks (HCL)	0701575-23	Water	03/21/07 00:00	03/21/07 11:28
NSP-2-10M-PAH-8-032107 dissolved	0701575-24	Water	03/21/07 08:50	03/21/07 11:28

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	5.0 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-PAH-2-032007 Front

0701575-01 (Air Tube)

3/20/07 12:26

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Chrysene	ND	5.96		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A1a, gp
Fluoranthene	ND	11.4		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A2, gp
Naphthalene	**35.1**	5.52		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-VOC-2-032007 Front

0701575-03 (Air Tube)

3/20/07 12:26

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	20.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**19.9**	19.7		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	23.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**34.3**	9.87		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	508		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**27.9**	9.76		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**104**	10.0		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**77.9**	9.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-PAH-5-032007 Front

0701575-05 (Air Tube)

3/20/07 16:31

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Chrysene	ND	2.98		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A1a, gp
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A2, gp
Naphthalene	**32.7**	2.76		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-VOC-5-032007 Front

0701575-07 (Air Tube)

3/20/07 16:31

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**11.5**	9.85		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**18.5**	4.94		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	254		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**12.9**	4.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**50.9**	5.02		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	ND	4.97		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**41.7**	4.97		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-PAH-6-032107 Front

0701575-09 (Air Tube)

3/21/07 8:37

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**6.48**	0.662		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
2-Methylnaphthalene	**11.0**	0.658		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Chrysene	ND	0.746		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A1a, gp
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	A2, gp
Naphthalene	**22.0**	0.689		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/3/07	4/4/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-VOC-6-032107 Front

0701575-11 (Air Tube)

3/21/07 8:37

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**2.72**	2.51		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**7.68**	2.46		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,3,5-Trimethylbenzene	**2.06**	1.20		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
1,4-Dichlorobenzene	ND	2.88		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Benzene	**10.6**	1.23		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Carbon Tetrachloride	ND	63.5		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	A1
Ethyl Benzene	**8.47**	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Styrene	**3.59**	1.63		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Toluene	**33.9**	1.25		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Trichloroethene	**1.61**	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	
Xylenes, Total	**29.2**	1.24		ug/m³	[CALC]	3/27/07	3/28/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-VOC-8-032107

0701575-13 (Slurry)

3/21/07 8:50

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**75**	2.0	0.14	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**180**	2.0	0.060	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	**46**	2.0	0.078	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	2.0	0.10	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	**80**	2.0	0.084	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	5.0	0.10	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	**630**	20	0.72	ug/L	B7C0490	3/28/07	3/29/07	EPA 8260B	
m,p-Xylenes	**400**	20	1.2	ug/L	B7C0490	3/28/07	3/29/07	EPA 8260B	
o-Xylene	**220**	20	1.4	ug/L	B7C0490	3/28/07	3/29/07	EPA 8260B	
sec-Butylbenzene	ND	2.0	0.054	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	2.0	0.098	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	**320**	20	0.96	ug/L	B7C0490	3/28/07	3/29/07	EPA 8260B	
Trichloroethene	ND	2.0	0.13	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*108 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*108 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-PAH-8-032107 total

0701575-14 (Water)

3/21/07 8:50

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**4100**	500	25	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	**530**	50	3.2	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**360**	50	5.7	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**2000**	500	51	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**6700**	500	39	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthene	**4000**	200	26	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthylene	**280**	20	1.9	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Anthracene	**1700**	200	21	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benz(a)anthracene	**670**	20	7.1	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Benzo(a)pyrene	**670**	20	7.7	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Benzo(b)fluoranthene	**410**	50	4.2	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Benzo(e)pyrene	**290**	50	8.0	ug/L	B7C0455	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**230**	20	6.7	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Benzo(k)fluoranthene	**380**	20	7.5	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Biphenyl	**420**	50	2.6	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Chrysene	**700**	20	7.0	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Dibenz(a,h)anthracene	**110**	50	7.8	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Fluoranthene	**1600**	200	26	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Fluorene	**1300**	200	46	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**180**	50	7.8	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Naphthalene	**5700**	500	32	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Perylene	**77**	50	2.8	ug/L	B7C0455	3/28/07	4/4/07	EPA 8270C	
Phenanthrene	**5900**	200	21	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Pyrene	**2400**	200	50	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*11.0 %*	*Limits: 59-101%*			*B7C0455*	*3/28/07*	*4/4/07*	*EPA 8270C*	*sk*
Surrogate: Nitrobenzene-d5	*10.1 %*	*Limits: 57-101%*			*B7C0455*	*3/28/07*	*4/4/07*	*EPA 8270C*	*sk*
Surrogate: Terphenyl-d14	*12.4 %*	*Limits: 65-100%*			*B7C0455*	*3/28/07*	*4/4/07*	*EPA 8270C*	*sk*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-DOC-8-032107

0701575-15 (Slurry)

3/21/07 8:50

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**12**	1.5	0.50	mg/L	B7D0048	3/28/07	3/28/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-TOC-8-032107

0701575-16 (Slurry)

3/21/07 8:50

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**740**	80	30	mg/L	B7D0048	4/2/07	4/2/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-TSS-8-032107

0701575-17 (Slurry)

3/21/07 8:50

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**2300**	10	3.6	mg/L	B7C0413	3/26/07	3/26/07	EPA 160.2	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-PAH-1-032107

0701575-18 (Soil)

3/21/07 9:50

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**75**	0.050	0.010	% Wt	B7C0419	3/26/07	3/26/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**84**	2.2	0.37	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**8.1**	0.45	0.053	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**16**	2.2	0.27	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**62**	2.2	0.33	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**190**	11	3.8	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**74**	2.2	0.33	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**6.1**	0.45	0.047	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Anthracene	**48**	2.2	0.33	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**14**	0.45	0.067	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(a)pyrene	**13**	0.45	0.053	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(b)fluoranthene	**8.1**	0.45	0.11	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(e)pyrene	**7.9**	0.45	0.067	mg/kg dry	B7C0383	3/23/07	4/9/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**0.97**	0.45	0.040	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Benzo(k)fluoranthene	**9.8**	0.45	0.093	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Biphenyl	**14**	0.45	0.080	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Chrysene	**16**	0.45	0.067	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Dibenz(a,h)anthracene	**0.49**	0.45	0.14	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Fluoranthene	**47**	2.2	0.23	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**83**	2.2	0.13	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**1.2**	0.45	0.060	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Naphthalene	**180**	11	0.83	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**1.9**	0.45	0.073	mg/kg dry	B7C0383	3/23/07	4/3/07	EPA 8270C	
Phenanthrene	**160**	11	1.3	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**51**	2.2	0.33	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*86.8 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/9/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*72.7 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*98.2 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/3/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-VOC-1-032107

0701575-19 (Soil)

3/21/07 9:50

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**4.9**	3.4	0.11	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**9.1**	3.4	0.24	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	3.4	0.33	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	3.4	0.40	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Benzene	ND	3.4	0.15	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	3.4	0.19	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Ethylbenzene	**4.6**	3.4	0.36	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
m,p-Xylenes	**7.5**	3.4	0.42	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
o-Xylene	**3.9**	3.4	0.47	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	3.4	0.14	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Styrene	ND	3.4	0.15	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Toluene	ND	3.4	0.58	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Trichloroethene	ND	3.4	0.25	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*98.8 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*104 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*106 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-TOC-7-032107

0701575-20 (Slurry)

3/21/07 9:55

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**16**	8.0	3.0	mg/L	B7D0048	4/2/07	4/2/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-TSS-7-032107

0701575-21 (Slurry)

3/21/07 9:55

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**3500**	10	3.6	mg/L	B7C0413	3/26/07	3/26/07	EPA 160.2	
Total Solids	**4000**	20	1.0	mg/L	B7C0438	3/27/07	3/27/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Trip Blank (MeOH)

0701575-22 (Soil)

3/21/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*101 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*103 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*109 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*104 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Trip Blanks (HCL)

0701575-23 (Water)

3/21/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*102 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*110 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-PAH-8-032107 dissolved

0701575-24 (Water)

3/21/07 8:50

Semivolatile Organic Compounds

gw

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**200**	29	1.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	18 J	29	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	29	3.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**270**	29	2.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**200**	29	2.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**76**	11	1.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	4.3 J	11	1.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	3.8 J	11	1.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	ND	11	4.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	ND	11	4.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	24 J	29	2.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	ND	29	4.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	A5
Benzo(g,h,i)perylene	ND	11	3.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	ND	11	4.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	6.5 J	29	1.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	ND	11	4.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	29	4.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	3.4 J	11	1.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	4.0 J	11	2.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	29	4.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	**730**	140	9.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Perylene	ND	29	1.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	**11**	11	1.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Pyrene	5.4 J	11	2.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*69.7 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*59.4 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*85.3 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Classical Chemistry Parameters - Quality Control

Batch B7C0413 - Default Prep GenChem

Method Blank (B7C0413-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7C0413-BS1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	255			mg/L	250	NA	102	80-120	NA	NA	

Batch B7C0419 - Default Prep GenChem

Method Blank (B7C0419-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7C0419-SRM1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	90.0			% Wt	88.8	NA	101	90-110	NA	NA	

Batch B7C0438 - Default Prep GenChem

Method Blank (B7C0438-BLK1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Method Blank (B7C0383-BLK1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0423 J	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.0743	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.248	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.813*			mg/kg	*0.833*	*NA*	*97.6*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.692*			mg/kg	*0.833*	*NA*	*83.1*	*30-90*			
Surrogate: Terphenyl-d14	*0.969*			mg/kg	*0.833*	*NA*	*116*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Laboratory Control Sample (B7C0383-BS1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	NA	NA	
Pyrene	1.35	0.067	0.010	mg/kg	1.67	NA	80.8	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.706*			mg/kg	*0.833*	*NA*	*84.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.588*			mg/kg	*0.833*	*NA*	*70.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.804*			mg/kg	*0.833*	*NA*	*96.5*	*30-115*			

Laboratory Control Sample Duplicate (B7C0383-BSD1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.25	0.067	0.010	mg/kg	1.66	NA	75.3	50-115	0.797	25	
Pyrene	1.32	0.067	0.010	mg/kg	1.66	NA	79.5	50-130	2.25	25	
Surrogate: 2-Fluorobiphenyl	*0.682*			mg/kg	*0.832*	*NA*	*82.0*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.521*			mg/kg	*0.832*	*NA*	*62.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.795*			mg/kg	*0.832*	*NA*	*95.6*	*30-115*			

Batch B7C0455 - EPA 3510C

Method Blank (B7C0455-BLK1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	5.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0455 - EPA 3510C

Method Blank (B7C0455-BLK1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Indeno(1,2,3-cd)pyrene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*18.7*			ug/L	*25.0*	*NA*	*74.8*	*59-101*			
Surrogate: Nitrobenzene-d5	*16.5*			ug/L	*25.0*	*NA*	*66.0*	*57-101*			
Surrogate: Terphenyl-d14	*23.2*			ug/L	*25.0*	*NA*	*92.8*	*65-100*			

Laboratory Control Sample (B7C0455-BS1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	39.0	2.0	0.26	ug/L	50.0	NA	78.0	50-110	NA	NA	
Pyrene	49.5	2.0	0.50	ug/L	50.0	NA	99.0	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*17.3*			ug/L	*25.0*	*NA*	*69.2*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*21.6*			ug/L	*25.0*	*NA*	*86.4*	*65-100*			

Laboratory Control Sample Duplicate (B7C0455-BSD1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	36.8	2.0	0.26	ug/L	50.0	NA	73.6	50-110	5.80	20	
Pyrene	49.0	2.0	0.50	ug/L	50.0	NA	98.0	55-120	1.02	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*22.2*			ug/L	*25.0*	*NA*	*88.8*	*65-100*			

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

Laboratory Control Sample (B7C0494-BS1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0494-BSD1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Method Blank (B7C0459-BLK1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.2*			ug/L	*25.0*	*NA*	*105*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*25.7*			ug/L	*25.0*	*NA*	*103*	*80-120*			

Laboratory Control Sample (B7C0459-BS1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.09	0.050	0.0035	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.09	0.050	0.0049	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,4-Dichlorobenzene	1.20	0.050	0.0060	mg/kg	1.25	NA	96.0	75-125	NA	NA	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	NA	NA	
Ethylbenzene	1.24	0.050	0.0053	mg/kg	1.25	NA	99.2	75-125	NA	NA	
m,p-Xylenes	2.49	0.050	0.0063	mg/kg	2.50	NA	99.6	75-125	NA	NA	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	NA	NA	
sec-Butylbenzene	1.10	0.050	0.0021	mg/kg	1.25	NA	88.0	75-125	NA	NA	
Styrene	1.24	0.050	0.0023	mg/kg	1.25	NA	99.2	75-125	NA	NA	
Toluene	1.21	0.050	0.0086	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Trichloroethene	1.33	0.050	0.0037	mg/kg	1.25	NA	106	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Laboratory Control Sample Duplicate (B7C0459-BSD1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.08	0.050	0.0035	mg/kg	1.25	NA	86.4	75-125	0.922	20	
1,3,5-Trimethylbenzene	1.07	0.050	0.0049	mg/kg	1.25	NA	85.6	75-125	1.85	20	
1,4-Dichlorobenzene	1.19	0.050	0.0060	mg/kg	1.25	NA	95.2	75-125	0.837	20	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	0.00	20	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	0.00	20	
Ethylbenzene	1.22	0.050	0.0053	mg/kg	1.25	NA	97.6	75-125	1.63	20	
m,p-Xylenes	2.45	0.050	0.0063	mg/kg	2.50	NA	98.0	75-125	1.62	20	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	0.00	20	
sec-Butylbenzene	1.09	0.050	0.0021	mg/kg	1.25	NA	87.2	75-125	0.913	20	
Styrene	1.22	0.050	0.0023	mg/kg	1.25	NA	97.6	75-125	1.63	20	
Toluene	1.20	0.050	0.0086	mg/kg	1.25	NA	96.0	75-125	0.830	20	
Trichloroethene	1.32	0.050	0.0037	mg/kg	1.25	NA	106	75-125	0.755	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Batch B7C0490 - EPA 5030B

Method Blank (B7C0490-BLK1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: Dibromofluoromethane	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Toluene-d8	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0490 - EPA 5030B

Laboratory Control Sample (B7C0490-BS1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.2	1.0	0.030	ug/L	25.0	NA	88.8	75-125	NA	NA	
1,3,5-Trimethylbenzene	22.3	1.0	0.039	ug/L	25.0	NA	89.2	75-125	NA	NA	
1,4-Dichlorobenzene	24.6	1.0	0.051	ug/L	25.0	NA	98.4	75-125	NA	NA	
Benzene	25.5	1.0	0.042	ug/L	25.0	NA	102	75-125	NA	NA	
Carbon Tetrachloride	23.0	2.5	0.050	ug/L	25.0	NA	92.0	75-125	NA	NA	
Ethylbenzene	24.9	1.0	0.036	ug/L	25.0	NA	99.6	75-125	NA	NA	
m,p-Xylenes	49.8	1.0	0.059	ug/L	50.0	NA	99.6	75-125	NA	NA	
o-Xylene	24.6	1.0	0.072	ug/L	25.0	NA	98.4	75-125	NA	NA	
sec-Butylbenzene	22.6	1.0	0.027	ug/L	25.0	NA	90.4	75-125	NA	NA	
Styrene	24.9	1.0	0.049	ug/L	25.0	NA	99.6	75-125	NA	NA	
Toluene	24.6	1.0	0.048	ug/L	25.0	NA	98.4	75-125	NA	NA	
Trichloroethene	27.0	1.0	0.067	ug/L	25.0	NA	108	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.5*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Dibromofluoromethane	*28.3*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Laboratory Control Sample Duplicate (B7C0490-BSD1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.1	1.0	0.030	ug/L	25.0	NA	88.4	75-125	0.451	20	
1,3,5-Trimethylbenzene	22.0	1.0	0.039	ug/L	25.0	NA	88.0	75-125	1.35	20	
1,4-Dichlorobenzene	23.8	1.0	0.051	ug/L	25.0	NA	95.2	75-125	3.31	20	
Benzene	25.1	1.0	0.042	ug/L	25.0	NA	100	75-125	1.58	20	
Carbon Tetrachloride	22.6	2.5	0.050	ug/L	25.0	NA	90.4	75-125	1.75	20	
Ethylbenzene	24.5	1.0	0.036	ug/L	25.0	NA	98.0	75-125	1.62	20	
m,p-Xylenes	49.2	1.0	0.059	ug/L	50.0	NA	98.4	75-125	1.21	20	
o-Xylene	24.5	1.0	0.072	ug/L	25.0	NA	98.0	75-125	0.407	20	
sec-Butylbenzene	22.4	1.0	0.027	ug/L	25.0	NA	89.6	75-125	0.889	20	
Styrene	24.4	1.0	0.049	ug/L	25.0	NA	97.6	75-125	2.03	20	
Toluene	24.3	1.0	0.048	ug/L	25.0	NA	97.2	75-125	1.23	20	
Trichloroethene	26.8	1.0	0.067	ug/L	25.0	NA	107	75-125	0.743	20	
Surrogate: 1,2-Dichloroethane-d4	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.5*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Dibromofluoromethane	*28.0*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample (B7C0442-BS1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	89500	2940	2940	ug/m³	110000	NA	81.4	75-125	NA	NA	
Xylenes, Total	284000	2990	2990	ug/m³	337000	NA	84.3	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	101000	2970	2970	ug/m³	99100	NA	102	75-125	NA	NA	
Styrene	104000	3920	3920	ug/m³	131000	NA	79.4	75-125	NA	NA	
Toluene	102000	3020	3020	ug/m³	101000	NA	101	75-125	NA	NA	
Trichloroethene	102000	2990	2990	ug/m³	99800	NA	102	75-125	NA	NA	

Laboratory Control Sample (B7C0442-BS3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	84100	6050	6050	ug/m³	90200	NA	93.2	75-125	NA	NA	
1,2,4-Trimethylbenzene	87700	5930	5930	ug/m³	91600	NA	95.7	75-125	NA	NA	
1,3,5-Trimethylbenzene	85900	2880	2880	ug/m³	94100	NA	91.3	75-125	NA	NA	
1,4-Dichlorobenzene	60200	6940	6940	ug/m³	65400	NA	92.0	75-125	NA	NA	
Carbon Tetrachloride	92000	30600	3060	ug/m³	102000	NA	90.2	75-125	NA	NA	
sec-Butylbenzene	96200	2940	2940	ug/m³	97000	NA	99.2	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7C0442-BSD1) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	2940	2940	ug/m³	110000	NA	90.0	75-125	10.1	20	
Xylenes, Total	317000	2990	2990	ug/m³	337000	NA	94.1	75-125	11.0	20	

Laboratory Control Sample Duplicate (B7C0442-BSD2) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	104000	2970	2970	ug/m³	99100	NA	105	75-125	2.93	20	
Styrene	121000	3920	3920	ug/m³	131000	NA	92.4	75-125	15.1	20	
Toluene	104000	3020	3020	ug/m³	101000	NA	103	75-125	1.94	20	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	1.94	20	

Laboratory Control Sample Duplicate (B7C0442-BSD3) Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	96100	6050	6050	ug/m³	90200	NA	107	75-125	13.3	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7C0442 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7C0442-BSD3)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	98800	5930	5930	ug/m³	91600	NA	108	75-125	11.9	20	
1,3,5-Trimethylbenzene	95500	2880	2880	ug/m³	94100	NA	101	75-125	10.6	20	
1,4-Dichlorobenzene	68900	6940	6940	ug/m³	65400	NA	105	75-125	13.5	20	
Carbon Tetrachloride	108000	30600	3060	ug/m³	102000	NA	106	75-125	16.0	20	
sec-Butylbenzene	107000	2940	2940	ug/m³	97000	NA	110	75-125	10.6	20	

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample (B7D0057-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27600	0.00		ug/m³	28200	NA	97.9	70-130	NA	NA	
2-Methylnaphthalene filter	27700	0.00		ug/m³	28200	NA	98.2	70-130	NA	NA	
Acenaphthene filter	25000	0.00		ug/m³	26000	NA	96.2	70-130	NA	NA	
Acenaphthylene filter	24900	0.00		ug/m³	25700	NA	96.9	70-130	NA	NA	
Anthracene filter	24600	0.00		ug/m³	25100	NA	98.0	70-130	NA	NA	
Benz(a)anthracene filter	24600	0.00		ug/m³	25600	NA	96.1	70-130	NA	NA	
Benzo(a)pyrene filter	24400	0.00		ug/m³	25300	NA	96.4	70-130	NA	NA	
Benzo(b)fluoranthene filter	24300	0.00		ug/m³	25300	NA	96.0	70-130	NA	NA	
Benzo(g,h,i)perylene filter	26900	0.00		ug/m³	25800	NA	104	70-130	NA	NA	
Benzo(k)fluoranthene filter	24600	0.00		ug/m³	25400	NA	96.9	70-130	NA	NA	
Chrysene filter	23800	0.00		ug/m³	25400	NA	93.7	70-130	NA	NA	
Dibenz(a,h)anthracene filter	32700	0.00		ug/m³	25100	NA	130	70-130	NA	NA	
Fluoranthene filter	24500	0.00		ug/m³	25500	NA	96.1	70-130	NA	NA	
Fluorene filter	24500	0.00		ug/m³	25600	NA	95.7	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	25800	0.00		ug/m³	26800	NA	96.3	70-130	NA	NA	
Naphthalene filter	26700	0.00		ug/m³	28100	NA	95.0	70-130	NA	NA	
Phenanthrene filter	24400	0.00		ug/m³	25500	NA	95.7	70-130	NA	NA	
Pyrene filter	24600	0.00		ug/m³	25600	NA	96.1	70-130	NA	NA	
1-Methylnaphthalene	25700	1590		ug/m³	26600	NA	96.6	70-130	NA	NA	
2-Methylnaphthalene	25700	1590		ug/m³	26400	NA	97.3	70-130	NA	NA	
Acenaphthene	26100	3310		ug/m³	27600	NA	94.6	70-130	NA	NA	
Acenaphthylene	26600	3050		ug/m³	25500	NA	104	70-130	NA	NA	
Anthracene	26400	3300		ug/m³	27500	NA	96.0	70-130	NA	NA	
Benz(a)anthracene	27200	1790		ug/m³	29800	NA	91.3	70-130	NA	NA	
Benzo(a)pyrene	27200	1890		ug/m³	31500	NA	86.3	70-130	NA	NA	
Benzo(b)fluoranthene	27600	1870		ug/m³	31200	NA	88.5	70-130	NA	NA	
Benzo(g,h,i)perylene	36600	4620		ug/m³	38500	NA	95.1	70-130	NA	NA	
Benzo(k)fluoranthene	28100	1890		ug/m³	31600	NA	88.9	70-130	NA	NA	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample (B7D0057-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Chrysene	26400	1800		ug/m³	29900	NA	88.3	70-130	NA	NA	
Dibenz(a,h)anthracene	37400	19300		ug/m³	32100	NA	117	70-130	NA	NA	
Fluoranthene	26500	3420		ug/m³	28500	NA	93.0	70-130	NA	NA	
Fluorene	25800	3250		ug/m³	27100	NA	95.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	28600	2030		ug/m³	33900	NA	84.4	70-130	NA	NA	
Naphthalene	26100	1660		ug/m³	27700	NA	94.2	70-130	NA	NA	
Phenanthrene	26100	3320		ug/m³	27700	NA	94.2	70-130	NA	NA	
Pyrene	26000	3480		ug/m³	29000	NA	89.7	70-130	NA	NA	

Laboratory Control Sample Duplicate (B7D0057-BSD1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	27800	0.00		ug/m³	28200	NA	98.6	70-130	0.722	20	
2-Methylnaphthalene filter	27900	0.00		ug/m³	28200	NA	98.9	70-130	0.719	20	
Acenaphthene filter	25400	0.00		ug/m³	26000	NA	97.7	70-130	1.59	20	
Acenaphthylene filter	24800	0.00		ug/m³	25700	NA	96.5	70-130	0.402	20	
Anthracene filter	25300	0.00		ug/m³	25100	NA	101	70-130	2.81	20	
Benz(a)anthracene filter	25300	0.00		ug/m³	25600	NA	98.8	70-130	2.81	20	
Benzo(a)pyrene filter	25000	0.00		ug/m³	25300	NA	98.8	70-130	2.43	20	
Benzo(b)fluoranthene filter	24900	0.00		ug/m³	25300	NA	98.4	70-130	2.44	20	
Benzo(g,h,i)perylene filter	28400	0.00		ug/m³	25800	NA	110	70-130	5.42	20	
Benzo(k)fluoranthene filter	25100	0.00		ug/m³	25400	NA	98.8	70-130	2.01	20	
Chrysene filter	24400	0.00		ug/m³	25400	NA	96.1	70-130	2.49	20	
Dibenz(a,h)anthracene filter	33700	0.00		ug/m³	25100	NA	134	70-130	3.01	20	
Fluoranthene filter	25100	0.00		ug/m³	25500	NA	98.4	70-130	2.42	20	
Fluorene filter	25100	0.00		ug/m³	25600	NA	98.0	70-130	2.42	20	
Indeno(1,2,3-cd)pyrene filter	26400	0.00		ug/m³	26800	NA	98.5	70-130	2.30	20	
Naphthalene filter	26900	0.00		ug/m³	28100	NA	95.7	70-130	0.746	20	
Phenanthrene filter	25100	0.00		ug/m³	25500	NA	98.4	70-130	2.83	20	
Pyrene filter	25300	0.00		ug/m³	25600	NA	98.8	70-130	2.81	20	
1-Methylnaphthalene	24400	1590		ug/m³	26600	NA	91.7	70-130	5.19	20	
2-Methylnaphthalene	24500	1590		ug/m³	26400	NA	92.8	70-130	4.78	20	
Acenaphthene	24400	3310		ug/m³	27600	NA	88.4	70-130	6.73	20	
Acenaphthylene	24800	3050		ug/m³	25500	NA	97.3	70-130	7.00	20	
Anthracene	24300	3300		ug/m³	27500	NA	88.4	70-130	8.28	20	
Benz(a)anthracene	24000	1790		ug/m³	29800	NA	80.5	70-130	12.5	20	
Benzo(a)pyrene	22600	1890		ug/m³	31500	NA	71.7	70-130	18.5	20	
Benzo(b)fluoranthene	23700	1870		ug/m³	31200	NA	76.0	70-130	15.2	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0057 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0057-BSD1) Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzo(g,h,i)perylene	29700	4620		ug/m³	38500	NA	77.1	70-130	20.8	20	
Benzo(k)fluoranthene	24100	1890		ug/m³	31600	NA	76.3	70-130	15.3	20	
Chrysene	23200	1800		ug/m³	29900	NA	77.6	70-130	12.9	20	
Dibenz(a,h)anthracene	29900	19300		ug/m³	32100	NA	93.1	70-130	22.3	20	
Fluoranthene	24200	3420		ug/m³	28500	NA	84.9	70-130	9.07	20	
Fluorene	24400	3250		ug/m³	27100	NA	90.0	70-130	5.58	20	
Indeno(1,2,3-cd)pyrene	23200	2030		ug/m³	33900	NA	68.4	70-130	20.8	20	
Naphthalene	25000	1660		ug/m³	27700	NA	90.3	70-130	4.31	20	
Phenanthrene	24200	3320		ug/m³	27700	NA	87.4	70-130	7.55	20	
Pyrene	23000	3480		ug/m³	29000	NA	79.3	70-130	12.2	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701575

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of ~~1~~ 2
RE PLF 3/21/07

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS Corp
Mailing Address: 700 3rd St. S, Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: (612) 370-0700 Fax #: (612) 373-6800
E-mail: hubert_huls@urscorp.com

Project ID/Name: Ashland NSP
P.O. #/Project #

SEND INVOICE TO
Contact Name
Company
Address: SAME
City, State, Zip
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Filter half of containers in line 7 & 8, Filter all of container in line 9.
*For PAH ~~[illegible]~~ slurry ~~samples~~ mix sample and report as Dry weight

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH	VOC	DOC	TOC	TSS	Percent Solids				FOR LAB USE ONLY
1	NSP-2-10M-PAH-2-032007	03/20/07	12:26	Air	301.2L	3	N	X									0701575-1,2
2	NSP-2-10M-VOC-2-032007		12:26	Air	301.2L	2	N		X								3,4
3	NSP-2-10M-PAH-5-032007		16:31	Air	602.4L	3	N	X									5,6
4	NSP-2-10M-VOC-5-032007	03/20/07	16:31	Air	602.4L	2	N		X								7,8
5	NSP-2-10M-PAH-6-032107	03/21/07	8:37	Air	2409.6L	3	N	X									9,10
6	NSP-2-10M-VOC-6-032107	03/21/07	8:37	Air	2409.6L	2	N		X								11,12
7	NSP-2-10M-VOC-8-032107	03/21/07	8:50	Slurry		6	N		X								13
8	NSP-2-10M-PAH-8-032107					6	N	X		X							14
9	NSP-2-10M-DOC-8-032107					1	N			X							15
10	NSP-2-10M-TOC-8-032107					1	N				X						16
11	NSP-2-10M-TSS-8-032107		8:50	Slurry		1	N					X					17
12	NSP-1-10M-PAH-1-032107		9:50	Soil		2	N	X									18
13	NSP-1-10M-VOC-1-032107		9:50	Soil		2	N		X								19
14	NSP-1-10M-TOC-7-032107		9:55	Slurry		1	N				X						20
15	NSP-1-10M-TSS-7-032107	3/21/07	9:55	Slurry		1	N					X	X				21

RE PLF 3/21/07

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/21/07 10:15
Received by: [signature] Date/Time 3/21/07 10:15
Relinquished by: [signature] Date/Time 3/21/07 11:28
Received Contents Not Verified: Richard Nelson Date/Time 3-21-07 11:28
Received Contents Verified: Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 5.0 °C

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701575
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701575

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquiries:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name: HUBERT HULS
Project ID/Name: ASHLAND NSP
P.O. #/Project #:
Company: URS
Mailing Address:
City, State, Zip:
Telephone #:
Fax #:
E-mail:

SEND INVOICE TO
Contact Name:
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	VOC								FOR LAB USE ONLY
1	TRIP BLANK (MeOH)	3/21		SOIL		1		X								0701575-22
2	TRIP BLANK (HCL)	↓		H_2O		2		X								↓ -23
3																
4																
5	* ITEMS 1 & 2 REC'D W/SHIPMENT															
6	BUT NOT ORIGINALLY ITEMIZED ON															
7	FIRST COC. (AC) PLK 3/21/07															
8																
9																
10																
11																
12																
13																
14																
15																

CHAIN OF CUSTODY
Collected by: (Print)
Collector's Signature:
Relinquished by: Date/Time
Relinquished by: Date/Time
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: Date/Time 3/21/07 1253
Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☐ Yes ☐ No
Temp Blank ☐ Yes ☐ No
Temp: _____ °C SEE PAGE 1
Comments:

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/05

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

April 30, 2007

Work Order #: 0701595
(Revised)

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 22, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Qualifiers and Abbreviations

vn	The surrogate recovery is below the laboratory generated control limits.
vm	The surrogate recovery is above the laboratory generated control limits.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
ts	This analysis was performed by a subcontract laboratory.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
ib	Unidentified compounds are present in the sample.
ia	The back section of the sample tube contained greater than 10 percent of the amount collected on the front section. This indicates possible analyte breakthrough (loss) during field sampling.
gw	The sample was extracted 1 day past the method specified holding time.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
go	The laboratory control sample recovery is outside of laboratory control limits.
A5	The MDL value for this analyte is an estimated value; no statistical value has been determined.
A2	The Laboratory Control Sample had a recovery of 69.6%, which is outside the laboratory limtis of 70-130%.
A1a	The Laboratory Control Sample recovery is 74.3%, which is below the laboratory limits of 75-125%.
A1	The Laboratory Control Sample and Laboratory Control Sample Duplicate filter recoveries were 141% and 143%, which are above the laboratory limits of 70-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit
NA	Not Applicable
ND	Analyte NOT DETECTED
NR	Not Reported
%Rec	Percent Recovery
RPD	Relative Percent Difference
VOC	Volatile Organic Compound

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-2-10M-VOC-3-032107	0701595-01	Soil	03/21/07 10:30	03/22/07 23:50
NSP-2-10M-PAH-3-032107	0701595-02	Soil	03/21/07 10:30	03/22/07 23:50
NSP-2-10M-PAH-4-032107	0701595-03	Water	03/21/07 11:40	03/22/07 23:50
NSP-2-10M-VOC-4-032107	0701595-04	Water	03/21/07 11:40	03/22/07 23:50
NSP-1-10M-PAH-2-032107 Front	0701595-05	Air Tube	03/21/07 12:03	03/22/07 23:50
NSP-1-10M-VOC-2-032107 Front	0701595-07	Air Tube	03/21/07 12:03	03/22/07 23:50
NSP-1-10M-PAH-5-032107 Front	0701595-09	Air Tube	03/21/07 16:07	03/22/07 23:50
NSP-1-10M-VOC-5-032107 Front	0701595-11	Air Tube	03/21/07 16:07	03/22/07 23:50
NSP-1-10M-PAH-6-032207 Front	0701595-13	Air Tube	03/22/07 08:12	03/22/07 23:50
NSP-1-10M-VOC-6-032207 Front	0701595-15	Air Tube	03/22/07 08:12	03/22/07 23:50
NSP-1-10M-VOC-6-032207 Back	0701595-16	Air Tube	03/22/07 08:12	03/22/07 23:50
NSP-1-10M-VOC-8-032207	0701595-17	Slurry	03/22/07 08:25	03/22/07 23:50
NSP-1-10M-PAH-8-032207 total	0701595-18	Water	03/22/07 08:25	03/22/07 23:50
NSP-1-10M-TOC-8-032207	0701595-19	Slurry	03/22/07 08:25	03/22/07 23:50
NSP-1-10M-DOC-8-032207	0701595-20	Slurry	03/22/07 08:25	03/22/07 23:50
NSP-1-10M-TSS-8-032207	0701595-21	Slurry	03/22/07 08:25	03/22/07 23:50
Trip Blank (MeOH)	0701595-22	Soil	03/22/07 00:00	03/22/07 23:50
Trip Blanks (HCL)	0701595-23	Water	03/22/07 00:00	03/22/07 23:50
NSP-1-10M-PAH-8-032207	0701595-24	Water	03/22/07 08:25	03/22/07 23:50

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	5.1 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-VOC-3-032107

0701595-01 (Soil)

3/21/07 10:30

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**58**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545, 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**5.8**	4.3	0.14	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**11**	4.3	0.30	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	4.3	0.42	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	4.3	0.51	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Benzene	ND	4.3	0.19	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	4.3	0.24	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Ethylbenzene	**18**	4.3	0.45	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
m,p-Xylenes	**12**	4.3	0.54	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
o-Xylene	**6.1**	4.3	0.60	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	4.3	0.18	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Styrene	ND	4.3	0.20	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Toluene	**6.7**	4.3	0.74	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Trichloroethene	ND	4.3	0.32	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*100 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*107 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-PAH-3-032107

0701595-02 (Soil)

3/21/07 10:30

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**68**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545, 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**160**	7.2	1.2	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
1-Methylphenanthrene	**16**	0.72	0.086	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**26**	7.2	0.86	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2,6-Dimethylnaphthalene	**95**	7.2	1.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
2-Methylnaphthalene	**230**	7.2	2.5	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthene	**140**	7.2	1.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Acenaphthylene	**11**	0.72	0.075	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Anthracene	**76**	7.2	1.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benz(a)anthracene	**19**	0.72	0.11	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(a)pyrene	**18**	0.72	0.086	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(b)fluoranthene	**11**	0.72	0.18	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(e)pyrene	**10**	0.72	0.11	mg/kg dry	B7C0383	3/23/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**3.3**	0.72	0.064	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Benzo(k)fluoranthene	**13**	0.72	0.15	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Biphenyl	**29**	7.2	1.3	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Chrysene	**23**	0.72	0.11	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Dibenz(a,h)anthracene	**1.3**	0.72	0.23	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluoranthene	**65**	7.2	0.75	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Fluorene	**100**	7.2	0.43	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**3.4**	0.72	0.097	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Naphthalene	**280**	7.2	0.54	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Perylene	**2.7**	0.72	0.12	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Phenanthrene	**210**	7.2	0.86	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Pyrene	**89**	7.2	1.1	mg/kg dry	B7C0383	3/23/07	4/4/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*87.7 %*	*Limits: 30-104%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*86.6 %*	*Limits: 30-90%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*97.2 %*	*Limits: 30-115%*			*B7C0383*	*3/23/07*	*4/4/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-PAH-4-032107

0701595-03 (Water)

3/21/07 11:40

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1600**	540	380	ng/L	B7C0423	3/27/07	3/30/07	EPA 8270C	
1-Methylphenanthrene	26 J	54	19	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	54	35	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
2,6-Dimethylnaphthalene	**310**	54	38	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
2-Methylnaphthalene	**2000**	540	30	ng/L	B7C0423	3/27/07	3/30/07	EPA 8270C	go
Acenaphthene	**540**	11	2.0	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Acenaphthylene	**16**	11	2.3	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Anthracene	**40**	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benz(a)anthracene	ND	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(a)pyrene	3.2 J	11	2.3	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(b)fluoranthene	ND	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(e)pyrene	ND	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(g,h,i)perylene	**12**	11	6.0	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(k)fluoranthene	5.6 J	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Biphenyl	**190**	54	39	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Chrysene	9.6 J	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Dibenz(a,h)anthracene	**22**	11	3.8	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Fluoranthene	**59**	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Fluorene	**300**	11	2.3	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**11**	11	2.7	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Naphthalene	**5300**	540	20	ng/L	B7C0423	3/27/07	3/30/07	EPA 8270C	go
Perylene	ND	22	12	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Phenanthrene	**430**	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Pyrene	**40**	11	5.4	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*77.7 %*	*Limits: 30-120%*			*B7C0423*	*3/27/07*	*3/29/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*96.7 %*	*Limits: 30-120%*			*B7C0423*	*3/27/07*	*3/29/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*124 %*	*Limits: 30-120%*			*B7C0423*	*3/27/07*	*3/29/07*	*EPA 8270C*	*vm*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-2-10M-VOC-4-032107

0701595-04 (Water)

3/21/07 11:40

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*104 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*110 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-PAH-2-032107 Front

0701595-05 (Air Tube)

3/21/07 12:03

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Chrysene	ND	5.96		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	A1, gp
Fluoranthene	ND	11.4		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	A2, gp
Naphthalene	**20.2**	5.52		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-VOC-2-032107 Front

0701595-07 (Air Tube)

3/21/07 12:03

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**15.2**	9.85		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Benzene	**27.6**	9.87		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Carbon Tetrachloride	**35.2**	20.3		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Ethyl Benzene	ND	19.5		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Toluene	**62.6**	10.0		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Xylenes, Total	**45.1**	19.9		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-PAH-5-032107 Front

0701595-09 (Air Tube)

3/21/07 16:07

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Chrysene	ND	2.98		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	A1, gp
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	A2, gp
Naphthalene	**12.0**	2.76		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-VOC-5-032107 Front

0701595-11 (Air Tube)

3/21/07 16:07

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	5.03		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**11.1**	4.93		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,4-Dichlorobenzene	ND	5.76		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Benzene	**16.9**	4.94		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Carbon Tetrachloride	ND	10.2		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Ethyl Benzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Toluene	**48.1**	5.02		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Trichloroethene	ND	4.97		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Xylenes, Total	**31.2**	9.94		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-PAH-6-032207 Front

0701595-13 (Air Tube)

3/22/07 8:12

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**3.62**	0.662		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
2-Methylnaphthalene	**7.24**	0.658		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Chrysene	ND	0.746		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	A1, gp
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	A2, gp
Naphthalene	**7.60**	0.689		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/5/07	4/5/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-VOC-6-032207 Front

0701595-15 (Air Tube)

3/22/07 8:12

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**2.32**	1.26		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**13.2**	1.23		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,3,5-Trimethylbenzene	**3.82**	1.20		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Benzene	**15.2**	1.23		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	ia
Carbon Tetrachloride	**82.7**	2.54		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Ethyl Benzene	**7.39**	2.44		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Styrene	**4.14**	1.63		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Toluene	**45.7**	1.25		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Trichloroethene	**2.08**	1.24		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Xylenes, Total	**35.3**	2.49		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-VOC-6-032207 Back

0701595-16 (Air Tube)

3/22/07 8:12

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.26		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,2,4-Trimethylbenzene	ND	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	ib
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Benzene	**1.26**	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Carbon Tetrachloride	ND	12.7		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Ethyl Benzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Styrene	ND	1.63		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	A1a
Toluene	ND	1.25		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Xylenes, Total	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-VOC-8-032207

0701595-17 (Slurry)

3/22/07 8:25

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**28**	1.0	0.069	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**62**	1.0	0.030	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	**15**	1.0	0.039	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	**10**	1.0	0.042	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	**2.6**	1.0	0.036	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
m,p-Xylenes	**110**	1.0	0.059	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
o-Xylene	**74**	1.0	0.072	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	**19**	1.0	0.048	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*108 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*110 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-PAH-8-032207 total

0701595-18 (Water)

3/22/07 8:25

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**180**	25	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	**66**	25	1.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	25	2.8	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**130**	25	2.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	11 J	25	2.0	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthene	**340**	10	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthylene	**39**	10	0.94	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Anthracene	**160**	10	1.0	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benz(a)anthracene	**86**	10	3.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	**71**	10	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	**49**	25	2.1	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	**41**	25	4.0	ug/L	B7C0455	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**27**	10	3.4	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	**44**	10	3.7	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Biphenyl	**26**	25	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Chrysene	**86**	10	3.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	23 J	25	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Fluoranthene	**190**	10	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Fluorene	**140**	10	2.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**33**	25	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Naphthalene	12 J	25	1.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Perylene	9.7 J	25	1.4	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Phenanthrene	**420**	100	10	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Pyrene	**290**	10	2.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*72.1 %*	*Limits: 59-101%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*61.4 %*	*Limits: 57-101%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*74.9 %*	*Limits: 65-100%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-TOC-8-032207

0701595-19 (Slurry)

3/22/07 8:25

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**8.8**	1.5	0.50	mg/L	B7D0081	4/3/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-DOC-8-032207

0701595-20 (Slurry)

3/22/07 8:25

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**8.2**	1.5	0.50	mg/L	B7D0082	3/28/07	3/28/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-TSS-8-032207

0701595-21 (Slurry)

3/22/07 8:25

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**380**	10	3.6	mg/L	B7C0413	3/26/07	3/26/07	EPA 160.2	
Total Solids	**1100**	20	1.0	mg/L	B7C0486	3/29/07	3/29/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Trip Blank (MeOH)

0701595-22 (Soil)

3/22/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*102 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*108 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*105 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Trip Blanks (HCL)

0701595-23 (Water)

3/22/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*101 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*109 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

NSP-1-10M-PAH-8-032207

0701595-24 (Water)

3/22/07 8:25

Semivolatile Organic Compounds

gw

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	1.9 J	17	0.85	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	ND	17	1.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	2.6 J	17	1.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**160**	17	1.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	1.9 J	17	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**60**	6.7	0.87	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	5.1 J	6.7	0.62	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	1.1 J	6.7	0.69	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	ND	6.7	2.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	ND	6.7	2.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	ND	17	1.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	ND	17	2.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	A5
Benzo(g,h,i)perylene	ND	6.7	2.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	ND	6.7	2.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	3.3 J	17	0.86	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	ND	6.7	2.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	17	2.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	ND	6.7	0.86	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	**11**	6.7	1.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	17	2.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	4.0 J	17	1.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Perylene	ND	17	0.95	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	4.7 J	6.7	0.69	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Pyrene	ND	6.7	1.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*76.2 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*64.8 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*84.6 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Classical Chemistry Parameters - Quality Control

Batch B7C0413 - Default Prep GenChem

Method Blank (B7C0413-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7C0413-BS1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	255			mg/L	250	NA	102	80-120	NA	NA	

Batch B7C0415 - Default Prep GenChem

Method Blank (B7C0415-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7C0415-SRM1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	91.1			% Wt	88.8	NA	103	90-110	NA	NA	

Batch B7C0486 - Default Prep GenChem

Method Blank (B7C0486-BLK1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Method Blank (B7C0383-BLK1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0423 J	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.0743	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.248	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.813*			mg/kg	*0.833*	*NA*	*97.6*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.692*			mg/kg	*0.833*	*NA*	*83.1*	*30-90*			
Surrogate: Terphenyl-d14	*0.969*			mg/kg	*0.833*	*NA*	*116*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0383 - EPA 3545

Laboratory Control Sample (B7C0383-BS1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	NA	NA	
Pyrene	1.35	0.067	0.010	mg/kg	1.67	NA	80.8	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.706*			mg/kg	*0.833*	*NA*	*84.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.588*			mg/kg	*0.833*	*NA*	*70.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.804*			mg/kg	*0.833*	*NA*	*96.5*	*30-115*			

Laboratory Control Sample Duplicate (B7C0383-BSD1) Prepared: 03/23/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.25	0.067	0.010	mg/kg	1.66	NA	75.3	50-115	0.797	25	
Pyrene	1.32	0.067	0.010	mg/kg	1.66	NA	79.5	50-130	2.25	25	
Surrogate: 2-Fluorobiphenyl	*0.682*			mg/kg	*0.832*	*NA*	*82.0*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.521*			mg/kg	*0.832*	*NA*	*62.6*	*30-90*			
Surrogate: Terphenyl-d14	*0.795*			mg/kg	*0.832*	*NA*	*95.6*	*30-115*			

Batch B7C0455 - EPA 3510C

Method Blank (B7C0455-BLK1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	5.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0455 - EPA 3510C

Method Blank (B7C0455-BLK1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Indeno(1,2,3-cd)pyrene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*18.7*			ug/L	*25.0*	*NA*	*74.8*	*59-101*			
Surrogate: Nitrobenzene-d5	*16.5*			ug/L	*25.0*	*NA*	*66.0*	*57-101*			
Surrogate: Terphenyl-d14	*23.2*			ug/L	*25.0*	*NA*	*92.8*	*65-100*			

Laboratory Control Sample (B7C0455-BS1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	39.0	2.0	0.26	ug/L	50.0	NA	78.0	50-110	NA	NA	
Pyrene	49.5	2.0	0.50	ug/L	50.0	NA	99.0	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*17.3*			ug/L	*25.0*	*NA*	*69.2*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*21.6*			ug/L	*25.0*	*NA*	*86.4*	*65-100*			

Laboratory Control Sample Duplicate (B7C0455-BSD1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	36.8	2.0	0.26	ug/L	50.0	NA	73.6	50-110	5.80	20	
Pyrene	49.0	2.0	0.50	ug/L	50.0	NA	98.0	55-120	1.02	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*22.2*			ug/L	*25.0*	*NA*	*88.8*	*65-100*			

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

Laboratory Control Sample (B7C0494-BS1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0494-BSD1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Method Blank (B7C0423-BLK1) Prepared: 03/27/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	25.5	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	16.8	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	3.90	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	9.01	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	43.5	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	25.5	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	7.98	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*144*			ng/L	*250*	*NA*	*57.6*	*30-120*			
Surrogate: Nitrobenzene-d5	*258*			ng/L	*250*	*NA*	*103*	*30-120*			
Surrogate: Terphenyl-d14	*282*			ng/L	*250*	*NA*	*113*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Laboratory Control Sample (B7C0423-BS1) Prepared: 03/27/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	410	50	36	ng/L	500	NA	82.0	70-130	NA	NA	
1-Methylphenanthrene	474	50	18	ng/L	500	NA	94.8	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	399	50	32	ng/L	500	NA	79.8	70-130	NA	NA	
2,6-Dimethylnaphthalene	390	50	35	ng/L	500	NA	78.0	70-130	NA	NA	
2-Methylnaphthalene	359	50	2.8	ng/L	500	NA	71.8	70-130	NA	NA	
Acenaphthene	392	10	1.9	ng/L	500	NA	78.4	43-120	NA	NA	
Acenaphthylene	372	10	2.1	ng/L	500	NA	74.4	70-130	NA	NA	
Anthracene	431	10	5.0	ng/L	500	NA	86.2	70-130	NA	NA	
Benz(a)anthracene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Benzo(a)pyrene	448	10	2.1	ng/L	500	NA	89.6	75-148	NA	NA	
Benzo(b)fluoranthene	431	10	5.0	ng/L	500	NA	86.2	70-130	NA	NA	
Benzo(e)pyrene	440	10	5.0	ng/L	500	NA	88.0	70-130	NA	NA	
Benzo(g,h,i)perylene	519	10	5.6	ng/L	500	NA	104	70-130	NA	NA	
Benzo(k)fluoranthene	448	10	5.0	ng/L	500	NA	89.6	70-130	NA	NA	
Biphenyl	398	50	36	ng/L	500	NA	79.6	70-130	NA	NA	
Chrysene	436	10	5.0	ng/L	500	NA	87.2	70-130	NA	NA	
Dibenz(a,h)anthracene	468	10	3.5	ng/L	500	NA	93.6	70-130	NA	NA	
Fluoranthene	492	10	5.0	ng/L	500	NA	98.4	67-130	NA	NA	
Fluorene	417	10	2.1	ng/L	500	NA	83.4	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	539	10	2.5	ng/L	500	NA	108	70-130	NA	NA	
Naphthalene	365	50	1.9	ng/L	500	NA	73.0	70-130	NA	NA	
Perylene	448	20	11	ng/L	500	NA	89.6	70-130	NA	NA	
Phenanthrene	424	10	5.0	ng/L	500	NA	84.8	70-130	NA	NA	
Pyrene	499	10	5.0	ng/L	500	NA	99.8	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*160*			ng/L	*250*	*NA*	*64.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*248*			ng/L	*250*	*NA*	*99.2*	*30-120*			
Surrogate: Terphenyl-d14	*291*			ng/L	*250*	*NA*	*116*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0423-BSD1) Prepared: 03/27/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	391	50	36	ng/L	500	NA	78.2	70-130	4.74	20	
1-Methylphenanthrene	447	50	18	ng/L	500	NA	89.4	70-130	5.86	20	
2,3,5-Trimethylnaphthalene	382	50	32	ng/L	500	NA	76.4	70-130	4.35	20	
2,6-Dimethylnaphthalene	374	50	35	ng/L	500	NA	74.8	70-130	4.19	20	
2-Methylnaphthalene	335	50	2.8	ng/L	500	NA	67.0	70-130	6.92	20	
Acenaphthene	374	10	1.9	ng/L	500	NA	74.8	43-120	4.70	20	
Acenaphthylene	360	10	2.1	ng/L	500	NA	72.0	70-130	3.28	20	
Anthracene	398	10	5.0	ng/L	500	NA	79.6	70-130	7.96	20	
Benz(a)anthracene	450	10	5.0	ng/L	500	NA	90.0	70-130	2.70	20	
Benzo(a)pyrene	452	10	2.1	ng/L	500	NA	90.4	75-148	0.889	20	
Benzo(b)fluoranthene	450	10	5.0	ng/L	500	NA	90.0	70-130	4.31	20	
Benzo(e)pyrene	455	10	5.0	ng/L	500	NA	91.0	70-130	3.35	20	
Benzo(g,h,i)perylene	533	10	5.6	ng/L	500	NA	107	70-130	2.66	20	
Benzo(k)fluoranthene	457	10	5.0	ng/L	500	NA	91.4	70-130	1.99	20	
Biphenyl	382	50	36	ng/L	500	NA	76.4	70-130	4.10	20	
Chrysene	448	10	5.0	ng/L	500	NA	89.6	70-130	2.71	20	
Dibenz(a,h)anthracene	475	10	3.5	ng/L	500	NA	95.0	70-130	1.48	20	
Fluoranthene	477	10	5.0	ng/L	500	NA	95.4	67-130	3.10	20	
Fluorene	396	10	2.1	ng/L	500	NA	79.2	70-130	5.17	20	
Indeno(1,2,3-cd)pyrene	548	10	2.5	ng/L	500	NA	110	70-130	1.66	20	
Naphthalene	339	50	1.9	ng/L	500	NA	67.8	70-130	7.39	20	
Perylene	457	20	11	ng/L	500	NA	91.4	70-130	1.99	20	
Phenanthrene	381	10	5.0	ng/L	500	NA	76.2	70-130	10.7	20	
Pyrene	485	10	5.0	ng/L	500	NA	97.0	70-130	2.85	20	
Surrogate: 2-Fluorobiphenyl	*149*			ng/L	*250*	*NA*	*59.6*	*30-120*			
Surrogate: Nitrobenzene-d5	*230*			ng/L	*250*	*NA*	*92.0*	*30-120*			
Surrogate: Terphenyl-d14	*288*			ng/L	*250*	*NA*	*115*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Matrix Spike (B7C0423-MS1) **Source: 0701595-03** Prepared: 03/27/07 Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1870	54	38	ng/L	538	1600	50.2	70-130	NA	NA	
1-Methylphenanthrene	539	54	19	ng/L	538	26	95.4	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	474	54	35	ng/L	538	ND	88.1	70-130	NA	NA	
2,6-Dimethylnaphthalene	738	54	38	ng/L	538	310	79.6	70-130	NA	NA	
2-Methylnaphthalene	2220	54	3.0	ng/L	538	2000	40.9	70-130	NA	NA	
Acenaphthene	855	11	2.0	ng/L	538	540	58.6	43-120	NA	NA	
Acenaphthylene	420	11	2.3	ng/L	538	16	75.1	70-130	NA	NA	
Anthracene	452	11	5.4	ng/L	538	40	76.6	70-130	NA	NA	
Benz(a)anthracene	511	11	5.4	ng/L	538	ND	95.0	70-130	NA	NA	
Benzo(a)pyrene	471	11	2.3	ng/L	538	3.2	87.0	75-148	NA	NA	
Benzo(b)fluoranthene	494	11	5.4	ng/L	538	ND	91.8	70-130	NA	NA	
Benzo(e)pyrene	513	11	5.4	ng/L	538	ND	95.4	70-130	NA	NA	
Benzo(g,h,i)perylene	598	11	6.0	ng/L	538	12	109	70-130	NA	NA	
Benzo(k)fluoranthene	527	11	5.4	ng/L	538	5.6	96.9	70-130	NA	NA	
Biphenyl	617	54	39	ng/L	538	190	79.4	70-130	NA	NA	
Chrysene	494	11	5.4	ng/L	538	9.6	90.0	70-130	NA	NA	
Dibenz(a,h)anthracene	539	11	3.8	ng/L	538	22	96.1	70-130	NA	NA	
Fluoranthene	581	11	5.4	ng/L	538	59	97.0	67-130	NA	NA	
Fluorene	701	11	2.3	ng/L	538	300	74.5	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	618	11	2.7	ng/L	538	11	113	70-130	NA	NA	
Naphthalene	4990	54	2.0	ng/L	538	5300	NR	70-130	NA	NA	
Perylene	491	22	12	ng/L	538	ND	91.3	70-130	NA	NA	
Phenanthrene	793	11	5.4	ng/L	538	430	67.5	70-130	NA	NA	
Pyrene	564	11	5.4	ng/L	538	40	97.4	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*200*			ng/L	*269*	*NA*	*74.3*	*30-120*			
Surrogate: Nitrobenzene-d5	*297*			ng/L	*269*	*NA*	*110*	*30-120*			
Surrogate: Terphenyl-d14	*319*			ng/L	*269*	*NA*	*119*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Matrix Spike Duplicate (B7C0423-MSD1) **Source: 0701595-03** Prepared: 03/27/07 Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1580	54	39	ng/L	543	1600	NR	70-130	16.8	20	
1-Methylphenanthrene	535	54	19	ng/L	543	26	93.7	70-130	0.745	20	
2,3,5-Trimethylnaphthalene	433	54	35	ng/L	543	ND	79.7	70-130	9.04	20	
2,6-Dimethylnaphthalene	666	54	38	ng/L	543	310	65.6	70-130	10.3	20	
2-Methylnaphthalene	2070	54	3.0	ng/L	543	2000	12.9	70-130	6.99	20	
Acenaphthene	805	11	2.1	ng/L	543	540	48.8	43-120	6.02	20	
Acenaphthylene	369	11	2.3	ng/L	543	16	65.0	70-130	12.9	20	
Anthracene	428	11	5.4	ng/L	543	40	71.5	70-130	5.45	20	
Benz(a)anthracene	516	11	5.4	ng/L	543	ND	95.0	70-130	0.974	20	
Benzo(a)pyrene	483	11	2.3	ng/L	543	3.2	88.4	75-148	2.52	20	
Benzo(b)fluoranthene	524	11	5.4	ng/L	543	ND	96.5	70-130	5.89	20	
Benzo(e)pyrene	526	11	5.4	ng/L	543	ND	96.9	70-130	2.50	20	
Benzo(g,h,i)perylene	616	11	6.1	ng/L	543	12	111	70-130	2.97	20	
Benzo(k)fluoranthene	529	11	5.4	ng/L	543	5.6	96.4	70-130	0.379	20	
Biphenyl	544	54	39	ng/L	543	190	65.2	70-130	12.6	20	
Chrysene	499	11	5.4	ng/L	543	9.6	90.1	70-130	1.01	20	
Dibenz(a,h)anthracene	553	11	3.8	ng/L	543	22	97.8	70-130	2.56	20	
Fluoranthene	577	11	5.4	ng/L	543	59	95.4	67-130	0.691	20	
Fluorene	650	11	2.3	ng/L	543	300	64.5	70-130	7.55	20	
Indeno(1,2,3-cd)pyrene	632	11	2.7	ng/L	543	11	114	70-130	2.24	20	
Naphthalene	4740	54	2.1	ng/L	543	5300	NR	70-130	5.14	20	
Perylene	503	22	12	ng/L	543	ND	92.6	70-130	2.41	20	
Phenanthrene	784	11	5.4	ng/L	543	430	65.2	70-130	1.14	20	
Pyrene	566	11	5.4	ng/L	543	40	96.9	70-130	0.354	20	
Surrogate: 2-Fluorobiphenyl	*178*			ng/L	*272*	*NA*	*65.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*240*			ng/L	*272*	*NA*	*88.2*	*30-120*			
Surrogate: Terphenyl-d14	*321*			ng/L	*272*	*NA*	*118*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Method Blank (B7C0459-BLK1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.2*			ug/L	*25.0*	*NA*	*105*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*25.7*			ug/L	*25.0*	*NA*	*103*	*80-120*			

Laboratory Control Sample (B7C0459-BS1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.09	0.050	0.0035	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.09	0.050	0.0049	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,4-Dichlorobenzene	1.20	0.050	0.0060	mg/kg	1.25	NA	96.0	75-125	NA	NA	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	NA	NA	
Ethylbenzene	1.24	0.050	0.0053	mg/kg	1.25	NA	99.2	75-125	NA	NA	
m,p-Xylenes	2.49	0.050	0.0063	mg/kg	2.50	NA	99.6	75-125	NA	NA	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	NA	NA	
sec-Butylbenzene	1.10	0.050	0.0021	mg/kg	1.25	NA	88.0	75-125	NA	NA	
Styrene	1.24	0.050	0.0023	mg/kg	1.25	NA	99.2	75-125	NA	NA	
Toluene	1.21	0.050	0.0086	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Trichloroethene	1.33	0.050	0.0037	mg/kg	1.25	NA	106	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Laboratory Control Sample Duplicate (B7C0459-BSD1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.08	0.050	0.0035	mg/kg	1.25	NA	86.4	75-125	0.922	20	
1,3,5-Trimethylbenzene	1.07	0.050	0.0049	mg/kg	1.25	NA	85.6	75-125	1.85	20	
1,4-Dichlorobenzene	1.19	0.050	0.0060	mg/kg	1.25	NA	95.2	75-125	0.837	20	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	0.00	20	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	0.00	20	
Ethylbenzene	1.22	0.050	0.0053	mg/kg	1.25	NA	97.6	75-125	1.63	20	
m,p-Xylenes	2.45	0.050	0.0063	mg/kg	2.50	NA	98.0	75-125	1.62	20	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	0.00	20	
sec-Butylbenzene	1.09	0.050	0.0021	mg/kg	1.25	NA	87.2	75-125	0.913	20	
Styrene	1.22	0.050	0.0023	mg/kg	1.25	NA	97.6	75-125	1.63	20	
Toluene	1.20	0.050	0.0086	mg/kg	1.25	NA	96.0	75-125	0.830	20	
Trichloroethene	1.32	0.050	0.0037	mg/kg	1.25	NA	106	75-125	0.755	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Batch B7C0490 - EPA 5030B

Method Blank (B7C0490-BLK1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: Dibromofluoromethane	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Toluene-d8	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Volatile Organic Compounds - Quality Control

Batch B7C0490 - EPA 5030B

Laboratory Control Sample (B7C0490-BS1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.2	1.0	0.030	ug/L	25.0	NA	88.8	75-125	NA	NA	
1,3,5-Trimethylbenzene	22.3	1.0	0.039	ug/L	25.0	NA	89.2	75-125	NA	NA	
1,4-Dichlorobenzene	24.6	1.0	0.051	ug/L	25.0	NA	98.4	75-125	NA	NA	
Benzene	25.5	1.0	0.042	ug/L	25.0	NA	102	75-125	NA	NA	
Carbon Tetrachloride	23.0	2.5	0.050	ug/L	25.0	NA	92.0	75-125	NA	NA	
Ethylbenzene	24.9	1.0	0.036	ug/L	25.0	NA	99.6	75-125	NA	NA	
m,p-Xylenes	49.8	1.0	0.059	ug/L	50.0	NA	99.6	75-125	NA	NA	
o-Xylene	24.6	1.0	0.072	ug/L	25.0	NA	98.4	75-125	NA	NA	
sec-Butylbenzene	22.6	1.0	0.027	ug/L	25.0	NA	90.4	75-125	NA	NA	
Styrene	24.9	1.0	0.049	ug/L	25.0	NA	99.6	75-125	NA	NA	
Toluene	24.6	1.0	0.048	ug/L	25.0	NA	98.4	75-125	NA	NA	
Trichloroethene	27.0	1.0	0.067	ug/L	25.0	NA	108	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.5*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Dibromofluoromethane	*28.3*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Laboratory Control Sample Duplicate (B7C0490-BSD1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.1	1.0	0.030	ug/L	25.0	NA	88.4	75-125	0.451	20	
1,3,5-Trimethylbenzene	22.0	1.0	0.039	ug/L	25.0	NA	88.0	75-125	1.35	20	
1,4-Dichlorobenzene	23.8	1.0	0.051	ug/L	25.0	NA	95.2	75-125	3.31	20	
Benzene	25.1	1.0	0.042	ug/L	25.0	NA	100	75-125	1.58	20	
Carbon Tetrachloride	22.6	2.5	0.050	ug/L	25.0	NA	90.4	75-125	1.75	20	
Ethylbenzene	24.5	1.0	0.036	ug/L	25.0	NA	98.0	75-125	1.62	20	
m,p-Xylenes	49.2	1.0	0.059	ug/L	50.0	NA	98.4	75-125	1.21	20	
o-Xylene	24.5	1.0	0.072	ug/L	25.0	NA	98.0	75-125	0.407	20	
sec-Butylbenzene	22.4	1.0	0.027	ug/L	25.0	NA	89.6	75-125	0.889	20	
Styrene	24.4	1.0	0.049	ug/L	25.0	NA	97.6	75-125	2.03	20	
Toluene	24.3	1.0	0.048	ug/L	25.0	NA	97.2	75-125	1.23	20	
Trichloroethene	26.8	1.0	0.067	ug/L	25.0	NA	107	75-125	0.743	20	
Surrogate: 1,2-Dichloroethane-d4	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.5*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Dibromofluoromethane	*28.0*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0093 - AIRTUBES Prep

Laboratory Control Sample (B7D0093-BS1) Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29100	0.00		ug/m³	28200	NA	103	70-130	NA	NA	
2-Methylnaphthalene filter	29200	0.00		ug/m³	28200	NA	104	70-130	NA	NA	
Acenaphthene filter	26500	0.00		ug/m³	26000	NA	102	70-130	NA	NA	
Acenaphthylene filter	26000	0.00		ug/m³	25700	NA	101	70-130	NA	NA	
Anthracene filter	26500	0.00		ug/m³	25100	NA	106	70-130	NA	NA	
Benz(a)anthracene filter	26500	0.00		ug/m³	25600	NA	104	70-130	NA	NA	
Benzo(a)pyrene filter	26100	0.00		ug/m³	25300	NA	103	70-130	NA	NA	
Benzo(b)fluoranthene filter	26100	0.00		ug/m³	25300	NA	103	70-130	NA	NA	
Benzo(g,h,i)perylene filter	32000	0.00		ug/m³	25800	NA	124	70-130	NA	NA	
Benzo(k)fluoranthene filter	26400	0.00		ug/m³	25400	NA	104	70-130	NA	NA	
Chrysene filter	25600	0.00		ug/m³	25400	NA	101	70-130	NA	NA	
Dibenz(a,h)anthracene filter	35400	0.00		ug/m³	25100	NA	141	70-130	NA	NA	
Fluoranthene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	27700	0.00		ug/m³	26800	NA	103	70-130	NA	NA	
Naphthalene filter	28100	0.00		ug/m³	28100	NA	100	70-130	NA	NA	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Pyrene filter	26400	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
1-Methylnaphthalene	25200	1590		ug/m³	26600	NA	94.7	70-130	NA	NA	
2-Methylnaphthalene	25200	1590		ug/m³	26400	NA	95.5	70-130	NA	NA	
Acenaphthene	25300	3310		ug/m³	27600	NA	91.7	70-130	NA	NA	
Acenaphthylene	23400	3050		ug/m³	25500	NA	91.8	70-130	NA	NA	
Anthracene	25200	3300		ug/m³	27500	NA	91.6	70-130	NA	NA	
Benz(a)anthracene	24800	1790		ug/m³	29800	NA	83.2	70-130	NA	NA	
Benzo(a)pyrene	23100	1890		ug/m³	31500	NA	73.3	70-130	NA	NA	
Benzo(b)fluoranthene	24300	1870		ug/m³	31200	NA	77.9	70-130	NA	NA	
Benzo(g,h,i)perylene	28100	4620		ug/m³	38500	NA	73.0	70-130	NA	NA	
Benzo(k)fluoranthene	24700	1890		ug/m³	31600	NA	78.2	70-130	NA	NA	
Chrysene	23900	1800		ug/m³	29900	NA	79.9	70-130	NA	NA	
Dibenz(a,h)anthracene	31100	19300		ug/m³	32100	NA	96.9	70-130	NA	NA	
Fluoranthene	25000	3420		ug/m³	28500	NA	87.7	70-130	NA	NA	
Fluorene	25200	3250		ug/m³	27100	NA	93.0	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	23600	2030		ug/m³	33900	NA	69.6	70-130	NA	NA	
Naphthalene	25700	1660		ug/m³	27700	NA	92.8	70-130	NA	NA	
Phenanthrene	25100	3320		ug/m³	27700	NA	90.6	70-130	NA	NA	
Pyrene	24800	3480		ug/m³	29000	NA	85.5	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0093 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0093-BSD1) Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29200	0.00		ug/m³	28200	NA	104	70-130	0.343	20	
2-Methylnaphthalene filter	29300	0.00		ug/m³	28200	NA	104	70-130	0.342	20	
Acenaphthene filter	26600	0.00		ug/m³	26000	NA	102	70-130	0.377	20	
Acenaphthylene filter	25800	0.00		ug/m³	25700	NA	100	70-130	0.772	20	
Anthracene filter	26400	0.00		ug/m³	25100	NA	105	70-130	0.378	20	
Benz(a)anthracene filter	26500	0.00		ug/m³	25600	NA	104	70-130	0.00	20	
Benzo(a)pyrene filter	26100	0.00		ug/m³	25300	NA	103	70-130	0.00	20	
Benzo(b)fluoranthene filter	26100	0.00		ug/m³	25300	NA	103	70-130	0.00	20	
Benzo(g,h,i)perylene filter	31800	0.00		ug/m³	25800	NA	123	70-130	0.627	20	
Benzo(k)fluoranthene filter	26300	0.00		ug/m³	25400	NA	104	70-130	0.380	20	
Chrysene filter	25600	0.00		ug/m³	25400	NA	101	70-130	0.00	20	
Dibenz(a,h)anthracene filter	35900	0.00		ug/m³	25100	NA	143	70-130	1.40	20	
Fluoranthene filter	26200	0.00		ug/m³	25500	NA	103	70-130	0.381	20	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	0.00	20	
Indeno(1,2,3-cd)pyrene filter	27900	0.00		ug/m³	26800	NA	104	70-130	0.719	20	
Naphthalene filter	28300	0.00		ug/m³	28100	NA	101	70-130	0.709	20	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	0.00	20	
Pyrene filter	26600	0.00		ug/m³	25600	NA	104	70-130	0.755	20	
1-Methylnaphthalene	26900	1590		ug/m³	26600	NA	101	70-130	6.53	20	
2-Methylnaphthalene	26900	1590		ug/m³	26400	NA	102	70-130	6.53	20	
Acenaphthene	27200	3310		ug/m³	27600	NA	98.6	70-130	7.24	20	
Acenaphthylene	25200	3050		ug/m³	25500	NA	98.8	70-130	7.41	20	
Anthracene	27600	3300		ug/m³	27500	NA	100	70-130	9.09	20	
Benz(a)anthracene	28300	1790		ug/m³	29800	NA	95.0	70-130	13.2	20	
Benzo(a)pyrene	28000	1890		ug/m³	31500	NA	88.9	70-130	19.2	20	
Benzo(b)fluoranthene	28600	1870		ug/m³	31200	NA	91.7	70-130	16.3	20	
Benzo(g,h,i)perylene	36200	4620		ug/m³	38500	NA	94.0	70-130	25.2	20	
Benzo(k)fluoranthene	29000	1890		ug/m³	31600	NA	91.8	70-130	16.0	20	
Chrysene	27400	1800		ug/m³	29900	NA	91.6	70-130	13.6	20	
Dibenz(a,h)anthracene	38400	19300		ug/m³	32100	NA	120	70-130	21.0	20	
Fluoranthene	27700	3420		ug/m³	28500	NA	97.2	70-130	10.2	20	
Fluorene	27100	3250		ug/m³	27100	NA	100	70-130	7.27	20	
Indeno(1,2,3-cd)pyrene	29200	2030		ug/m³	33900	NA	86.1	70-130	21.2	20	
Naphthalene	27300	1660		ug/m³	27700	NA	98.6	70-130	6.04	20	
Phenanthrene	27400	3320		ug/m³	27700	NA	98.9	70-130	8.76	20	
Pyrene	27700	3480		ug/m³	29000	NA	95.5	70-130	11.0	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample (B7D0206-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	5880	5880	ug/m³	110000	NA	90.0	75-125	NA	NA	
Xylenes, Total	289000	5990	2990	ug/m³	337000	NA	85.8	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	103000	2970	2970	ug/m³	99100	NA	104	75-125	NA	NA	
Styrene	122000	3920	3920	ug/m³	131000	NA	93.1	75-125	NA	NA	
Toluene	107000	3020	3020	ug/m³	101000	NA	106	75-125	NA	NA	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	82400	3030	3030	ug/m³	90200	NA	91.4	75-125	NA	NA	
1,2,4-Trimethylbenzene	85700	2970	2970	ug/m³	91600	NA	93.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	92500	2880	2880	ug/m³	94100	NA	98.3	75-125	NA	NA	
1,4-Dichlorobenzene	62800	3470	3470	ug/m³	65400	NA	96.0	75-125	NA	NA	
Carbon Tetrachloride	97000	6120	6120	ug/m³	102000	NA	95.1	75-125	NA	NA	
sec-Butylbenzene	100000	2940	2940	ug/m³	97000	NA	103	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0206-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	109000	5880	5880	ug/m³	110000	NA	99.1	75-125	9.62	20	
Xylenes, Total	329000	5990	2990	ug/m³	337000	NA	97.6	75-125	12.9	20	

Laboratory Control Sample Duplicate (B7D0206-BSD2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	98100	2970	2970	ug/m³	99100	NA	99.0	75-125	4.87	20	
Styrene	120000	3920	3920	ug/m³	131000	NA	91.6	75-125	1.65	20	
Toluene	100000	3020	3020	ug/m³	101000	NA	99.0	75-125	6.76	20	
Trichloroethene	98700	2990	2990	ug/m³	99800	NA	98.9	75-125	5.23	20	

Laboratory Control Sample Duplicate (B7D0206-BSD3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	93300	3030	3030	ug/m³	90200	NA	103	75-125	12.4	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0206-BSD3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	96000	2970	2970	ug/m³	91600	NA	105	75-125	11.3	20	
1,3,5-Trimethylbenzene	102000	2880	2880	ug/m³	94100	NA	108	75-125	9.77	20	
1,4-Dichlorobenzene	71400	3470	3470	ug/m³	65400	NA	109	75-125	12.8	20	
Carbon Tetrachloride	107000	6120	6120	ug/m³	102000	NA	105	75-125	9.80	20	
sec-Butylbenzene	110000	2940	2940	ug/m³	97000	NA	113	75-125	9.52	20	

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample (B7D0415-BS1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	88100	2940	2940	ug/m³	98000	NA	89.9	75-125	NA	NA	
Xylenes, Total	261000	2990	2990	ug/m³	299000	NA	87.3	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	NA	NA	
Styrene	97300	3920	3920	ug/m³	131000	NA	74.3	75-125	NA	NA	
Toluene	99700	3020	3020	ug/m³	101000	NA	98.7	75-125	NA	NA	
Trichloroethene	99400	2990	2990	ug/m³	99800	NA	99.6	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86300	3030	3030	ug/m³	90200	NA	95.7	75-125	NA	NA	
1,2,4-Trimethylbenzene	90100	2970	2970	ug/m³	91600	NA	98.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	95800	2880	2880	ug/m³	94100	NA	102	75-125	NA	NA	
1,4-Dichlorobenzene	64000	3470	3470	ug/m³	65400	NA	97.9	75-125	NA	NA	
Carbon Tetrachloride	103000	30600	3060	ug/m³	102000	NA	101	75-125	NA	NA	
sec-Butylbenzene	102000	2940	2940	ug/m³	97000	NA	105	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0415-BSD1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	85700	2940	2940	ug/m³	98000	NA	87.4	75-125	2.76	20	
Xylenes, Total	258000	2990	2990	ug/m³	299000	NA	86.3	75-125	1.16	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

Organic Compounds - Quality Control

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0415-BSD2) Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	0.00	20	
Styrene	108000	3920	3920	ug/m³	131000	NA	82.4	75-125	10.4	20	
Toluene	98400	3020	3020	ug/m³	101000	NA	97.4	75-125	1.31	20	
Trichloroethene	98100	2990	2990	ug/m³	99800	NA	98.3	75-125	1.32	20	

Laboratory Control Sample Duplicate (B7D0415-BSD3) Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86800	3030	3030	ug/m³	90200	NA	96.2	75-125	0.578	20	
1,2,4-Trimethylbenzene	89000	2970	2970	ug/m³	91600	NA	97.2	75-125	1.23	20	
1,3,5-Trimethylbenzene	93700	2880	2880	ug/m³	94100	NA	99.6	75-125	2.22	20	
1,4-Dichlorobenzene	64600	3470	3470	ug/m³	65400	NA	98.8	75-125	0.933	20	
Carbon Tetrachloride	100000	30600	3060	ug/m³	102000	NA	98.0	75-125	2.96	20	
sec-Butylbenzene	99300	2940	2940	ug/m³	97000	NA	102	75-125	2.68	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701595

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of ~~1~~ 2
HC PLF 3/22/07

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS Corp
Mailing Address 700 3rd St. S. Suite 600
City, State, Zip Minneapolis MN 55415
Telephone # (612) 370-0700 Fax # (612) 373-6800
E-mail hubert-huls@urscorp.com

Project ID/Name ASHland NSP
P.O. #/Project # 256A8335 75000

SEND INVOICE TO
Contact Name
Company
Address
City, State, Zip
Telephone #
Fax #
SAME

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Line Items 11 & 12: Filter 3 of 6 prior to analysis
Agitate all non-filtered PAH samples prior to analysis

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	VOC	PAH	TOC	DOC	TSS	Percent Solids					FOR LAB USE ONLY
1	NSP-2-10M-VOC-3-032107	03/21/07	10:30	Soil		2	N	X										0701595-1
2	NSP-2-10M-PAH-3-032107		"	"		2	N		X									-2
3	NSP-2-10M-PAH-4-032107		11:40	Water		3	N		X									-3
4	NSP-2-10M-VOC-4-032107		"	"		3	N	X										-4
5	NSP-1-10M-PAH-2-032107		12:03	Air	301.2L	2	N		X									-5,6
6	NSP-1-10M-VOC-2-032107		"	"	301.2L	2	N	X										-7,8
7	NSP-1-10M-PAH-5-032107		16:07	"	602.4L	3	N		X									-9,10
8	NSP-1-10M-~~PA~~ VOC-5-032107	03/21/07	16:07	Air	602.4L	2	N	X										-11,12
9	NSP-1-10M-PAH-6-032207	03/22/07	08:12	"	2409.6L	3	N		X									-13,14
10	NSP-1-10M-VOC-6-032207		08:12	Air	2409.6L	2	N	X										-15,16
11	NSP-1-10M-VOC-8-032207		08:25	Slurry		6	N	X										-17
12	NSP-1-10M-PAH-8-032207					6	N		X									-18
13	NSP-1-10M-TOC-8-032207					1	N			X								-19
14	NSP-1-10M-DOC-8-032207					1	N				X							-20
15	NSP-1-10M-TSS-8-032207	3/22/07	8:25	Slurry		1	N					X	X					-21

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr.
Collector's Signature:
Relinquished by: Date/Time 03/22/07 08:00
Received by: Date/Time 03/22/07 0800
Relinquished by: Date/Time 3/22/07 11:35
Received Contents Not Verified: Date/Time 3/22/07 11:35
Received Contents Verified: Date/Time
Comments:
Custody Seal Intact ☐ Yes ☐ No ☐ N/A Hand delivered
On Ice ☒ Yes ☐ No
Temp Blank ☒ Yes ☐ No
Temp: 5.1 °C

Form # CS02.02 F:\Groups\QA OC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701595
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: CVXX-00-600A

For Braun Intertec Use Only
Laboratory Work Order No.
0701595

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ___ Yes ___ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name: HUBERT HULS
Company: URS
Mailing Address:
City, State, Zip:
Telephone #: Fax #:
E-mail:

Project ID/Name:
P.O. #/Project #:

SEND INVOICE TO
Contact Name: Company:
Address:
City, State, Zip:
Telephone #: Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	VOC									FOR LAB USE ONLY
1	TRIP BLANK (MEOH)	3/22/07		SOIL		1		X									0701595-22
2	TRIP BLANK (HCL)	↓		H2O		2		X									↓ -23
3																	
4	* ITEMS 1 & 2 REC'D W/SHIPMENT																
5	BUT NOT ORIGINALLY ITEMIZED ON																
6	FIRST COC. AC PLK 3/22/07																
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

CHAIN OF CUSTODY
Collected by: *(Print)*
Relinquished by: Date/Time
Relinquished by: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☐ Yes ☐ No
Temp Blank ☐ Yes ☐ No
Temp: _____ °C SEE PAGE 1

Collector's Signature:
Received by: Date/Time
Received Contents Not Verified: Date/Time
Received Contents Verified: Date/Time 3/22/07 1340
Comments:

Form # CS02.02 F:/Groups/QA-QC/Forms/clientservices/COC-CS/02 Effective Date: 11/17/06

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

May 14, 2007

Work Order #: 0701617
(Revised)

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 23, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Qualifiers and Abbreviations

vn	The surrogate recovery is below the laboratory generated control limits.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
ts	This analysis was performed by a subcontract laboratory.
sk	The surrogate recovery is outside of laboratory control limits due to matrix interference.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
ib	Unidentified compounds are present in the sample.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
go	The laboratory control sample recovery is outside of laboratory control limits.
A5	The MDL value for this analyte is an estimated value; no statistical value has been determined.
A2	The Laboratory Control Sample recovery is 69.6%, which is outside the laboratory limits of 70-130%.
A1	The Laboratory Control Sample and Laboratory Control Sample Duplicate for the filters recovered at 141% and 143%, which are outside the laboratory limits of 70-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit
NA	Not Applicable
ND	Analyte NOT DETECTED
NR	Not Reported
%Rec	Percent Recovery
RPD	Relative Percent Difference
VOC	Volatile Organic Compound

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-1-10Q-TSS-7-032207	0701617-01	Slurry	03/22/07 09:45	03/23/07 14:39
NSP-1-10Q-TOC-7-032207	0701617-02	Slurry	03/22/07 09:45	03/23/07 14:39
NSP-1-10M-PAH-3-032207	0701617-03	Soil	03/22/07 10:30	03/23/07 14:39
NSP-1-10M-VOC-3-032207	0701617-04	Soil	03/22/07 10:30	03/23/07 14:39
NSP-1-10M-PAH-4-032207	0701617-05	Water	03/22/07 12:05	03/23/07 14:39
NSP-1-10M-VOC-4-032207	0701617-06	Slurry	03/22/07 12:05	03/23/07 14:39
NSP-1-10Q-PAH-2-032207 Front	0701617-07	Air Tube	03/22/07 11:53	03/23/07 14:39
NSP-1-10Q-VOC-2-032207 Front	0701617-09	Air Tube	03/22/07 11:53	03/23/07 14:39
NSP-1-10Q-PAH-5-032207 Front	0701617-11	Air Tube	03/22/07 15:57	03/23/07 14:39
NSP-1-10Q-VOC-5-032207 Front	0701617-13	Air Tube	03/22/07 15:57	03/23/07 14:39
NSP-1-10Q-PAH-6-032307 Front	0701617-15	Air Tube	03/23/07 08:03	03/23/07 14:39
NSP-1-10Q-VOC-6-032307 Front	0701617-17	Air Tube	03/23/07 08:03	03/23/07 14:39
NSP-1-10Q-PAH-8-032307 total	0701617-19	Water	03/23/07 08:15	03/23/07 14:39
NSP-1-10Q-PAH-8-032307 dissolved	0701617-20	Water	03/23/07 08:15	03/23/07 14:39
NSP-1-10Q-VOC-8-032307	0701617-21	Slurry	03/23/07 08:15	03/23/07 14:39
NSP-1-10Q-TSS-8-032307	0701617-22	Slurry	03/23/07 08:15	03/23/07 14:39
NSP-1-10Q-DOC-8-032307	0701617-23	Slurry	03/23/07 08:15	03/23/07 14:39
NSP-1-10Q-TOC-8-032307	0701617-24	Slurry	03/23/07 08:15	03/23/07 14:39
Trip Blanks (DI)	0701617-25	Water	03/23/07 00:00	03/23/07 14:39
Trip Blank (MeOH)	0701617-26	Soil	03/23/07 00:00	03/23/07 14:39

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	1.3 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-TSS-7-032207

0701617-01 (Slurry)

3/22/07 9:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**4200**	10	3.6	mg/L	B7C0413	3/26/07	3/26/07	EPA 160.2	
Total Solids	**4100**	20	1.0	mg/L	B7C0486	3/29/07	3/29/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-TOC-7-032207

0701617-02 (Slurry)

3/22/07 9:45

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**30**	15	5.0	mg/L	B7D0048	4/2/07	4/2/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10M-PAH-3-032207

0701617-03 (Soil)

3/22/07 10:30

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**74**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**100**	3.3	0.54	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**9.4**	0.66	0.079	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**15**	0.66	0.079	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**57**	3.3	0.49	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**230**	17	5.7	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Acenaphthene	**81**	3.3	0.49	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Acenaphthylene	**5.7**	0.66	0.069	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Anthracene	**45**	3.3	0.49	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Benz(a)anthracene	**16**	0.66	0.099	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**11**	0.66	0.079	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**5.7**	0.66	0.17	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**5.8**	0.66	0.099	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**1.6**	0.66	0.059	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**7.3**	0.66	0.14	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Biphenyl	**15**	0.66	0.12	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Chrysene	**13**	0.66	0.099	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	0.64 J	0.66	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Fluoranthene	**40**	3.3	0.35	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Fluorene	**64**	3.3	0.20	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**1.7**	0.66	0.089	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Naphthalene	**230**	17	1.2	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Perylene	**1.6**	0.66	0.11	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Phenanthrene	**170**	17	2.0	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Pyrene	**26**	0.66	0.099	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*70.3 %*	*Limits: 30-104%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*52.1 %*	*Limits: 30-90%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*75.2 %*	*Limits: 30-115%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10M-VOC-3-032207

0701617-04 (Soil)

3/22/07 10:30

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**76**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**0.89**	0.33	0.010	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**2.0**	0.33	0.023	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	**0.59**	0.33	0.032	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.33	0.039	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Benzene	ND	0.33	0.014	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	0.33	0.018	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Ethylbenzene	**0.54**	0.33	0.035	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
m,p-Xylenes	**1.2**	0.33	0.041	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
o-Xylene	**0.65**	0.33	0.046	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	0.33	0.014	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Styrene	ND	0.33	0.015	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Toluene	ND	0.33	0.056	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Trichloroethene	ND	0.33	0.024	mg/kg dry	B7C0459	3/27/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*101 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*102 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*107 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10M-PAH-4-032207

0701617-05 (Water)

3/22/07 12:05

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**990**	51	37	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
1-Methylphenanthrene	28 J	51	18	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	40 J	51	33	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
2,6-Dimethylnaphthalene	**250**	51	36	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
2-Methylnaphthalene	**930**	51	2.9	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	go
Acenaphthene	**420**	10	1.9	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Acenaphthylene	**14**	10	2.2	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Anthracene	**32**	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benz(a)anthracene	ND	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(a)pyrene	ND	10	2.2	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(b)fluoranthene	ND	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(e)pyrene	ND	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	10	5.7	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Benzo(k)fluoranthene	ND	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Biphenyl	**120**	51	37	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Chrysene	7.4 J	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	10	3.6	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Fluoranthene	**62**	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Fluorene	**220**	10	2.2	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	3.0 J	10	2.6	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Naphthalene	**1400**	510	19	ng/L	B7C0423	3/27/07	3/30/07	EPA 8270C	go
Perylene	ND	21	12	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Phenanthrene	**360**	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Pyrene	**46**	10	5.1	ng/L	B7C0423	3/27/07	3/29/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*77.3 %*	*Limits: 30-120%*			*B7C0423*	*3/27/07*	*3/29/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*85.2 %*	*Limits: 30-120%*			*B7C0423*	*3/27/07*	*3/29/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*120 %*	*Limits: 30-120%*			*B7C0423*	*3/27/07*	*3/29/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10M-VOC-4-032207

0701617-06 (Slurry)

3/22/07 12:05

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*104 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*100 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*109 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-PAH-2-032207 Front

0701617-07 (Air Tube)

3/22/07 11:53

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Chrysene	ND	5.96		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp, A1
Fluoranthene	ND	11.4		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp, A2
Naphthalene	**14.4**	5.52		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-VOC-2-032207 Front

0701617-09 (Air Tube)

3/22/07 11:53

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**12.7**	9.85		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Benzene	**28.0**	9.87		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Carbon Tetrachloride	ND	20.3		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Ethyl Benzene	ND	19.5		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Toluene	**54.1**	10.0		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Xylenes, Total	ND	19.9		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-PAH-5-032207 Front

0701617-11 (Air Tube)

3/22/07 15:57

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Chrysene	ND	2.98		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A1, gp
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A2, gp
Naphthalene	**7.29**	2.76		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-VOC-5-032207 Front

0701617-13 (Air Tube)

3/22/07 15:57

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	5.03		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**8.87**	4.93		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
1,4-Dichlorobenzene	ND	5.76		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Benzene	**13.8**	4.94		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Carbon Tetrachloride	**12.1**	10.2		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Ethyl Benzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Toluene	**29.8**	5.02		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Trichloroethene	**5.82**	4.97		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	
Xylenes, Total	**25.4**	9.94		ug/m³	[CALC]	4/11/07	4/11/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-PAH-6-032307 Front

0701617-15 (Air Tube)

3/23/07 8:03

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**2.16**	0.662		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
2-Methylnaphthalene	ND	0.658		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Chrysene	ND	0.746		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A1, gp
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A2, gp
Naphthalene	**4.08**	0.689		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-VOC-6-032307 Front

0701617-17 (Air Tube)

3/23/07 8:03

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**2.80**	1.26		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**8.96**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	**2.52**	1.20		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**10.1**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**16.4**	2.54		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**4.68**	2.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**2.98**	1.63		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**30.8**	1.25		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**3.02**	1.24		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**24.5**	2.49		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-PAH-8-032307 total

0701617-19 (Water)

3/23/07 8:15

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**690**	250	13	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	**92**	25	1.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**76**	25	2.8	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**340**	25	2.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**230**	25	2.0	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthene	**710**	100	13	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthylene	**56**	10	0.94	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Anthracene	**290**	10	1.0	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benz(a)anthracene	**89**	10	3.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	**99**	10	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	**59**	10	2.1	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	**50**	25	4.0	ug/L	B7C0455	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**36**	10	3.4	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	**58**	10	3.7	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Biphenyl	**90**	25	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Chrysene	**120**	10	3.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	**28**	10	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Fluoranthene	**300**	10	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Fluorene	**310**	10	2.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**38**	10	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Naphthalene	22 J	25	1.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Perylene	13 J	25	1.4	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Phenanthrene	**860**	100	10	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Pyrene	**430**	10	2.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*64.6 %*	*Limits: 59-101%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*55.7 %*	*Limits: 57-101%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	*sk*
Surrogate: Terphenyl-d14	*70.9 %*	*Limits: 65-100%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-PAH-8-032307 dissolved

0701617-20 (Water)

3/23/07 8:15

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**140**	20	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	ND	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	20	2.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**21**	20	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	3.2 J	20	1.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**120**	8.0	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	7.9 J	8.0	0.75	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	ND	8.0	0.83	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	ND	8.0	1.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	ND	20	3.2	ug/L	B7C0494	3/30/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	ND	8.0	2.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	ND	8.0	3.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	10 J	20	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	ND	8.0	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	**14**	8.0	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	2.1 J	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Perylene	ND	20	1.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	5.4 J	8.0	0.82	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Pyrene	ND	8.0	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*67.6 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*55.2 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*vn*
Surrogate: Terphenyl-d14	*87.3 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-VOC-8-032307

0701617-21 (Slurry)

3/23/07 8:15

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**60**	2.0	0.14	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	**150**	2.0	0.060	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	**33**	2.0	0.078	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	2.0	0.10	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	**12**	2.0	0.084	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	5.0	0.10	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	**6.4**	2.0	0.072	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
m,p-Xylenes	**290**	2.0	0.12	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
o-Xylene	**180**	2.0	0.14	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	2.0	0.054	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	2.0	0.098	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	**32**	2.0	0.096	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Trichloroethene	ND	2.0	0.13	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*116 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*107 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-TSS-8-032307

0701617-22 (Slurry)

3/23/07 8:15

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**360**	10	3.6	mg/L	B7C0413	3/26/07	3/26/07	EPA 160.2	
Total Solids	**1500**	20	1.0	mg/L	B7C0486	3/29/07	3/29/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-DOC-8-032307

0701617-23 (Slurry)

3/23/07 8:15

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**9.1**	1.5	0.50	mg/L	B7D0048	3/28/07	3/28/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-TOC-8-032307

0701617-24 (Slurry)

3/23/07 8:15

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	30 J	80	30	mg/L	B7D0048	4/2/07	4/2/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blanks (DI)

0701617-25 (Water)

3/23/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0490	3/28/07	3/28/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*100 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*109 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7C0490*	*3/28/07*	*3/28/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blank (MeOH)

0701617-26 (Soil)

3/23/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7C0459	3/27/07	3/27/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*103 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*108 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*105 %*	*Limits: 80-120%*			*B7C0459*	*3/27/07*	*3/27/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7C0413 - Default Prep GenChem

Method Blank (B7C0413-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7C0413-BS1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	255			mg/L	250	NA	102	80-120	NA	NA	

Batch B7C0415 - Default Prep GenChem

Method Blank (B7C0415-BLK1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7C0415-SRM1)

Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	91.1			% Wt	88.8	NA	103	90-110	NA	NA	

Batch B7C0486 - Default Prep GenChem

Method Blank (B7C0486-BLK1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0446 - EPA 3545

Method Blank (B7C0446-BLK1) Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.144	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	0.0359 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.312	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	0.0443 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	0.0359 J	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	0.00	0.067		mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	0.0210 J	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	0.0176 J	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.606	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	0.0639 J	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	0.0303 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.572*			mg/kg	*0.832*	*NA*	*68.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.416*			mg/kg	*0.832*	*NA*	*50.0*	*30-90*			
Surrogate: Terphenyl-d14	*0.722*			mg/kg	*0.832*	*NA*	*86.8*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0446 - EPA 3545

Laboratory Control Sample (B7C0446-BS1) Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	NA	NA	
Pyrene	1.18	0.067	0.010	mg/kg	1.67	NA	70.7	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.630*			mg/kg	*0.833*	*NA*	*75.6*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.416*			mg/kg	*0.833*	*NA*	*49.9*	*30-90*			
Surrogate: Terphenyl-d14	*0.728*			mg/kg	*0.833*	*NA*	*87.4*	*30-115*			

Laboratory Control Sample Duplicate (B7C0446-BSD1) Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	0.00	25	
Pyrene	1.23	0.067	0.010	mg/kg	1.67	NA	73.7	50-130	4.15	25	
Surrogate: 2-Fluorobiphenyl	*0.682*			mg/kg	*0.833*	*NA*	*81.9*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.472*			mg/kg	*0.833*	*NA*	*56.7*	*30-90*			
Surrogate: Terphenyl-d14	*0.737*			mg/kg	*0.833*	*NA*	*88.5*	*30-115*			

Batch B7C0455 - EPA 3510C

Method Blank (B7C0455-BLK1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	5.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0455 - EPA 3510C

Method Blank (B7C0455-BLK1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Indeno(1,2,3-cd)pyrene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*18.7*			ug/L	*25.0*	*NA*	*74.8*	*59-101*			
Surrogate: Nitrobenzene-d5	*16.5*			ug/L	*25.0*	*NA*	*66.0*	*57-101*			
Surrogate: Terphenyl-d14	*23.2*			ug/L	*25.0*	*NA*	*92.8*	*65-100*			

Laboratory Control Sample (B7C0455-BS1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	39.0	2.0	0.26	ug/L	50.0	NA	78.0	50-110	NA	NA	
Pyrene	49.5	2.0	0.50	ug/L	50.0	NA	99.0	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*17.3*			ug/L	*25.0*	*NA*	*69.2*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*21.6*			ug/L	*25.0*	*NA*	*86.4*	*65-100*			

Laboratory Control Sample Duplicate (B7C0455-BSD1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	36.8	2.0	0.26	ug/L	50.0	NA	73.6	50-110	5.80	20	
Pyrene	49.0	2.0	0.50	ug/L	50.0	NA	98.0	55-120	1.02	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*22.2*			ug/L	*25.0*	*NA*	*88.8*	*65-100*			

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

Laboratory Control Sample (B7C0494-BS1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0494-BSD1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Method Blank (B7C0423-BLK1) Prepared: 03/27/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	25.5	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	16.8	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	3.90	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	9.01	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	43.5	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	25.5	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	7.98	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*144*			ng/L	*250*	*NA*	*57.6*	*30-120*			
Surrogate: Nitrobenzene-d5	*258*			ng/L	*250*	*NA*	*103*	*30-120*			
Surrogate: Terphenyl-d14	*282*			ng/L	*250*	*NA*	*113*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Laboratory Control Sample (B7C0423-BS1) Prepared: 03/27/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	410	50	36	ng/L	500	NA	82.0	70-130	NA	NA	
1-Methylphenanthrene	474	50	18	ng/L	500	NA	94.8	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	399	50	32	ng/L	500	NA	79.8	70-130	NA	NA	
2,6-Dimethylnaphthalene	390	50	35	ng/L	500	NA	78.0	70-130	NA	NA	
2-Methylnaphthalene	359	50	2.8	ng/L	500	NA	71.8	70-130	NA	NA	
Acenaphthene	392	10	1.9	ng/L	500	NA	78.4	43-120	NA	NA	
Acenaphthylene	372	10	2.1	ng/L	500	NA	74.4	70-130	NA	NA	
Anthracene	431	10	5.0	ng/L	500	NA	86.2	70-130	NA	NA	
Benz(a)anthracene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Benzo(a)pyrene	448	10	2.1	ng/L	500	NA	89.6	75-148	NA	NA	
Benzo(b)fluoranthene	431	10	5.0	ng/L	500	NA	86.2	70-130	NA	NA	
Benzo(e)pyrene	440	10	5.0	ng/L	500	NA	88.0	70-130	NA	NA	
Benzo(g,h,i)perylene	519	10	5.6	ng/L	500	NA	104	70-130	NA	NA	
Benzo(k)fluoranthene	448	10	5.0	ng/L	500	NA	89.6	70-130	NA	NA	
Biphenyl	398	50	36	ng/L	500	NA	79.6	70-130	NA	NA	
Chrysene	436	10	5.0	ng/L	500	NA	87.2	70-130	NA	NA	
Dibenz(a,h)anthracene	468	10	3.5	ng/L	500	NA	93.6	70-130	NA	NA	
Fluoranthene	492	10	5.0	ng/L	500	NA	98.4	67-130	NA	NA	
Fluorene	417	10	2.1	ng/L	500	NA	83.4	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	539	10	2.5	ng/L	500	NA	108	70-130	NA	NA	
Naphthalene	365	50	1.9	ng/L	500	NA	73.0	70-130	NA	NA	
Perylene	448	20	11	ng/L	500	NA	89.6	70-130	NA	NA	
Phenanthrene	424	10	5.0	ng/L	500	NA	84.8	70-130	NA	NA	
Pyrene	499	10	5.0	ng/L	500	NA	99.8	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*160*			ng/L	*250*	*NA*	*64.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*248*			ng/L	*250*	*NA*	*99.2*	*30-120*			
Surrogate: Terphenyl-d14	*291*			ng/L	*250*	*NA*	*116*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0423 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0423-BSD1) Prepared: 03/27/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	391	50	36	ng/L	500	NA	78.2	70-130	4.74	20	
1-Methylphenanthrene	447	50	18	ng/L	500	NA	89.4	70-130	5.86	20	
2,3,5-Trimethylnaphthalene	382	50	32	ng/L	500	NA	76.4	70-130	4.35	20	
2,6-Dimethylnaphthalene	374	50	35	ng/L	500	NA	74.8	70-130	4.19	20	
2-Methylnaphthalene	335	50	2.8	ng/L	500	NA	67.0	70-130	6.92	20	
Acenaphthene	374	10	1.9	ng/L	500	NA	74.8	43-120	4.70	20	
Acenaphthylene	360	10	2.1	ng/L	500	NA	72.0	70-130	3.28	20	
Anthracene	398	10	5.0	ng/L	500	NA	79.6	70-130	7.96	20	
Benz(a)anthracene	450	10	5.0	ng/L	500	NA	90.0	70-130	2.70	20	
Benzo(a)pyrene	452	10	2.1	ng/L	500	NA	90.4	75-148	0.889	20	
Benzo(b)fluoranthene	450	10	5.0	ng/L	500	NA	90.0	70-130	4.31	20	
Benzo(e)pyrene	455	10	5.0	ng/L	500	NA	91.0	70-130	3.35	20	
Benzo(g,h,i)perylene	533	10	5.6	ng/L	500	NA	107	70-130	2.66	20	
Benzo(k)fluoranthene	457	10	5.0	ng/L	500	NA	91.4	70-130	1.99	20	
Biphenyl	382	50	36	ng/L	500	NA	76.4	70-130	4.10	20	
Chrysene	448	10	5.0	ng/L	500	NA	89.6	70-130	2.71	20	
Dibenz(a,h)anthracene	475	10	3.5	ng/L	500	NA	95.0	70-130	1.48	20	
Fluoranthene	477	10	5.0	ng/L	500	NA	95.4	67-130	3.10	20	
Fluorene	396	10	2.1	ng/L	500	NA	79.2	70-130	5.17	20	
Indeno(1,2,3-cd)pyrene	548	10	2.5	ng/L	500	NA	110	70-130	1.66	20	
Naphthalene	339	50	1.9	ng/L	500	NA	67.8	70-130	7.39	20	
Perylene	457	20	11	ng/L	500	NA	91.4	70-130	1.99	20	
Phenanthrene	381	10	5.0	ng/L	500	NA	76.2	70-130	10.7	20	
Pyrene	485	10	5.0	ng/L	500	NA	97.0	70-130	2.85	20	
Surrogate: 2-Fluorobiphenyl	*149*			ng/L	*250*	*NA*	*59.6*	*30-120*			
Surrogate: Nitrobenzene-d5	*230*			ng/L	*250*	*NA*	*92.0*	*30-120*			
Surrogate: Terphenyl-d14	*288*			ng/L	*250*	*NA*	*115*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Method Blank (B7C0459-BLK1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.2*			ug/L	*25.0*	*NA*	*105*	*80-120*			
Surrogate: Dibromofluoromethane	*26.9*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Toluene-d8	*25.7*			ug/L	*25.0*	*NA*	*103*	*80-120*			

Laboratory Control Sample (B7C0459-BS1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.09	0.050	0.0035	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.09	0.050	0.0049	mg/kg	1.25	NA	87.2	75-125	NA	NA	
1,4-Dichlorobenzene	1.20	0.050	0.0060	mg/kg	1.25	NA	96.0	75-125	NA	NA	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	NA	NA	
Ethylbenzene	1.24	0.050	0.0053	mg/kg	1.25	NA	99.2	75-125	NA	NA	
m,p-Xylenes	2.49	0.050	0.0063	mg/kg	2.50	NA	99.6	75-125	NA	NA	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	NA	NA	
sec-Butylbenzene	1.10	0.050	0.0021	mg/kg	1.25	NA	88.0	75-125	NA	NA	
Styrene	1.24	0.050	0.0023	mg/kg	1.25	NA	99.2	75-125	NA	NA	
Toluene	1.21	0.050	0.0086	mg/kg	1.25	NA	96.8	75-125	NA	NA	
Trichloroethene	1.33	0.050	0.0037	mg/kg	1.25	NA	106	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7C0459 - EPA 5035

Laboratory Control Sample Duplicate (B7C0459-BSD1)

Prepared & Analyzed: 03/27/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.08	0.050	0.0035	mg/kg	1.25	NA	86.4	75-125	0.922	20	
1,3,5-Trimethylbenzene	1.07	0.050	0.0049	mg/kg	1.25	NA	85.6	75-125	1.85	20	
1,4-Dichlorobenzene	1.19	0.050	0.0060	mg/kg	1.25	NA	95.2	75-125	0.837	20	
Benzene	1.21	0.050	0.0022	mg/kg	1.25	NA	96.8	75-125	0.00	20	
Carbon Tetrachloride	1.15	0.050	0.0028	mg/kg	1.25	NA	92.0	75-125	0.00	20	
Ethylbenzene	1.22	0.050	0.0053	mg/kg	1.25	NA	97.6	75-125	1.63	20	
m,p-Xylenes	2.45	0.050	0.0063	mg/kg	2.50	NA	98.0	75-125	1.62	20	
o-Xylene	1.22	0.050	0.0070	mg/kg	1.25	NA	97.6	75-125	0.00	20	
sec-Butylbenzene	1.09	0.050	0.0021	mg/kg	1.25	NA	87.2	75-125	0.913	20	
Styrene	1.22	0.050	0.0023	mg/kg	1.25	NA	97.6	75-125	1.63	20	
Toluene	1.20	0.050	0.0086	mg/kg	1.25	NA	96.0	75-125	0.830	20	
Trichloroethene	1.32	0.050	0.0037	mg/kg	1.25	NA	106	75-125	0.755	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*27.0*			ug/L	*25.0*	*NA*	*108*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Batch B7C0490 - EPA 5030B

Method Blank (B7C0490-BLK1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: Dibromofluoromethane	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Toluene-d8	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7C0490 - EPA 5030B

Laboratory Control Sample (B7C0490-BS1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.2	1.0	0.030	ug/L	25.0	NA	88.8	75-125	NA	NA	
1,3,5-Trimethylbenzene	22.3	1.0	0.039	ug/L	25.0	NA	89.2	75-125	NA	NA	
1,4-Dichlorobenzene	24.6	1.0	0.051	ug/L	25.0	NA	98.4	75-125	NA	NA	
Benzene	25.5	1.0	0.042	ug/L	25.0	NA	102	75-125	NA	NA	
Carbon Tetrachloride	23.0	2.5	0.050	ug/L	25.0	NA	92.0	75-125	NA	NA	
Ethylbenzene	24.9	1.0	0.036	ug/L	25.0	NA	99.6	75-125	NA	NA	
m,p-Xylenes	49.8	1.0	0.059	ug/L	50.0	NA	99.6	75-125	NA	NA	
o-Xylene	24.6	1.0	0.072	ug/L	25.0	NA	98.4	75-125	NA	NA	
sec-Butylbenzene	22.6	1.0	0.027	ug/L	25.0	NA	90.4	75-125	NA	NA	
Styrene	24.9	1.0	0.049	ug/L	25.0	NA	99.6	75-125	NA	NA	
Toluene	24.6	1.0	0.048	ug/L	25.0	NA	98.4	75-125	NA	NA	
Trichloroethene	27.0	1.0	0.067	ug/L	25.0	NA	108	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.5*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Dibromofluoromethane	*28.3*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Laboratory Control Sample Duplicate (B7C0490-BSD1)

Prepared & Analyzed: 03/28/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.1	1.0	0.030	ug/L	25.0	NA	88.4	75-125	0.451	20	
1,3,5-Trimethylbenzene	22.0	1.0	0.039	ug/L	25.0	NA	88.0	75-125	1.35	20	
1,4-Dichlorobenzene	23.8	1.0	0.051	ug/L	25.0	NA	95.2	75-125	3.31	20	
Benzene	25.1	1.0	0.042	ug/L	25.0	NA	100	75-125	1.58	20	
Carbon Tetrachloride	22.6	2.5	0.050	ug/L	25.0	NA	90.4	75-125	1.75	20	
Ethylbenzene	24.5	1.0	0.036	ug/L	25.0	NA	98.0	75-125	1.62	20	
m,p-Xylenes	49.2	1.0	0.059	ug/L	50.0	NA	98.4	75-125	1.21	20	
o-Xylene	24.5	1.0	0.072	ug/L	25.0	NA	98.0	75-125	0.407	20	
sec-Butylbenzene	22.4	1.0	0.027	ug/L	25.0	NA	89.6	75-125	0.889	20	
Styrene	24.4	1.0	0.049	ug/L	25.0	NA	97.6	75-125	2.03	20	
Toluene	24.3	1.0	0.048	ug/L	25.0	NA	97.2	75-125	1.23	20	
Trichloroethene	26.8	1.0	0.067	ug/L	25.0	NA	107	75-125	0.743	20	
Surrogate: 1,2-Dichloroethane-d4	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.5*			ug/L	*25.0*	*NA*	*106*	*80-120*			
Surrogate: Dibromofluoromethane	*28.0*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0093 - AIRTUBES Prep

Laboratory Control Sample (B7D0093-BS1) Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29100	0.00		ug/m³	28200	NA	103	70-130	NA	NA	
2-Methylnaphthalene filter	29200	0.00		ug/m³	28200	NA	104	70-130	NA	NA	
Acenaphthene filter	26500	0.00		ug/m³	26000	NA	102	70-130	NA	NA	
Acenaphthylene filter	26000	0.00		ug/m³	25700	NA	101	70-130	NA	NA	
Anthracene filter	26500	0.00		ug/m³	25100	NA	106	70-130	NA	NA	
Benz(a)anthracene filter	26500	0.00		ug/m³	25600	NA	104	70-130	NA	NA	
Benzo(a)pyrene filter	26100	0.00		ug/m³	25300	NA	103	70-130	NA	NA	
Benzo(b)fluoranthene filter	26100	0.00		ug/m³	25300	NA	103	70-130	NA	NA	
Benzo(g,h,i)perylene filter	32000	0.00		ug/m³	25800	NA	124	70-130	NA	NA	
Benzo(k)fluoranthene filter	26400	0.00		ug/m³	25400	NA	104	70-130	NA	NA	
Chrysene filter	25600	0.00		ug/m³	25400	NA	101	70-130	NA	NA	
Dibenz(a,h)anthracene filter	35400	0.00		ug/m³	25100	NA	141	70-130	NA	NA	
Fluoranthene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	27700	0.00		ug/m³	26800	NA	103	70-130	NA	NA	
Naphthalene filter	28100	0.00		ug/m³	28100	NA	100	70-130	NA	NA	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Pyrene filter	26400	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
1-Methylnaphthalene	25200	1590		ug/m³	26600	NA	94.7	70-130	NA	NA	
2-Methylnaphthalene	25200	1590		ug/m³	26400	NA	95.5	70-130	NA	NA	
Acenaphthene	25300	3310		ug/m³	27600	NA	91.7	70-130	NA	NA	
Acenaphthylene	23400	3050		ug/m³	25500	NA	91.8	70-130	NA	NA	
Anthracene	25200	3300		ug/m³	27500	NA	91.6	70-130	NA	NA	
Benz(a)anthracene	24800	1790		ug/m³	29800	NA	83.2	70-130	NA	NA	
Benzo(a)pyrene	23100	1890		ug/m³	31500	NA	73.3	70-130	NA	NA	
Benzo(b)fluoranthene	24300	1870		ug/m³	31200	NA	77.9	70-130	NA	NA	
Benzo(g,h,i)perylene	28100	4620		ug/m³	38500	NA	73.0	70-130	NA	NA	
Benzo(k)fluoranthene	24700	1890		ug/m³	31600	NA	78.2	70-130	NA	NA	
Chrysene	23900	1800		ug/m³	29900	NA	79.9	70-130	NA	NA	
Dibenz(a,h)anthracene	31100	19300		ug/m³	32100	NA	96.9	70-130	NA	NA	
Fluoranthene	25000	3420		ug/m³	28500	NA	87.7	70-130	NA	NA	
Fluorene	25200	3250		ug/m³	27100	NA	93.0	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	23600	2030		ug/m³	33900	NA	69.6	70-130	NA	NA	
Naphthalene	25700	1660		ug/m³	27700	NA	92.8	70-130	NA	NA	
Phenanthrene	25100	3320		ug/m³	27700	NA	90.6	70-130	NA	NA	
Pyrene	24800	3480		ug/m³	29000	NA	85.5	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0093 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0093-BSD1) Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29200	0.00		ug/m³	28200	NA	104	70-130	0.343	20	
2-Methylnaphthalene filter	29300	0.00		ug/m³	28200	NA	104	70-130	0.342	20	
Acenaphthene filter	26600	0.00		ug/m³	26000	NA	102	70-130	0.377	20	
Acenaphthylene filter	25800	0.00		ug/m³	25700	NA	100	70-130	0.772	20	
Anthracene filter	26400	0.00		ug/m³	25100	NA	105	70-130	0.378	20	
Benz(a)anthracene filter	26500	0.00		ug/m³	25600	NA	104	70-130	0.00	20	
Benzo(a)pyrene filter	26100	0.00		ug/m³	25300	NA	103	70-130	0.00	20	
Benzo(b)fluoranthene filter	26100	0.00		ug/m³	25300	NA	103	70-130	0.00	20	
Benzo(g,h,i)perylene filter	31800	0.00		ug/m³	25800	NA	123	70-130	0.627	20	
Benzo(k)fluoranthene filter	26300	0.00		ug/m³	25400	NA	104	70-130	0.380	20	
Chrysene filter	25600	0.00		ug/m³	25400	NA	101	70-130	0.00	20	
Dibenz(a,h)anthracene filter	35900	0.00		ug/m³	25100	NA	143	70-130	1.40	20	
Fluoranthene filter	26200	0.00		ug/m³	25500	NA	103	70-130	0.381	20	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	0.00	20	
Indeno(1,2,3-cd)pyrene filter	27900	0.00		ug/m³	26800	NA	104	70-130	0.719	20	
Naphthalene filter	28300	0.00		ug/m³	28100	NA	101	70-130	0.709	20	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	0.00	20	
Pyrene filter	26600	0.00		ug/m³	25600	NA	104	70-130	0.755	20	
1-Methylnaphthalene	26900	1590		ug/m³	26600	NA	101	70-130	6.53	20	
2-Methylnaphthalene	26900	1590		ug/m³	26400	NA	102	70-130	6.53	20	
Acenaphthene	27200	3310		ug/m³	27600	NA	98.6	70-130	7.24	20	
Acenaphthylene	25200	3050		ug/m³	25500	NA	98.8	70-130	7.41	20	
Anthracene	27600	3300		ug/m³	27500	NA	100	70-130	9.09	20	
Benz(a)anthracene	28300	1790		ug/m³	29800	NA	95.0	70-130	13.2	20	
Benzo(a)pyrene	28000	1890		ug/m³	31500	NA	88.9	70-130	19.2	20	
Benzo(b)fluoranthene	28600	1870		ug/m³	31200	NA	91.7	70-130	16.3	20	
Benzo(g,h,i)perylene	36200	4620		ug/m³	38500	NA	94.0	70-130	25.2	20	
Benzo(k)fluoranthene	29000	1890		ug/m³	31600	NA	91.8	70-130	16.0	20	
Chrysene	27400	1800		ug/m³	29900	NA	91.6	70-130	13.6	20	
Dibenz(a,h)anthracene	38400	19300		ug/m³	32100	NA	120	70-130	21.0	20	
Fluoranthene	27700	3420		ug/m³	28500	NA	97.2	70-130	10.2	20	
Fluorene	27100	3250		ug/m³	27100	NA	100	70-130	7.27	20	
Indeno(1,2,3-cd)pyrene	29200	2030		ug/m³	33900	NA	86.1	70-130	21.2	20	
Naphthalene	27300	1660		ug/m³	27700	NA	98.6	70-130	6.04	20	
Phenanthrene	27400	3320		ug/m³	27700	NA	98.9	70-130	8.76	20	
Pyrene	27700	3480		ug/m³	29000	NA	95.5	70-130	11.0	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample (B7D0206-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	5880	5880	ug/m³	110000	NA	90.0	75-125	NA	NA	
Xylenes, Total	289000	5990	2990	ug/m³	337000	NA	85.8	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	103000	2970	2970	ug/m³	99100	NA	104	75-125	NA	NA	
Styrene	122000	3920	3920	ug/m³	131000	NA	93.1	75-125	NA	NA	
Toluene	107000	3020	3020	ug/m³	101000	NA	106	75-125	NA	NA	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	82400	3030	3030	ug/m³	90200	NA	91.4	75-125	NA	NA	
1,2,4-Trimethylbenzene	85700	2970	2970	ug/m³	91600	NA	93.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	92500	2880	2880	ug/m³	94100	NA	98.3	75-125	NA	NA	
1,4-Dichlorobenzene	62800	3470	3470	ug/m³	65400	NA	96.0	75-125	NA	NA	
Carbon Tetrachloride	97000	6120	6120	ug/m³	102000	NA	95.1	75-125	NA	NA	
sec-Butylbenzene	100000	2940	2940	ug/m³	97000	NA	103	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0206-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	109000	5880	5880	ug/m³	110000	NA	99.1	75-125	9.62	20	
Xylenes, Total	329000	5990	2990	ug/m³	337000	NA	97.6	75-125	12.9	20	

Laboratory Control Sample Duplicate (B7D0206-BSD2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	98100	2970	2970	ug/m³	99100	NA	99.0	75-125	4.87	20	
Styrene	120000	3920	3920	ug/m³	131000	NA	91.6	75-125	1.65	20	
Toluene	100000	3020	3020	ug/m³	101000	NA	99.0	75-125	6.76	20	
Trichloroethene	98700	2990	2990	ug/m³	99800	NA	98.9	75-125	5.23	20	

Laboratory Control Sample Duplicate (B7D0206-BSD3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	93300	3030	3030	ug/m³	90200	NA	103	75-125	12.4	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0206-BSD3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	96000	2970	2970	ug/m³	91600	NA	105	75-125	11.3	20	
1,3,5-Trimethylbenzene	102000	2880	2880	ug/m³	94100	NA	108	75-125	9.77	20	
1,4-Dichlorobenzene	71400	3470	3470	ug/m³	65400	NA	109	75-125	12.8	20	
Carbon Tetrachloride	107000	6120	6120	ug/m³	102000	NA	105	75-125	9.80	20	
sec-Butylbenzene	110000	2940	2940	ug/m³	97000	NA	113	75-125	9.52	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701617

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS corp
Mailing Address: 700 3rd St. S, Suite #600
City, State, Zip: Minneapolis, MN 55415
Telephone #: (612) 370-0700 Fax #: (612) 373-6800
E-mail: hubert_huls@urscorp.com

Project ID/Name: NSP Ashland
P.O. #/Project #: 25688375.75000

SEND INVOICE TO
Contact Name:
Company:
Address: SAME
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units) 1/2 of containers should be filtered and 1/2 not filtered for samples in line # 13 & 14. PAH slurries should have stirred soil/water mix tested

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	TSS	TOC	Percent Solids	PAH	VOC	Percent Solids					FOR LAB USE ONLY
1	NSP-1-10Q-TSS-7-032207	3/22/07	9:45	Slurry		1	N	X		X								0701617-1
2	NSP-1-10Q-TOC-7-032207		9:45	Slurry		1	N		X									-2
3	NSP-1-10Q-PAH-3-032207		10:30	Soil		2	N				X							-3
4	NSP-1-10Q-VOC-3-032207		10:30	Soil		2	N					X						-4
5	NSP-1-10Q-PAH-4-032207		12:05	Water		3	N				X							-5
6	NSP-1-10Q-VOC-4-032207		1205	Water		3	N					X						-6
7	NSP-1-10Q-PAH-2-032207		11:53	Air	301.2 L	3	N				X							-7,8
8	NSP-1-10Q-VOC-2-032207		11:53		301.2 L	2	N					X						-9,10
9	NSP-1-10Q-PAH-5-032207		15:57		602.4 L	3	N				X							-11,12
10	NSP-1-10Q-VOC-5-032207	03/22/07	15:57		602.4 L	2	N					X						-13,14
11	NSP-1-10Q-PAH-6-032307	03/23/07	08:03		2409.6 L	3	N				X							-15,16
12	NSP-1-10Q-VOC-6-032307		08:03	Air	2409.6 L	2	N					X						-17,18
13	NSP-1-10Q-PAH-8-032307		08:15	Slurry		6	N				X							-19,20
14	NSP-1-10Q-VOC-8-032307					6	N					X						-21
15	NSP-1-10Q-TSS-8-032307	03/23/07	8:15	Slurry		1	N	X					X					-22

"10M" on Bottles
"10M" on Vials

CHAIN OF CUSTODY
Collected by: (Print) William G. Flynn Jr.
Collector's Signature:
Relinquished by: Date/Time 03/23/07 08:40
Received by: Date/Time 3/23 2:00
Relinquished by: Date/Time 3/23/07 2:37
Received Contents Not Verified: Date/Time 3/23/07 1439
Received Contents Verified: Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 1.3 °C

Form # CS02.02 F:/Groups/QA-QC/Forms/clientservices/COC CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701617
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701617

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS Corp
Mailing Address 700 3rd St S., Suite 600
City, State, Zip Minneapolis, MN 55415
Telephone # 612-370-0700 Fax # 612-373-6800
E-mail hubert-huls@urscorp.com

Project ID/Name Ashland NSP
P.O. #/Project # 25688375.75000

SEND INVOICE TO
Contact Name
Company
Address
City, State, Zip SAME
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Agitate all non-filtered PAH samples prior to analysis

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	DOC	TOC	FOR LAB USE ONLY
1	NSP-1-10Q-DOC-B-032307	03/23/07	08:15	Slurry		1	N	X		0701617-23
2	NSP-1-10Q-TOC-B-032307	03/23/07	08:15	Slurry		1	N		X	-24
3	Trip Blank (DI)					2	N			-25
4	Trip Blank (MeOH)					1	N			-26
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

CHAIN OF CUSTODY
Collected by: (Print) William G. Flynn Jr
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/23/07 08:40
Received by: [signature] Date/Time 3/23 2:00
Relinquished by: [signature] Date/Time 3/23/07 2:37
Received Contents Not Verified: [signature] Date/Time 3/23/07 1440
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 1.3 °C
Comments:

Form # CS02.02 F:\Groups\QA\QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

May 02, 2007

Work Order #: 0701670

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 28, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Qualifiers and Abbreviations

A5b	The MDL value for this analyte is an estimated value; no statistical value has been determined.
A1a	The Laboratory Control Sample has a recovery of 66.3%, which is below the laboratory limits of 70-130%.
A1b	The Laboratory Control Sample recovery is 74.3%, which is below the laboratory limits of 75-125%.
A2	The calibration check standards were at 120% and 117%, which are outside the laboratory limits of 85-115%. There may be a high bias to the reported results.
A2a	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 29.6% and 46.8%, which are below the laboratory limits of 70-130%.
A3	The calibration check standards were at 186% and 181%, which are outside the laboratory limits of 85-115%. There may be a high bias to the reported results.
A3a	The Laboratory Control Sample has a recovery of 54.8%, which is below laboratory limits of 70-130%.
A4	The Laboratory Control Sample and Laboratory Control Sample Duplicate had recoveries of 150% & 161% for tubes and 181% & 178 % for filters. These are outside the laboratory limits of 75-125%, and may indicate a high bias to the results.
A4a	The Laboratory Control Sample has a recovery of 60.4%, which is below the laboratory limits of 70-130%.
A1	The calibration check standards were at 122% and 119%, which are outside the laboratory limits of 85-115%. There may be a high bias to the reported results.
A5a	The Laboratory Control Sample has a recovery of 69.9%, which is below the laboratory limits of 70-130%.
vn	The surrogate recovery is below the laboratory generated control limits.
B	Analyte is found in the associated blank as well as in the sample (CLP B-flag).
gk	The sample was analyzed 23 days past the method specified holding time.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
ia	The back section of the sample tube contained greater than 10 percent of the amount collected on the front section. This indicates possible analyte breakthrough (loss) during field sampling.
ib	Unidentified compounds are present in the sample.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
sk	The surrogate recovery is outside of laboratory control limits due to matrix interference.
ts	This analysis was performed by a subcontract laboratory.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
A5	The Laboratory Control Sample has a recovery of 60.8%, which is below the laboratory limits of 70-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-2A-10Q-TSS-7-032607	0701670-01	Slurry	03/26/07 10:00	03/28/07 12:06
NSP-2A-10Q-PAH-2-032607 Front	0701670-02	Air Tube	03/26/07 12:10	03/28/07 12:06
NSP-2A-10Q-PAH-2-032607 Back	0701670-03	Air Tube	03/26/07 12:10	03/28/07 12:06
NSP-2A-10Q-VOC-2-032607 Front	0701670-04	Air Tube	03/26/07 12:10	03/28/07 12:06
NSP-2A-10Q-PAH-5-032607 Front	0701670-06	Air Tube	03/26/07 16:14	03/28/07 12:06
NSP-2A-10Q-PAH-5-032607 Back	0701670-07	Air Tube	03/26/07 16:14	03/28/07 12:06
NSP-2A-10Q-VOC-5-032607 Front	0701670-08	Air Tube	03/26/07 16:14	03/28/07 12:06
NSP-2A-10Q-PAH-6-032707 Front	0701670-10	Air Tube	03/27/07 08:18	03/28/07 12:06
NSP-2A-10Q-PAH-6-032707 Back	0701670-11	Air Tube	03/27/07 08:18	03/28/07 12:06
NSP-2A-10Q-VOC-6-032707 Front	0701670-12	Air Tube	03/27/07 08:18	03/28/07 12:06
NSP-2A-10Q-VOC-6-032707 Back	0701670-13	Air Tube	03/27/07 08:18	03/28/07 12:06
NSP-2A-10Q-PAH-8-032707 total	0701670-14	Slurry	03/27/07 08:30	03/28/07 12:06
NSP-2A-10Q-PAH-8-032707 Dissolved	0701670-15	Slurry	03/27/07 08:30	03/28/07 12:06
NSP-2A-10Q-VOC-8-032707	0701670-16	Slurry	03/27/07 08:30	03/28/07 12:06
NSP-2A-10Q-DOC-8-032707	0701670-17	Slurry	03/27/07 08:30	03/28/07 12:06
NSP-2A-10Q-TOC-8-032707	0701670-18	Slurry	03/27/07 08:30	03/28/07 12:06
NSP-2A-10Q-TSS-8-032707	0701670-19	Slurry	03/27/07 08:30	03/28/07 12:06
NSP-2A-1M-PAH-1-032707	0701670-20	Soil	03/27/07 09:20	03/28/07 12:06
NSP-2A-1M-VOC-1-032707	0701670-21	Soil	03/27/07 09:20	03/28/07 12:06
NSP-2A-1M-TSS-7-032707	0701670-22	Slurry	03/27/07 09:45	03/28/07 12:06
NSP-2A-1M-TOC-7-032707	0701670-23	Slurry	03/27/07 09:45	03/28/07 12:06
NSP-2A-10Q-PAH-3-032707	0701670-24	Soil	03/27/07 10:10	03/28/07 12:06
NSP-2A-10Q-VOC-3-032707	0701670-25	Soil	03/27/07 10:10	03/28/07 12:06
NSP-2A-10Q-PAH-4-032707	0701670-26	Water	03/27/07 11:30	03/28/07 12:06
NSP-2A-10Q-VOC-4-032707	0701670-27	Slurry	03/27/07 11:30	03/28/07 12:06
Trip Blanks (DI)	0701670-28	Water	03/27/07 00:00	03/28/07 12:06
Trip Blank (MeOH)	0701670-29	Soil	03/27/07 00:00	03/28/07 12:06

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	7.7 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-TSS-7-032607

0701670-01 (Slurry)

3/26/07 10:00

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**14000**	10	3.6	mg/L	B7D0002	3/30/07	3/30/07	EPA 160.2	
Total Solids	**15000**	20	1.0	mg/L	B7D0028	4/2/07	4/2/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-2-032607 Front

0701670-02 (Air Tube)

3/26/07 12:10

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A1
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A2
Chrysene	ND	5.96		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A3, A4
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Fluoranthene	ND	11.4		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Naphthalene	**27.5**	5.52		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	ia
Phenanthrene	ND	11.0		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-2-032607 Back

0701670-03 (Air Tube)

3/26/07 12:10

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A1a, gp
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A2a, gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A5a, gp
Chrysene	ND	5.96		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A3a, gp
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A4a, gp
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	13.5		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A5, gp
Naphthalene	ND	5.52		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-2-032607 Front

0701670-04 (Air Tube)

3/26/07 12:10

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**15.4**	9.85		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**23.7**	9.87		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	ND	20.3		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**26.5**	19.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**50.5**	10.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	ND	19.9		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-5-032607 Front

0701670-06 (Air Tube)

3/26/07 16:14

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A1
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A2
Chrysene	ND	2.98		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A3, A4
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Naphthalene	**12.3**	2.76		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	ia
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-5-032607 Back

0701670-07 (Air Tube)

3/26/07 16:14

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Acenaphthene	ND	2.75		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Acenaphthylene	ND	2.54		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A1a, gp
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	3.84		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A2a, gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	gp, A5a
Chrysene	ND	2.98		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A3a, gp
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A4a, gp
Fluoranthene	ND	2.84		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Fluorene	ND	2.70		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A5, gp
Naphthalene	**2.95**	2.76		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Phenanthrene	ND	2.76		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Pyrene	ND	2.89		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-5-032607 Front

0701670-08 (Air Tube)

3/26/07 16:14

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	5.03		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**8.26**	4.93		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	5.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**13.4**	4.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**12.3**	10.2		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**28.7**	5.02		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	ND	4.97		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**22.2**	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-6-032707 Front

0701670-10 (Air Tube)

3/27/07 8:18

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**2.28**	0.662		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
2-Methylnaphthalene	**4.76**	0.658		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A1
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A2
Chrysene	ND	0.746		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	A3, A4
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Naphthalene	**3.95**	0.689		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	ia
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/9/07	4/10/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-6-032707 Back

0701670-11 (Air Tube)

3/27/07 8:18

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**0.719**	0.662		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
2-Methylnaphthalene	**1.32**	0.658		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Acenaphthene	ND	0.688		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Acenaphthylene	ND	0.634		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A1a, gp
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	0.959		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A2a, gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A5a, gp
Chrysene	ND	0.746		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A3a, gp
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A4a, gp
Fluoranthene	ND	0.710		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Fluorene	ND	0.675		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	1.69		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	A5, gp
Naphthalene	**1.84**	0.689		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Phenanthrene	ND	0.689		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	
Pyrene	ND	0.721		ug/m³	[CALC]	4/24/07	4/24/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-6-032707 Front

0701670-12 (Air Tube)

3/27/07 8:18

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**2.81**	1.26		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**11.9**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	**3.41**	1.20		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**13.8**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ia
Carbon Tetrachloride	**18.6**	2.54		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**6.75**	2.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**3.92**	1.63		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**40.6**	1.25		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**5.67**	1.24		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**34.1**	2.49		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-6-032707 Back

0701670-13 (Air Tube)

3/27/07 8:18

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.26		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	ib
1,2,4-Trimethylbenzene	ND	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Benzene	**1.37**	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Carbon Tetrachloride	ND	12.7		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Ethyl Benzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Styrene	ND	1.63		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	A1b
Toluene	ND	1.25		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Xylenes, Total	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-8-032707 total

0701670-14 (Slurry)

3/27/07 8:30

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**220**	34	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	ND	34	2.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	34	3.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	8.4 J	34	3.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**230**	34	2.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**80**	14	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	3.5 J	14	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	ND	14	1.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	ND	14	4.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	ND	14	5.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	ND	14	2.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	ND	34	5.5	ug/L	B7C0494	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	ND	14	4.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	ND	14	5.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	6.7 J	34	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	ND	14	4.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	14	5.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	ND	14	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	3.4 J	14	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	14	5.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	**1100**	340	22	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Perylene	ND	34	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	ND	14	1.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Pyrene	ND	14	3.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*65.1 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*55.6 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*sk*
Surrogate: Terphenyl-d14	*88.4 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-8-032707 Dissolved

0701670-15 (Slurry)

3/27/07 8:30

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**27000**	10000	510	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**2800**	1000	64	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**2000**	1000	110	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
2,6-Dimethylnaphthalene	**10000**	1000	100	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
2-Methylnaphthalene	**22000**	10000	790	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**20000**	400	52	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Acenaphthylene	**1200**	400	37	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Anthracene	**8700**	400	42	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Benz(a)anthracene	**1800**	40	14	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	**2200**	400	150	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Benzo(b)fluoranthene	**1400**	40	8.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	**1100**	100	16	ug/L	B7C0494	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	**860**	40	13	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	**710**	40	15	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	**2400**	1000	52	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Chrysene	**1700**	40	14	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	**310**	40	16	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	**8000**	400	51	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Fluorene	**6200**	400	91	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**650**	40	16	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	9600 J	10000	630	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Perylene	**330**	100	5.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	**21000**	4000	410	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Pyrene	**10000**	400	100	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*87.4 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*54.0 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*sk*
Surrogate: Terphenyl-d14	*50.4 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*sk*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-8-032707

0701670-16 (Slurry)

3/27/07 8:30

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**100**	10	0.69	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	**320**	10	0.30	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	**70**	10	0.39	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	10	0.51	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Benzene	**530**	10	0.42	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	10	0.50	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Ethylbenzene	**1000**	200	7.2	ug/L	B7D0045	4/2/07	4/4/07	EPA 8260B	
m,p-Xylenes	**850**	10	0.59	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
o-Xylene	**500**	10	0.72	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	10	0.27	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Styrene	ND	10	0.49	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Toluene	**950**	200	9.6	ug/L	B7D0045	4/2/07	4/4/07	EPA 8260B	
Trichloroethene	ND	10	0.67	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*104 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*101 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.4 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*98.0 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-DOC-8-032707

0701670-17 (Slurry)

3/27/07 8:30

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**8.7**	1.5	0.50	mg/L	B7D0082	4/3/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-TOC-8-032707

0701670-18 (Slurry)

3/27/07 8:30

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**41**	15	5.0	mg/L	B7D0081	4/3/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-TSS-8-032707

0701670-19 (Slurry)

3/27/07 8:30

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**2300**	10	3.6	mg/L	B7D0002	3/30/07	3/30/07	EPA 160.2	
Total Solids	**2400**	20	1.0	mg/L	B7D0028	4/2/07	4/2/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-1-032707

0701670-20 (Soil)

3/27/07 9:20

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**49**	0.050	0.010	% Wt	B7C0460	3/28/07	3/29/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1800**	140	22	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**46**	2.7	0.32	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**72**	2.7	0.32	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**870**	27	4.0	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**2700**	140	46	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**850**	27	4.0	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthylene	**28**	2.7	0.28	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Anthracene	**560**	27	4.0	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benz(a)anthracene	**78**	2.7	0.40	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**60**	2.7	0.32	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**39**	2.7	0.69	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**34**	2.7	0.40	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	**6.6**	2.7	0.24	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**40**	2.7	0.57	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Biphenyl	**62**	2.7	0.48	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Chrysene	**66**	2.7	0.40	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	**3.1**	2.7	0.85	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Fluoranthene	**480**	27	2.8	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Fluorene	**860**	27	1.6	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**7.8**	2.7	0.36	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Naphthalene	**3300**	140	10	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Perylene	**8.4**	2.7	0.44	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Phenanthrene	**1900**	140	16	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Pyrene	**95**	2.7	0.40	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*89.3 %*	*Limits: 30-104%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*65.2 %*	*Limits: 30-90%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*72.9 %*	*Limits: 30-115%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-VOC-1-032707

0701670-21 (Soil)

3/27/07 9:20

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**52**	0.050	0.010	% Wt	B7C0460	3/28/07	3/29/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**14**	1.9	0.061	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	**47**	1.9	0.13	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	**12**	1.9	0.19	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.9	0.23	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Benzene	**3.2**	1.9	0.084	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	1.9	0.11	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Ethylbenzene	**62**	1.9	0.20	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
m,p-Xylenes	**42**	1.9	0.24	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
o-Xylene	**24**	1.9	0.27	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	1.9	0.081	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Styrene	ND	1.9	0.088	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Toluene	**14**	1.9	0.33	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Trichloroethene	ND	1.9	0.14	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*101 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*92.8 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.8 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-TSS-7-032707

0701670-22 (Slurry)

3/27/07 9:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**2500**	10	3.6	mg/L	B7D0002	3/30/07	3/30/07	EPA 160.2	
Total Solids	**2900**	20	1.0	mg/L	B7D0505	4/26/07	4/26/07	EPA 160.3	gk

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-TOC-7-032707

0701670-23 (Slurry)

3/27/07 9:45

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**18**	15	5.0	mg/L	B7D0081	4/3/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-3-032707

0701670-24 (Soil)

3/27/07 10:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**18**	0.050	0.010	% Wt	B7D0015	4/2/07	4/3/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1600**	72	12	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**1600**	72	8.6	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**230**	7.2	0.86	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**820**	72	11	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**2300**	72	25	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**1200**	72	11	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthylene	**77**	7.2	0.75	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Anthracene	**540**	72	11	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benz(a)anthracene	**180**	7.2	1.1	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**140**	7.2	0.86	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**94**	7.2	1.8	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**88**	7.2	1.1	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	**14**	7.2	0.64	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**95**	7.2	1.5	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Biphenyl	**170**	7.2	1.3	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Chrysene	**170**	7.2	1.1	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	**7.4**	7.2	2.2	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Fluoranthene	**450**	72	7.5	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Fluorene	**810**	72	4.3	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**18**	7.2	0.96	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Naphthalene	**2600**	72	5.3	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Perylene	**21**	7.2	1.2	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Phenanthrene	**1700**	72	8.6	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Pyrene	**260**	7.2	1.1	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*53.5 %*	*Limits: 30-104%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*59.6 %*	*Limits: 30-90%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*31.2 %*	*Limits: 30-115%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-3-032707

0701670-25 (Soil)

3/27/07 10:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**21**	0.050	0.010	% Wt	B7D0015	4/2/07	4/3/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**13**	2.3	0.074	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	**45**	2.3	0.16	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	**11**	2.3	0.23	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	2.3	0.28	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Benzene	**7.8**	2.3	0.10	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	2.3	0.13	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Ethylbenzene	**78**	2.3	0.25	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
m,p-Xylenes	**52**	2.3	0.29	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
o-Xylene	**28**	2.3	0.33	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	2.3	0.098	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Styrene	ND	2.3	0.11	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Toluene	**27**	2.3	0.40	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Trichloroethene	ND	2.3	0.17	mg/kg dry	B7D0075	4/3/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*104 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*96.0 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.0 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*99.6 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-4-032707

0701670-26 (Water)

3/27/07 11:30

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1900**	530	380	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
1-Methylphenanthrene	52 J	53	19	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**76**	53	35	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2,6-Dimethylnaphthalene	**540**	53	37	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2-Methylnaphthalene	**2600**	530	30	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Acenaphthene	**1100**	110	20	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Acenaphthylene	**33**	11	2.2	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Anthracene	**970**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benz(a)anthracene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(a)pyrene	ND	11	2.2	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(b)fluoranthene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(e)pyrene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	11	6.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(k)fluoranthene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Biphenyl	**260**	53	39	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Chrysene	8.9 J	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	11	3.7	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Fluoranthene	**99**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Fluorene	**500**	11	2.2	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	11	2.7	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Naphthalene	**5200**	530	20	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Perylene	ND	21	12	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Phenanthrene	**790**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Pyrene	**94**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Surrogate: 2-Fluorobiphenyl	*88.7 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*118 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*115 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-4-032707

0701670-27 (Slurry)

3/27/07 11:30

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*104 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*92.4 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.4 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blanks (DI)

0701670-28 (Water)

3/27/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*107 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*87.2 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.8 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blank (MeOH)

0701670-29 (Soil)

3/27/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7D0075	4/3/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*85.6 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.4 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7D0075*	*4/3/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7C0460 - % Solids

Method Blank (B7C0460-BLK1)

Prepared: 03/28/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7C0460-SRM1)

Prepared: 03/28/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	89.9			% Wt	88.8	NA	101	90-110	NA	NA	

Batch B7D0002 - Default Prep GenChem

Method Blank (B7D0002-BLK1)

Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7D0002-BS1)

Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	268			mg/L	250	NA	107	80-120	NA	NA	

Batch B7D0015 - Default Prep GenChem

Method Blank (B7D0015-BLK1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7D0015-SRM1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	87.9			% Wt	88.8	NA	99.0	90-110	NA	NA	

Batch B7D0028 - Default Prep GenChem

Method Blank (B7D0028-BLK1)

Prepared & Analyzed: 04/02/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5b
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample (B7C0494-BS1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

Laboratory Control Sample Duplicate (B7C0494-BSD1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0728	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	0.0133 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.142	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	0.0509 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5b
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.188	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	0.0402 J	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	0.0309 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.629*			mg/kg	*0.831*	*NA*	*75.7*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.468*			mg/kg	*0.831*	*NA*	*56.3*	*30-90*			
Surrogate: Terphenyl-d14	*0.715*			mg/kg	*0.831*	*NA*	*86.0*	*30-115*			

Laboratory Control Sample (B7C0507-BS1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.22	0.067	0.010	mg/kg	1.66	NA	73.5	50-115	NA	NA	
Pyrene	1.20	0.067	0.010	mg/kg	1.66	NA	72.3	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.652*			mg/kg	*0.832*	*NA*	*78.4*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.488*			mg/kg	*0.832*	*NA*	*58.7*	*30-90*			
Surrogate: Terphenyl-d14	*0.730*			mg/kg	*0.832*	*NA*	*87.7*	*30-115*			

Laboratory Control Sample Duplicate (B7C0507-BSD1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-115	0.816	25	
Pyrene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-130	2.47	25	
Surrogate: 2-Fluorobiphenyl	*0.657*			mg/kg	*0.831*	*NA*	*79.1*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.503*			mg/kg	*0.831*	*NA*	*60.5*	*30-90*			
Surrogate: Terphenyl-d14	*0.725*			mg/kg	*0.831*	*NA*	*87.2*	*30-115*			

Matrix Spike (B7C0507-MS1) **Source: 0701670-20** Prepared: 03/30/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1350000000	2.7	0.40	mg/kg dry	6.73	850	NR	30-115	NA	NA	
Pyrene	120	2.7	0.40	mg/kg dry	6.73	95	371	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*2.80*			mg/kg dry	*3.37*	*NA*	*83.1*	*30-104*			
Surrogate: Nitrobenzene-d5	*2.24*			mg/kg dry	*3.37*	*NA*	*66.5*	*30-90*			
Surrogate: Terphenyl-d14	*2.30*			mg/kg dry	*3.37*	*NA*	*68.2*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0507 - EPA 3545

Matrix Spike Duplicate (B7C0507-MSD1) **Source: 0701670-20** Prepared: 03/30/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1350000000	2.7	0.40	mg/kg dry	6.73	850	NR	30-115	0.00	30	
Pyrene	101	2.7	0.40	mg/kg dry	6.73	95	89.2	30-130	17.2	35	
Surrogate: 2-Fluorobiphenyl	*2.42*			mg/kg dry	*3.36*	*NA*	*72.0*	*30-104*			
Surrogate: Nitrobenzene-d5	*1.91*			mg/kg dry	*3.36*	*NA*	*56.8*	*30-90*			
Surrogate: Terphenyl-d14	*1.67*			mg/kg dry	*3.36*	*NA*	*49.7*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Method Blank (B7C0481-BLK1) Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	23.3	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	20.4	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	5.29	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	7.18	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	5.23	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	4.72	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	6.49	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	13.1	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	12.9	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	3.80	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	29.0	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	31.8	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	13.9	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*145*			ng/L	*250*	*NA*	*58.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*281*			ng/L	*250*	*NA*	*112*	*30-120*			
Surrogate: Terphenyl-d14	*280*			ng/L	*250*	*NA*	*112*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Laboratory Control Sample (B7C0481-BS1) Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	381	50	36	ng/L	500	NA	76.2	70-130	NA	NA	
1-Methylphenanthrene	488	50	18	ng/L	500	NA	97.6	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	396	50	32	ng/L	500	NA	79.2	70-130	NA	NA	
2,6-Dimethylnaphthalene	401	50	35	ng/L	500	NA	80.2	70-130	NA	NA	
2-Methylnaphthalene	368	50	2.8	ng/L	500	NA	73.6	70-130	NA	NA	
Acenaphthene	395	10	1.9	ng/L	500	NA	79.0	43-120	NA	NA	
Acenaphthylene	376	10	2.1	ng/L	500	NA	75.2	70-130	NA	NA	
Anthracene	450	10	5.0	ng/L	500	NA	90.0	70-130	NA	NA	
Benz(a)anthracene	447	10	5.0	ng/L	500	NA	89.4	70-130	NA	NA	
Benzo(a)pyrene	467	10	2.1	ng/L	500	NA	93.4	75-148	NA	NA	
Benzo(b)fluoranthene	428	10	5.0	ng/L	500	NA	85.6	70-130	NA	NA	
Benzo(e)pyrene	446	10	5.0	ng/L	500	NA	89.2	70-130	NA	NA	
Benzo(g,h,i)perylene	529	10	5.6	ng/L	500	NA	106	70-130	NA	NA	
Benzo(k)fluoranthene	467	10	5.0	ng/L	500	NA	93.4	70-130	NA	NA	
Biphenyl	405	50	36	ng/L	500	NA	81.0	70-130	NA	NA	
Chrysene	444	10	5.0	ng/L	500	NA	88.8	70-130	NA	NA	
Dibenz(a,h)anthracene	480	10	3.5	ng/L	500	NA	96.0	70-130	NA	NA	
Fluoranthene	497	10	5.0	ng/L	500	NA	99.4	67-130	NA	NA	
Fluorene	431	10	2.1	ng/L	500	NA	86.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	547	10	2.5	ng/L	500	NA	109	70-130	NA	NA	
Naphthalene	358	50	1.9	ng/L	500	NA	71.6	70-130	NA	NA	
Perylene	456	20	11	ng/L	500	NA	91.2	70-130	NA	NA	
Phenanthrene	435	10	5.0	ng/L	500	NA	87.0	70-130	NA	NA	
Pyrene	505	10	5.0	ng/L	500	NA	101	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*165*			ng/L	*250*	*NA*	*66.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*299*			ng/L	*250*	*NA*	*120*	*30-120*			
Surrogate: Terphenyl-d14	*290*			ng/L	*250*	*NA*	*116*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0481-BSD1) Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	404	50	36	ng/L	500	NA	80.8	70-130	5.86	20	
1-Methylphenanthrene	494	50	18	ng/L	500	NA	98.8	70-130	1.22	20	
2,3,5-Trimethylnaphthalene	399	50	32	ng/L	500	NA	79.8	70-130	0.755	20	
2,6-Dimethylnaphthalene	419	50	35	ng/L	500	NA	83.8	70-130	4.39	20	
2-Methylnaphthalene	393	50	2.8	ng/L	500	NA	78.6	70-130	6.57	20	
Acenaphthene	409	10	1.9	ng/L	500	NA	81.8	43-120	3.48	20	
Acenaphthylene	365	10	2.1	ng/L	500	NA	73.0	70-130	2.97	20	
Anthracene	466	10	5.0	ng/L	500	NA	93.2	70-130	3.49	20	
Benz(a)anthracene	464	10	5.0	ng/L	500	NA	92.8	70-130	3.73	20	
Benzo(a)pyrene	488	10	2.1	ng/L	500	NA	97.6	75-148	4.40	20	
Benzo(b)fluoranthene	467	10	5.0	ng/L	500	NA	93.4	70-130	8.72	20	
Benzo(e)pyrene	459	10	5.0	ng/L	500	NA	91.8	70-130	2.87	20	
Benzo(g,h,i)perylene	547	10	5.6	ng/L	500	NA	109	70-130	3.35	20	
Benzo(k)fluoranthene	454	10	5.0	ng/L	500	NA	90.8	70-130	2.82	20	
Biphenyl	407	50	36	ng/L	500	NA	81.4	70-130	0.493	20	
Chrysene	456	10	5.0	ng/L	500	NA	91.2	70-130	2.67	20	
Dibenz(a,h)anthracene	505	10	3.5	ng/L	500	NA	101	70-130	5.08	20	
Fluoranthene	521	10	5.0	ng/L	500	NA	104	67-130	4.72	20	
Fluorene	435	10	2.1	ng/L	500	NA	87.0	70-130	0.924	20	
Indeno(1,2,3-cd)pyrene	571	10	2.5	ng/L	500	NA	114	70-130	4.29	20	
Naphthalene	367	50	1.9	ng/L	500	NA	73.4	70-130	2.48	20	
Perylene	469	20	11	ng/L	500	NA	93.8	70-130	2.81	20	
Phenanthrene	465	10	5.0	ng/L	500	NA	93.0	70-130	6.67	20	
Pyrene	538	10	5.0	ng/L	500	NA	108	70-130	6.33	20	
Surrogate: 2-Fluorobiphenyl	*165*			ng/L	*250*	*NA*	*66.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*277*			ng/L	*250*	*NA*	*111*	*30-120*			
Surrogate: Terphenyl-d14	*295*			ng/L	*250*	*NA*	*118*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Method Blank (B7D0063-BLK1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	13.4	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	16.1	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	5.59	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	100	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	100	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	23.9	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	100	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	12.0	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	16.8	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	12.3	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*180*			ng/L	*250*	*NA*	*72.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*194*			ng/L	*250*	*NA*	*77.6*	*30-120*			
Surrogate: Terphenyl-d14	*234*			ng/L	*250*	*NA*	*93.6*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Laboratory Control Sample (B7D0063-BS1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	439	50	36	ng/L	500	NA	87.8	70-130	NA	NA	
1-Methylphenanthrene	449	50	18	ng/L	500	NA	89.8	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	448	50	32	ng/L	500	NA	89.6	70-130	NA	NA	
2,6-Dimethylnaphthalene	450	50	35	ng/L	500	NA	90.0	70-130	NA	NA	
2-Methylnaphthalene	428	50	2.8	ng/L	500	NA	85.6	70-130	NA	NA	
Acenaphthene	457	10	1.9	ng/L	500	NA	91.4	43-120	NA	NA	
Acenaphthylene	500	10	2.1	ng/L	500	NA	100	70-130	NA	NA	
Anthracene	495	10	5.0	ng/L	500	NA	99.0	70-130	NA	NA	
Benz(a)anthracene	464	10	5.0	ng/L	500	NA	92.8	70-130	NA	NA	
Benzo(a)pyrene	394	10	2.1	ng/L	500	NA	78.8	75-148	NA	NA	
Benzo(b)fluoranthene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Benzo(e)pyrene	434	10	5.0	ng/L	500	NA	86.8	70-130	NA	NA	
Benzo(g,h,i)perylene	514	10	5.6	ng/L	500	NA	103	70-130	NA	NA	
Benzo(k)fluoranthene	412	10	5.0	ng/L	500	NA	82.4	70-130	NA	NA	
Biphenyl	466	50	36	ng/L	500	NA	93.2	70-130	NA	NA	
Chrysene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Dibenz(a,h)anthracene	405	10	3.5	ng/L	500	NA	81.0	70-130	NA	NA	
Fluoranthene	465	10	5.0	ng/L	500	NA	93.0	67-130	NA	NA	
Fluorene	473	10	2.1	ng/L	500	NA	94.6	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	493	10	2.5	ng/L	500	NA	98.6	70-130	NA	NA	
Naphthalene	441	50	1.9	ng/L	500	NA	88.2	70-130	NA	NA	
Perylene	411	20	11	ng/L	500	NA	82.2	70-130	NA	NA	
Phenanthrene	441	10	5.0	ng/L	500	NA	88.2	70-130	NA	NA	
Pyrene	458	10	5.0	ng/L	500	NA	91.6	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*197*			ng/L	*250*	*NA*	*78.8*	*30-120*			
Surrogate: Nitrobenzene-d5	*209*			ng/L	*250*	*NA*	*83.6*	*30-120*			
Surrogate: Terphenyl-d14	*221*			ng/L	*250*	*NA*	*88.4*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Laboratory Control Sample Duplicate (B7D0063-BSD1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	368	50	36	ng/L	500	NA	73.6	70-130	17.6	20	
1-Methylphenanthrene	410	50	18	ng/L	500	NA	82.0	70-130	9.08	20	
2,3,5-Trimethylnaphthalene	387	50	32	ng/L	500	NA	77.4	70-130	14.6	20	
2,6-Dimethylnaphthalene	366	50	35	ng/L	500	NA	73.2	70-130	20.6	20	
2-Methylnaphthalene	357	50	2.8	ng/L	500	NA	71.4	70-130	18.1	20	
Acenaphthene	404	10	1.9	ng/L	500	NA	80.8	43-120	12.3	20	
Acenaphthylene	400	10	2.1	ng/L	500	NA	80.0	70-130	22.2	20	
Anthracene	436	10	5.0	ng/L	500	NA	87.2	70-130	12.7	20	
Benz(a)anthracene	433	10	5.0	ng/L	500	NA	86.6	70-130	6.91	20	
Benzo(a)pyrene	366	10	2.1	ng/L	500	NA	73.2	75-148	7.37	20	
Benzo(b)fluoranthene	396	10	5.0	ng/L	500	NA	79.2	70-130	10.1	20	
Benzo(e)pyrene	416	10	5.0	ng/L	500	NA	83.2	70-130	4.24	20	
Benzo(g,h,i)perylene	399	10	5.6	ng/L	500	NA	79.8	70-130	25.2	20	
Benzo(k)fluoranthene	408	10	5.0	ng/L	500	NA	81.6	70-130	0.976	20	
Biphenyl	394	50	36	ng/L	500	NA	78.8	70-130	16.7	20	
Chrysene	425	10	5.0	ng/L	500	NA	85.0	70-130	3.01	20	
Dibenz(a,h)anthracene	335	10	3.5	ng/L	500	NA	67.0	70-130	18.9	20	
Fluoranthene	430	10	5.0	ng/L	500	NA	86.0	67-130	7.82	20	
Fluorene	423	10	2.1	ng/L	500	NA	84.6	70-130	11.2	20	
Indeno(1,2,3-cd)pyrene	404	10	2.5	ng/L	500	NA	80.8	70-130	19.8	20	
Naphthalene	355	50	1.9	ng/L	500	NA	71.0	70-130	21.6	20	
Perylene	400	20	11	ng/L	500	NA	80.0	70-130	2.71	20	
Phenanthrene	399	10	5.0	ng/L	500	NA	79.8	70-130	10.0	20	
Pyrene	423	10	5.0	ng/L	500	NA	84.6	70-130	7.95	20	
Surrogate: 2-Fluorobiphenyl	*155*			ng/L	*250*	*NA*	*62.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*183*			ng/L	*250*	*NA*	*73.2*	*30-120*			
Surrogate: Terphenyl-d14	*204*			ng/L	*250*	*NA*	*81.6*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0045 - EPA 5030B

Method Blank (B7D0045-BLK1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*22.5*			ug/L	*25.0*	*NA*	*90.0*	*80-120*			
Surrogate: Dibromofluoromethane	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Laboratory Control Sample (B7D0045-BS1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	28.3	1.0	0.030	ug/L	25.0	NA	113	75-125	NA	NA	
1,3,5-Trimethylbenzene	28.3	1.0	0.039	ug/L	25.0	NA	113	75-125	NA	NA	
1,4-Dichlorobenzene	26.4	1.0	0.051	ug/L	25.0	NA	106	75-125	NA	NA	
Benzene	27.7	1.0	0.042	ug/L	25.0	NA	111	75-125	NA	NA	
Carbon Tetrachloride	27.3	1.0	0.050	ug/L	25.0	NA	109	75-125	NA	NA	
Ethylbenzene	27.3	1.0	0.036	ug/L	25.0	NA	109	75-125	NA	NA	
m,p-Xylenes	54.4	1.0	0.059	ug/L	50.0	NA	109	75-125	NA	NA	
o-Xylene	27.0	1.0	0.072	ug/L	25.0	NA	108	75-125	NA	NA	
sec-Butylbenzene	28.9	1.0	0.027	ug/L	25.0	NA	116	75-125	NA	NA	
Styrene	28.0	1.0	0.049	ug/L	25.0	NA	112	75-125	NA	NA	
Toluene	26.6	1.0	0.048	ug/L	25.0	NA	106	75-125	NA	NA	
Trichloroethene	25.7	1.0	0.067	ug/L	25.0	NA	103	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			
Surrogate: Dibromofluoromethane	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0045 - EPA 5030B

Laboratory Control Sample Duplicate (B7D0045-BSD1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	28.5	1.0	0.030	ug/L	25.0	NA	114	75-125	0.704	20	
1,3,5-Trimethylbenzene	28.3	1.0	0.039	ug/L	25.0	NA	113	75-125	0.00	20	
1,4-Dichlorobenzene	26.4	1.0	0.051	ug/L	25.0	NA	106	75-125	0.00	20	
Benzene	27.5	1.0	0.042	ug/L	25.0	NA	110	75-125	0.725	20	
Carbon Tetrachloride	28.5	1.0	0.050	ug/L	25.0	NA	114	75-125	4.30	20	
Ethylbenzene	27.6	1.0	0.036	ug/L	25.0	NA	110	75-125	1.09	20	
m,p-Xylenes	55.3	1.0	0.059	ug/L	50.0	NA	111	75-125	1.64	20	
o-Xylene	27.5	1.0	0.072	ug/L	25.0	NA	110	75-125	1.83	20	
sec-Butylbenzene	29.0	1.0	0.027	ug/L	25.0	NA	116	75-125	0.345	20	
Styrene	28.5	1.0	0.049	ug/L	25.0	NA	114	75-125	1.77	20	
Toluene	26.4	1.0	0.048	ug/L	25.0	NA	106	75-125	0.755	20	
Trichloroethene	25.9	1.0	0.067	ug/L	25.0	NA	104	75-125	0.775	20	
Surrogate: 1,2-Dichloroethane-d4	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: Dibromofluoromethane	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Toluene-d8	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			

Batch B7D0075 - EPA 5035

Method Blank (B7D0075-BLK1)

Prepared & Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*22.0*			ug/L	*25.0*	*NA*	*88.0*	*80-120*			
Surrogate: Dibromofluoromethane	*24.2*			ug/L	*25.0*	*NA*	*96.8*	*80-120*			
Surrogate: Toluene-d8	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0075 - EPA 5035

Laboratory Control Sample (B7D0075-BS1)

Prepared & Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.35	0.050	0.0035	mg/kg	1.25	NA	108	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.35	0.050	0.0049	mg/kg	1.25	NA	108	75-125	NA	NA	
1,4-Dichlorobenzene	1.29	0.050	0.0060	mg/kg	1.25	NA	103	75-125	NA	NA	
Benzene	1.36	0.050	0.0022	mg/kg	1.25	NA	109	75-125	NA	NA	
Carbon Tetrachloride	1.25	0.050	0.0028	mg/kg	1.25	NA	100	75-125	NA	NA	
Ethylbenzene	1.31	0.050	0.0053	mg/kg	1.25	NA	105	75-125	NA	NA	
m,p-Xylenes	2.56	0.050	0.0063	mg/kg	2.50	NA	102	75-125	NA	NA	
o-Xylene	1.26	0.050	0.0070	mg/kg	1.25	NA	101	75-125	NA	NA	
sec-Butylbenzene	1.35	0.050	0.0021	mg/kg	1.25	NA	108	75-125	NA	NA	
Styrene	1.32	0.050	0.0023	mg/kg	1.25	NA	106	75-125	NA	NA	
Toluene	1.30	0.050	0.0086	mg/kg	1.25	NA	104	75-125	NA	NA	
Trichloroethene	1.24	0.050	0.0037	mg/kg	1.25	NA	99.2	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.2*			ug/L	*25.0*	*NA*	*92.8*	*80-120*			
Surrogate: Dibromofluoromethane	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: Toluene-d8	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			

Laboratory Control Sample Duplicate (B7D0075-BSD1)

Prepared & Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.38	0.050	0.0035	mg/kg	1.25	NA	110	75-125	2.20	20	
1,3,5-Trimethylbenzene	1.38	0.050	0.0049	mg/kg	1.25	NA	110	75-125	2.20	20	
1,4-Dichlorobenzene	1.30	0.050	0.0060	mg/kg	1.25	NA	104	75-125	0.772	20	
Benzene	1.37	0.050	0.0022	mg/kg	1.25	NA	110	75-125	0.733	20	
Carbon Tetrachloride	1.24	0.050	0.0028	mg/kg	1.25	NA	99.2	75-125	0.803	20	
Ethylbenzene	1.33	0.050	0.0053	mg/kg	1.25	NA	106	75-125	1.52	20	
m,p-Xylenes	2.57	0.050	0.0063	mg/kg	2.50	NA	103	75-125	0.390	20	
o-Xylene	1.26	0.050	0.0070	mg/kg	1.25	NA	101	75-125	0.00	20	
sec-Butylbenzene	1.38	0.050	0.0021	mg/kg	1.25	NA	110	75-125	2.20	20	
Styrene	1.33	0.050	0.0023	mg/kg	1.25	NA	106	75-125	0.755	20	
Toluene	1.29	0.050	0.0086	mg/kg	1.25	NA	103	75-125	0.772	20	
Trichloroethene	1.24	0.050	0.0037	mg/kg	1.25	NA	99.2	75-125	0.00	20	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.3*			ug/L	*25.0*	*NA*	*93.2*	*80-120*			
Surrogate: Dibromofluoromethane	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0153 - AIRTUBES Prep

Laboratory Control Sample (B7D0153-BS1) Prepared: 04/09/07 Analyzed: 04/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29500	0.00		ug/m³	28200	NA	105	70-130	NA	NA	
2-Methylnaphthalene filter	29500	0.00		ug/m³	28200	NA	105	70-130	NA	NA	
Acenaphthene filter	26800	0.00		ug/m³	26000	NA	103	70-130	NA	NA	
Acenaphthylene filter	26300	0.00		ug/m³	25700	NA	102	70-130	NA	NA	
Anthracene filter	26500	0.00		ug/m³	25100	NA	106	70-130	NA	NA	
Benz(a)anthracene filter	27000	0.00		ug/m³	25600	NA	105	70-130	NA	NA	
Benzo(a)pyrene filter	27000	0.00		ug/m³	25300	NA	107	70-130	NA	NA	
Benzo(b)fluoranthene filter	26500	0.00		ug/m³	25300	NA	105	70-130	NA	NA	
Benzo(g,h,i)perylene filter	30600	0.00		ug/m³	25800	NA	119	70-130	NA	NA	
Benzo(k)fluoranthene filter	29800	0.00		ug/m³	25400	NA	117	70-130	NA	NA	
Chrysene filter	46100	0.00		ug/m³	25400	NA	181	70-130	NA	NA	
Dibenz(a,h)anthracene filter	25900	0.00		ug/m³	25100	NA	103	70-130	NA	NA	
Fluoranthene filter	26600	0.00		ug/m³	25500	NA	104	70-130	NA	NA	
Fluorene filter	26400	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	29000	0.00		ug/m³	26800	NA	108	70-130	NA	NA	
Naphthalene filter	28500	0.00		ug/m³	28100	NA	101	70-130	NA	NA	
Phenanthrene filter	26700	0.00		ug/m³	25500	NA	105	70-130	NA	NA	
Pyrene filter	27000	0.00		ug/m³	25600	NA	105	70-130	NA	NA	
1-Methylnaphthalene	25900	1590		ug/m³	26600	NA	97.4	70-130	NA	NA	
2-Methylnaphthalene	25900	1590		ug/m³	26400	NA	98.1	70-130	NA	NA	
Acenaphthene	25900	3310		ug/m³	27600	NA	93.8	70-130	NA	NA	
Acenaphthylene	24100	3050		ug/m³	25500	NA	94.5	70-130	NA	NA	
Anthracene	25700	3300		ug/m³	27500	NA	93.5	70-130	NA	NA	
Benz(a)anthracene	26200	1790		ug/m³	29800	NA	87.9	70-130	NA	NA	
Benzo(a)pyrene	25400	1890		ug/m³	31500	NA	80.6	70-130	NA	NA	
Benzo(b)fluoranthene	26000	1870		ug/m³	31200	NA	83.3	70-130	NA	NA	
Benzo(g,h,i)perylene	31300	4620		ug/m³	38500	NA	81.3	70-130	NA	NA	
Benzo(k)fluoranthene	29400	1890		ug/m³	31600	NA	93.0	70-130	NA	NA	
Chrysene	44800	1800		ug/m³	29900	NA	150	70-130	NA	NA	
Dibenz(a,h)anthracene	23500	19300		ug/m³	32100	NA	73.2	70-130	NA	NA	
Fluoranthene	26000	3420		ug/m³	28500	NA	91.2	70-130	NA	NA	
Fluorene	25700	3250		ug/m³	27100	NA	94.8	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	26200	2030		ug/m³	33900	NA	77.3	70-130	NA	NA	
Naphthalene	26500	1660		ug/m³	27700	NA	95.7	70-130	NA	NA	
Phenanthrene	25900	3320		ug/m³	27700	NA	93.5	70-130	NA	NA	
Pyrene	25600	3480		ug/m³	29000	NA	88.3	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0153 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0153-BSD1) Prepared: 04/09/07 Analyzed: 04/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	28900	0.00		ug/m³	28200	NA	102	70-130	2.05	20	
2-Methylnaphthalene filter	29000	0.00		ug/m³	28200	NA	103	70-130	1.71	20	
Acenaphthene filter	26200	0.00		ug/m³	26000	NA	101	70-130	2.26	20	
Acenaphthylene filter	25400	0.00		ug/m³	25700	NA	98.8	70-130	3.48	20	
Anthracene filter	25800	0.00		ug/m³	25100	NA	103	70-130	2.68	20	
Benz(a)anthracene filter	26300	0.00		ug/m³	25600	NA	103	70-130	2.63	20	
Benzo(a)pyrene filter	26400	0.00		ug/m³	25300	NA	104	70-130	2.25	20	
Benzo(b)fluoranthene filter	25900	0.00		ug/m³	25300	NA	102	70-130	2.29	20	
Benzo(g,h,i)perylene filter	29700	0.00		ug/m³	25800	NA	115	70-130	2.99	20	
Benzo(k)fluoranthene filter	29100	0.00		ug/m³	25400	NA	115	70-130	2.38	20	
Chrysene filter	45100	0.00		ug/m³	25400	NA	178	70-130	2.19	20	
Dibenz(a,h)anthracene filter	24900	0.00		ug/m³	25100	NA	99.2	70-130	3.94	20	
Fluoranthene filter	26100	0.00		ug/m³	25500	NA	102	70-130	1.90	20	
Fluorene filter	25800	0.00		ug/m³	25600	NA	101	70-130	2.30	20	
Indeno(1,2,3-cd)pyrene filter	27900	0.00		ug/m³	26800	NA	104	70-130	3.87	20	
Naphthalene filter	28000	0.00		ug/m³	28100	NA	99.6	70-130	1.77	20	
Phenanthrene filter	26100	0.00		ug/m³	25500	NA	102	70-130	2.27	20	
Pyrene filter	26100	0.00		ug/m³	25600	NA	102	70-130	3.39	20	
1-Methylnaphthalene	26700	1590		ug/m³	26600	NA	100	70-130	3.04	20	
2-Methylnaphthalene	26600	1590		ug/m³	26400	NA	101	70-130	2.67	20	
Acenaphthene	27000	3310		ug/m³	27600	NA	97.8	70-130	4.16	20	
Acenaphthylene	25000	3050		ug/m³	25500	NA	98.0	70-130	3.67	20	
Anthracene	26900	3300		ug/m³	27500	NA	97.8	70-130	4.56	20	
Benz(a)anthracene	28100	1790		ug/m³	29800	NA	94.3	70-130	7.00	20	
Benzo(a)pyrene	28300	1890		ug/m³	31500	NA	89.8	70-130	10.8	20	
Benzo(b)fluoranthene	28300	1870		ug/m³	31200	NA	90.7	70-130	8.47	20	
Benzo(g,h,i)perylene	36000	4620		ug/m³	38500	NA	93.5	70-130	14.0	20	
Benzo(k)fluoranthene	32000	1890		ug/m³	31600	NA	101	70-130	8.47	20	
Chrysene	48200	1800		ug/m³	29900	NA	161	70-130	7.31	20	
Dibenz(a,h)anthracene	26700	19300		ug/m³	32100	NA	83.2	70-130	12.7	20	
Fluoranthene	27400	3420		ug/m³	28500	NA	96.1	70-130	5.24	20	
Fluorene	26600	3250		ug/m³	27100	NA	98.2	70-130	3.44	20	
Indeno(1,2,3-cd)pyrene	29700	2030		ug/m³	33900	NA	87.6	70-130	12.5	20	
Naphthalene	27200	1660		ug/m³	27700	NA	98.2	70-130	2.61	20	
Phenanthrene	27100	3320		ug/m³	27700	NA	97.8	70-130	4.53	20	
Pyrene	27300	3480		ug/m³	29000	NA	94.1	70-130	6.43	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample (B7D0206-BS1)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	5880	5880	ug/m³	110000	NA	90.0	75-125	NA	NA	
Xylenes, Total	289000	5990	2990	ug/m³	337000	NA	85.8	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS2)

Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	103000	2970	2970	ug/m³	99100	NA	104	75-125	NA	NA	
Styrene	122000	3920	3920	ug/m³	131000	NA	93.1	75-125	NA	NA	
Toluene	107000	3020	3020	ug/m³	101000	NA	106	75-125	NA	NA	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	82400	3030	3030	ug/m³	90200	NA	91.4	75-125	NA	NA	
1,2,4-Trimethylbenzene	85700	2970	2970	ug/m³	91600	NA	93.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	92500	2880	2880	ug/m³	94100	NA	98.3	75-125	NA	NA	
1,4-Dichlorobenzene	62800	3470	3470	ug/m³	65400	NA	96.0	75-125	NA	NA	
Carbon Tetrachloride	97000	6120	6120	ug/m³	102000	NA	95.1	75-125	NA	NA	
sec-Butylbenzene	100000	2940	2940	ug/m³	97000	NA	103	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0206-BSD1)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	109000	5880	5880	ug/m³	110000	NA	99.1	75-125	9.62	20	
Xylenes, Total	329000	5990	2990	ug/m³	337000	NA	97.6	75-125	12.9	20	

Laboratory Control Sample Duplicate (B7D0206-BSD2)

Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	98100	2970	2970	ug/m³	99100	NA	99.0	75-125	4.87	20	
Styrene	120000	3920	3920	ug/m³	131000	NA	91.6	75-125	1.65	20	
Toluene	100000	3020	3020	ug/m³	101000	NA	99.0	75-125	6.76	20	
Trichloroethene	98700	2990	2990	ug/m³	99800	NA	98.9	75-125	5.23	20	

Laboratory Control Sample Duplicate (B7D0206-BSD3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	93300	3030	3030	ug/m³	90200	NA	103	75-125	12.4	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0206-BSD3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	96000	2970	2970	ug/m³	91600	NA	105	75-125	11.3	20	
1,3,5-Trimethylbenzene	102000	2880	2880	ug/m³	94100	NA	108	75-125	9.77	20	
1,4-Dichlorobenzene	71400	3470	3470	ug/m³	65400	NA	109	75-125	12.8	20	
Carbon Tetrachloride	107000	6120	6120	ug/m³	102000	NA	105	75-125	9.80	20	
sec-Butylbenzene	110000	2940	2940	ug/m³	97000	NA	113	75-125	9.52	20	

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample (B7D0415-BS1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	88100	2940	2940	ug/m³	98000	NA	89.9	75-125	NA	NA	
Xylenes, Total	261000	2990	2990	ug/m³	299000	NA	87.3	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	NA	NA	
Styrene	97300	3920	3920	ug/m³	131000	NA	74.3	75-125	NA	NA	
Toluene	99700	3020	3020	ug/m³	101000	NA	98.7	75-125	NA	NA	
Trichloroethene	99400	2990	2990	ug/m³	99800	NA	99.6	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86300	3030	3030	ug/m³	90200	NA	95.7	75-125	NA	NA	
1,2,4-Trimethylbenzene	90100	2970	2970	ug/m³	91600	NA	98.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	95800	2880	2880	ug/m³	94100	NA	102	75-125	NA	NA	
1,4-Dichlorobenzene	64000	3470	3470	ug/m³	65400	NA	97.9	75-125	NA	NA	
Carbon Tetrachloride	103000	30600	3060	ug/m³	102000	NA	101	75-125	NA	NA	
sec-Butylbenzene	102000	2940	2940	ug/m³	97000	NA	105	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0415-BSD1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	85700	2940	2940	ug/m³	98000	NA	87.4	75-125	2.76	20	
Xylenes, Total	258000	2990	2990	ug/m³	299000	NA	86.3	75-125	1.16	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0415-BSD2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	0.00	20	
Styrene	108000	3920	3920	ug/m³	131000	NA	82.4	75-125	10.4	20	
Toluene	98400	3020	3020	ug/m³	101000	NA	97.4	75-125	1.31	20	
Trichloroethene	98100	2990	2990	ug/m³	99800	NA	98.3	75-125	1.32	20	

Laboratory Control Sample Duplicate (B7D0415-BSD3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86800	3030	3030	ug/m³	90200	NA	96.2	75-125	0.578	20	
1,2,4-Trimethylbenzene	89000	2970	2970	ug/m³	91600	NA	97.2	75-125	1.23	20	
1,3,5-Trimethylbenzene	93700	2880	2880	ug/m³	94100	NA	99.6	75-125	2.22	20	
1,4-Dichlorobenzene	64600	3470	3470	ug/m³	65400	NA	98.8	75-125	0.933	20	
Carbon Tetrachloride	100000	30600	3060	ug/m³	102000	NA	98.0	75-125	2.96	20	
sec-Butylbenzene	99300	2940	2940	ug/m³	97000	NA	102	75-125	2.68	20	

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample (B7D0431-BS1)

Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	25900	1590		ug/m³	26600	NA	97.4	70-130	NA	NA	
2-Methylnaphthalene	26100	1590		ug/m³	26400	NA	98.9	70-130	NA	NA	
Acenaphthene	25600	1660		ug/m³	27600	NA	92.8	70-130	NA	NA	
Acenaphthylene	24000	1530		ug/m³	25500	NA	94.1	70-130	NA	NA	
Anthracene	25100	3300		ug/m³	27500	NA	91.3	70-130	NA	NA	
Benz(a)anthracene	23600	1790		ug/m³	29800	NA	79.2	70-130	NA	NA	
Benzo(a)pyrene	20900	1890		ug/m³	31500	NA	66.3	70-130	NA	NA	
Benzo(b)fluoranthene	22700	1870		ug/m³	31200	NA	72.8	70-130	NA	NA	
Benzo(g,h,i)perylene	11400	2310		ug/m³	38500	NA	29.6	70-130	NA	NA	
Benzo(k)fluoranthene	22100	1890		ug/m³	31600	NA	69.9	70-130	NA	NA	
Chrysene	16400	1800		ug/m³	29900	NA	54.8	70-130	NA	NA	
Dibenz(a,h)anthracene	19400	19300		ug/m³	32100	NA	60.4	70-130	NA	NA	
Fluoranthene	24600	1710		ug/m³	28500	NA	86.3	70-130	NA	NA	
Fluorene	25400	1630		ug/m³	27100	NA	93.7	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	20600	4070		ug/m³	33900	NA	60.8	70-130	NA	NA	
Naphthalene	27200	1660		ug/m³	27700	NA	98.2	70-130	NA	NA	
Phenanthrene	25000	1660		ug/m³	27700	NA	90.3	70-130	NA	NA	
Pyrene	24000	1740		ug/m³	29000	NA	82.8	70-130	NA	NA	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0431-BSD1) Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	26800	1590		ug/m³	26600	NA	101	70-130	3.42	20	
2-Methylnaphthalene	26900	1590		ug/m³	26400	NA	102	70-130	3.02	20	
Acenaphthene	27000	1660		ug/m³	27600	NA	97.8	70-130	5.32	20	
Acenaphthylene	25000	1530		ug/m³	25500	NA	98.0	70-130	4.08	20	
Anthracene	27000	3300		ug/m³	27500	NA	98.2	70-130	7.29	20	
Benz(a)anthracene	27400	1790		ug/m³	29800	NA	91.9	70-130	14.9	20	
Benzo(a)pyrene	26400	1890		ug/m³	31500	NA	83.8	70-130	23.3	20	
Benzo(b)fluoranthene	27500	1870		ug/m³	31200	NA	88.1	70-130	19.1	20	
Benzo(g,h,i)perylene	18000	2310		ug/m³	38500	NA	46.8	70-130	44.9	20	
Benzo(k)fluoranthene	27600	1890		ug/m³	31600	NA	87.3	70-130	22.1	20	
Chrysene	22100	1800		ug/m³	29900	NA	73.9	70-130	29.6	20	
Dibenz(a,h)anthracene	25800	19300		ug/m³	32100	NA	80.4	70-130	28.3	20	
Fluoranthene	27100	1710		ug/m³	28500	NA	95.1	70-130	9.67	20	
Fluorene	26600	1630		ug/m³	27100	NA	98.2	70-130	4.62	20	
Indeno(1,2,3-cd)pyrene	27300	4070		ug/m³	33900	NA	80.5	70-130	28.0	20	
Naphthalene	27900	1660		ug/m³	27700	NA	101	70-130	2.54	20	
Phenanthrene	26800	1660		ug/m³	27700	NA	96.8	70-130	6.95	20	
Pyrene	27300	1740		ug/m³	29000	NA	94.1	70-130	12.9	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701670

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS Corp
Mailing Address: 700 3rd St. S, Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: (612) 370-0700 Fax #: (612) 373-6800
E-mail: hubert_huls@urscorp.com

Project ID/Name: Ashland NSP
P.O. #/Project #: 25688375.75000

SEND INVOICE TO
Contact Name: SAME
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Agitate line item #8 prior to analysis
~~Agitate~~ line item #9 prior to analysis
Filter

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	TSS	Percent Solids	PAH	VOC	DOC	TOC					FOR LAB USE ONLY
1	NSP-2A-10Q-TSS-7-032607	3/26/07	10:00	Slurry		1	N	X	X									0701670-1
2	NSP-2A-10Q-PAH-2-032607		12:10	Air	301.2L	3	N			X								-2,3
3	NSP-2A-10Q-VOC-2-032607		12:10		301.2L	2	N				X							-4,5
4	NSP-2A-10Q-PAH-5-032607		16:14		602.4L	3	N			X								-6,7
5	NSP-2A-10Q-VOC-5-032607	3/26/07	16:14		602.4L	2	N				X							-8,9
6	NSP-2A-10Q-PAH-6-032707	3/27/07	8:18		2409.6L	3	N			X								-10,11
7	NSP-2A-10Q-VOC-6-032707		8:18	Air	2409.6L	2	N				X							-12,13
8	NSP-2A-10Q-PAH-8-032707		8:30	Slurry		3	N			X								-14
9	NSP-2A-10Q-PAH-8-032707					3	N			X	X							-15
10	NSP-2A-10Q-VOC-8-032707					6	N				X							-16
11	NSP-2A-10Q-DOC-8-032707					1	N					X						-17
12	NSP-2A-10Q-TOC-8-032707					1	N						X					-18
13	NSP-2A-10Q-TSS-8-032707		8:30	Slurry		1	N	X	X									-19
14	NSP-2A-1M-PAH-1-032707		9:20	Soil		2	N			X								-20
15	NSP-2A-1M-VOC-1-032707	3/27/07	9:20	Soil		2	N				X							-21

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/28/07 10:05
Received by: [signature] Date/Time 03/28/07 1005
Relinquished by: [signature] Date/Time 03/28/07 1204
Received Contents Not Verified: [signature] Date/Time 3/28/07 1206
Received Contents Verified: Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 7.7 °C

Form # CS02.02 F:/Groups/QA/QC/Forms/clientservices/COC-CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701670
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701670

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS Corp
Mailing Address 700 3rd St. S, Suite #600
City, State, Zip Minneapolis, MN 55415
Telephone # (612) 370-0700 Fax # (612) 373-6800
E-mail hubert_huls@urscorp.com

Project ID/Name Ashland NSP
P.O. #/Project # 25688 375.75000

SEND INVOICE TO
Contact Name
Company
Address SAME
City, State, Zip
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	TSS	Percent Solids	TOC	PAH	VOC						FOR LAB USE ONLY
1	NSP-2A-1M-TSS-7-032707	3/27/07	945	Slurry		1	N	X	X									0701670-22
2	NSP-2A-1M-TOC-7-032707	3/27/07	945	Slurry		1	N			X								-23
3	NSP-2A-10Q-PAH-3-032707		10:10	Soil		2	N				X							-24
4	NSP-2A-10Q-VOC-3-032707		10:10	Soil		2	N					X						-25
5	NSP-2A-10Q-PAH-4-032707		11:30	Water		3	N				X							-26
6	NSP-2A-10Q-VOC-4-032707	03/27/07	11:30	Water		3	N					X						-27
7	Trip Blanks (DI)					2												-28
8	Trip Blank (MeOH)					1												-29
9	Temp. Blank					1												
10																		
11																		
12																		
13																		
14																		
15																		

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr
Collector's Signature
Relinquished by: Date/Time 03/28/07 10:05
Relinquished by: Date/Time 03/28/07 1209
Received by: Date/Time 03/28/07 1005
Received Contents Not Verified: Date/Time 3/28/07 1206
Received Contents Verified: Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 7.7 °C

Form # CS02.02 F:\Groups\QA\QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

May 02, 2007

Work Order #: 0701696

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 28, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Qualifiers and Abbreviations

A5a	The Laboratory Control Sample has a recovery of 69.9%, which is below the laboratory limits of 70-130%.
A1a	The Laboratory Control Sample has a recovery of 66.3%, which is below laboratory limits of 70-130%.
A1b	The Laboratory Control Sample recovery is 74.3%, which is below the laboratory limits of 75-125%.
A2	The calibration check standards were at 120% and 117%, which are outside the laboratory limits of 85-115%. There may be a high bias to the reported results.
A2a	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 29.6% and 46.8%, which are below the laboratory limits of 70-130%.
A3	The calibration check standards were at 186% and 181%, which are outside the laboratory limits of 85-115%. There may be a high bias to the reported results.
A3a	The Laboratory Control Sample has a recovery of 54.8%, which is below the laboratory limits of 70-130%.
A4	The Laboratory Control Sample and Laboratory Control Sample Duplicate had recoveries of 150% & 161% for tubes and 181% & 178 % for filters, these are outside laboratory limits of 75-125%.
A1	The calibration check standards were at 122% and 119%, which are outside the laboratory limits of 85-115%. There may be a high bias to the reported results.
A5	The Laboratory Control Sample has a recovery of 60.8%, which is below the laboratory limits of 70-130%.
vn	The surrogate recovery is below the laboratory generated control limits.
A5b	The MDL value for this analyte is an estimated value; no statistical value has been determined.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
ia	The back section of the sample tube contained greater than 10 percent of the amount collected on the front section. This indicates possible analyte breakthrough (loss) during field sampling.
ib	Unidentified compounds are present in the sample.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
sk	The surrogate recovery is outside of laboratory control limits due to matrix interference.
ts	This analysis was performed by a subcontract laboratory.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
A4a	The Laboratory Control Sample has a recovery of 60.4%, which is below the laboratory limits of 70-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-2A-1M-PAH-2-032707 Front	0701696-01	Air Tube	03/27/07 11:57	03/28/07 12:08
NSP-2A-1M-VOC-2-032707 Front	0701696-03	Air Tube	03/27/07 11:57	03/28/07 12:08
NSP-2A-1M-PAH-5-032707 Front	0701696-05	Air Tube	03/27/07 16:02	03/28/07 12:08
NSP-2A-1M-VOC-5-032707 Front	0701696-07	Air Tube	03/27/07 16:02	03/28/07 12:08
NSP-2A-1M-PAH-6-032807 Front	0701696-09	Air Tube	03/28/07 08:06	03/28/07 12:08
NSP-2A-1M-PAH-6-032807 Back	0701696-10	Air Tube	03/28/07 08:06	03/28/07 12:08
NSP-2A-1M-VOC-6-032807 Front	0701696-11	Air Tube	03/28/07 08:06	03/28/07 12:08
NSP-2A-1M-VOC-6-032807 Back	0701696-12	Air Tube	03/28/07 08:06	03/28/07 12:08
NSP-2A-1M-PAH-8-032807 Total	0701696-13	Slurry	03/28/07 08:20	03/28/07 12:08
NSP-2A-1M-PAH-8-032807 Dissolved	0701696-14	Slurry	03/28/07 08:20	03/28/07 12:08
NSP-2A-1M-VOC-8-032807	0701696-15	Slurry	03/28/07 08:20	03/28/07 12:08
NSP-2A-1M-TSS-8-032807	0701696-16	Slurry	03/28/07 08:20	03/28/07 12:08
NSP-2A-1M-TOC-8-032807	0701696-17	Slurry	03/28/07 08:20	03/28/07 12:08
NSP-2A-1M-DOC-8-032807	0701696-18	Slurry	03/28/07 08:20	03/28/07 12:08
NSP-2A-10M-TOC-1-032807	0701696-19	Soil	03/28/07 09:10	03/28/07 12:08
NSP-2A-10M-PAH-1-032807	0701696-20	Soil	03/28/07 09:10	03/28/07 12:08
NSP-2A-10M-VOC-1-032807	0701696-21	Soil	03/28/07 09:10	03/28/07 12:08
NSP-2A-1M-PAH-3-032807	0701696-22	Soil	03/28/07 09:45	03/28/07 12:08
NSP-2A-1M-VOC-3-032807	0701696-23	Soil	03/28/07 09:45	03/28/07 12:08
Trip Blanks (DI)	0701696-24	Water	03/28/07 00:00	03/28/07 12:08
Trip Blank (MeOH)	0701696-25	Soil	03/28/07 00:00	03/28/07 12:08

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	10.4 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-2-032707 Front

0701696-01 (Air Tube)

3/27/07 11:57

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
2-Methylnaphthalene	**14.1**	5.26		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A1
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A2
Chrysene	ND	5.96		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A3, A4
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Fluoranthene	ND	11.4		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Naphthalene	**17.4**	5.52		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-VOC-2-032707 Front

0701696-03 (Air Tube)

3/27/07 11:57

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**13.0**	9.85		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**19.0**	9.87		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	ND	20.3		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	ND	19.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**48.2**	10.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	ND	19.9		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-5-032707 Front

0701696-05 (Air Tube)

3/27/07 16:02

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
2-Methylnaphthalene	**8.07**	2.63		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A1
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A2
Chrysene	ND	2.98		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A3, A4
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Naphthalene	**9.74**	2.76		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-VOC-5-032707 Front

0701696-07 (Air Tube)

3/27/07 16:02

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	5.03		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**7.84**	4.93		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	5.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**14.5**	4.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**13.0**	10.2		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**33.4**	5.02		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**13.2**	4.97		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**24.3**	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-6-032807 Front

0701696-09 (Air Tube)

3/28/07 8:06

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**2.33**	0.662		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
2-Methylnaphthalene	**4.67**	0.658		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A1
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A2
Chrysene	ND	0.746		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	A3, A4
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Naphthalene	**4.50**	0.689		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	ia
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/9/07	4/11/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-6-032807 Back

0701696-10 (Air Tube)

3/28/07 8:06

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**0.741**	0.662		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
2-Methylnaphthalene	ND	0.658		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthene	ND	0.688		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthylene	ND	0.634		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A1a, gp
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	0.959		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A2a, gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5a, gp
Chrysene	ND	0.746		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A3a, gp
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A4a, gp
Fluoranthene	ND	0.710		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Fluorene	ND	0.675		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	1.69		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5, gp
Naphthalene	**1.82**	0.689		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Phenanthrene	ND	0.689		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Pyrene	ND	0.721		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-VOC-6-032807 Front

0701696-11 (Air Tube)

3/28/07 8:06

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**3.10**	1.26		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**8.40**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	**2.31**	1.20		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**11.4**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ia
Carbon Tetrachloride	**12.4**	2.54		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**4.85**	2.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**2.79**	1.63		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**29.4**	1.25		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**45.5**	1.24		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ia
Xylenes, Total	**23.6**	2.49		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-VOC-6-032807 Back

0701696-12 (Air Tube)

3/28/07 8:06

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.26		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	ib
1,2,4-Trimethylbenzene	ND	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Benzene	ND	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Carbon Tetrachloride	**104**	12.7		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Ethyl Benzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Styrene	ND	1.63		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	A1b
Toluene	ND	1.25		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Xylenes, Total	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-8-032807 Total

0701696-13 (Slurry)

3/28/07 8:20

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**140**	25	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	**89**	25	1.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**48**	25	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**210**	25	2.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**110**	25	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**390**	10	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	**49**	10	0.94	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	**280**	10	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	**130**	10	3.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	**110**	10	3.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	**68**	10	2.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	**56**	25	4.0	ug/L	B7C0494	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	**37**	10	3.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	**61**	10	3.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	24 J	25	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	**130**	10	3.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	**29**	10	3.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	**300**	10	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	**110**	10	2.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**40**	10	3.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	**74**	25	1.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Perylene	14 J	25	1.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	**370**	100	10	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Pyrene	**410**	10	2.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*54.9 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*vn*
Surrogate: Nitrobenzene-d5	*42.4 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*vn*
Surrogate: Terphenyl-d14	*73.8 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-8-032807 Dissolved

0701696-14 (Slurry)

3/28/07 8:20

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	4.2 J	20	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	ND	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	20	2.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	7.5 J	20	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	4.5 J	20	1.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**25**	8.0	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	4.7 J	8.0	0.75	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	ND	8.0	0.83	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	ND	8.0	1.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	ND	20	3.2	ug/L	B7C0494	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	ND	8.0	2.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	ND	8.0	3.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	ND	20	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	ND	8.0	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	ND	8.0	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	9.0 J	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Perylene	ND	20	1.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	ND	8.0	0.82	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Pyrene	ND	8.0	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*64.7 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*49.8 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*vn*
Surrogate: Terphenyl-d14	*85.1 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-VOC-8-032807

0701696-15 (Slurry)

3/28/07 8:20

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**19**	1.0	0.069	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	**48**	1.0	0.030	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	**13**	1.0	0.039	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Benzene	**21**	1.0	0.042	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Ethylbenzene	**9.3**	1.0	0.036	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
m,p-Xylenes	**72**	1.0	0.059	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
o-Xylene	**50**	1.0	0.072	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Toluene	**41**	1.0	0.048	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*104 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*98.4 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*99.2 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-TSS-8-032807

0701696-16 (Slurry)

3/28/07 8:20

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**140**	10	3.6	mg/L	B7D0060	4/3/07	4/3/07	EPA 160.2	
Total Solids	**890**	20	1.0	mg/L	B7D0111	4/4/07	4/4/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-TOC-8-032807

0701696-17 (Slurry)

3/28/07 8:20

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**8.0**	1.5	0.50	mg/L	B7D0081	4/3/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-DOC-8-032807

0701696-18 (Slurry)

3/28/07 8:20

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**8.4**	1.5	0.50	mg/L	B7D0082	4/3/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10M-TOC-1-032807

0701696-19 (Soil)

3/28/07 9:10

Subcontracted to Minnesota Valley Testing Laboratories, Inc Bismark

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**105000**	1000	1000	mg/kg	B7D0217	4/11/07	4/11/07	EPA 9060	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10M-PAH-1-032807

0701696-20 (Soil)

3/28/07 9:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**53**	0.050	0.010	% Wt	B7D0015	4/2/07	4/3/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**250**	25	4.1	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**45**	2.5	0.30	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**31**	2.5	0.30	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**110**	25	3.7	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**380**	25	8.5	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**91**	2.5	0.37	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Acenaphthylene	**16**	2.5	0.26	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Anthracene	**90**	2.5	0.37	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benz(a)anthracene	**37**	2.5	0.37	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**36**	2.5	0.30	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**24**	2.5	0.63	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**20**	2.5	0.37	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	**7.6**	2.5	0.22	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**27**	2.5	0.52	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Biphenyl	**35**	2.5	0.45	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Chrysene	**40**	2.5	0.37	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	**2.9**	2.5	0.78	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Fluoranthene	**92**	25	2.6	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Fluorene	**110**	25	1.5	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**7.9**	2.5	0.33	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Naphthalene	**410**	25	1.9	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Perylene	**5.8**	2.5	0.41	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Phenanthrene	**290**	25	3.0	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Pyrene	**66**	2.5	0.37	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*72.2 %*	*Limits: 30-104%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*55.3 %*	*Limits: 30-90%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*45.0 %*	*Limits: 30-115%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10M-VOC-1-032807

0701696-21 (Soil)

3/28/07 9:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**38**	0.050	0.010	% Wt	B7D0015	4/2/07	4/3/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**11**	1.3	0.042	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	**40**	1.3	0.091	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	**9.9**	1.3	0.13	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.3	0.16	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Benzene	**7.0**	1.3	0.057	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	1.3	0.073	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Ethylbenzene	**58**	1.3	0.14	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
m,p-Xylenes	**43**	1.3	0.16	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
o-Xylene	**24**	1.3	0.18	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	1.3	0.055	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Styrene	ND	1.3	0.060	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Toluene	**19**	1.3	0.22	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Trichloroethene	ND	1.3	0.096	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*93.6 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*97.2 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*100 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-PAH-3-032807

0701696-22 (Soil)

3/28/07 9:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**37**	0.050	0.010	% Wt	B7D0015	4/2/07	4/3/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**110**	3.6	0.60	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
1-Methylphenanthrene	**36**	3.6	0.43	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**20**	3.6	0.43	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**82**	3.6	0.54	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
2-Methylnaphthalene	**140**	3.6	1.2	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Acenaphthene	**87**	3.6	0.54	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Acenaphthylene	**11**	3.6	0.38	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Anthracene	**62**	3.6	0.54	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benz(a)anthracene	**26**	3.6	0.54	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**23**	3.6	0.43	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**14**	3.6	0.92	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**13**	3.6	0.54	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	A5b
Benzo(g,h,i)perylene	**6.9**	3.6	0.32	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**18**	3.6	0.76	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Biphenyl	**22**	3.6	0.65	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Chrysene	**27**	3.6	0.54	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	2.4 J	3.6	1.1	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Fluoranthene	**63**	3.6	0.38	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Fluorene	**87**	3.6	0.22	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**6.5**	3.6	0.49	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Naphthalene	**280**	18	1.4	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Perylene	**3.8**	3.6	0.60	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Phenanthrene	**190**	18	2.2	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Pyrene	**65**	3.6	0.54	mg/kg dry	B7C0507	3/30/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*33.5 %*	*Limits: 30-104%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*22.4 %*	*Limits: 30-90%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	*sk*
Surrogate: Terphenyl-d14	*11.2 %*	*Limits: 30-115%*			*B7C0507*	*3/30/07*	*4/11/07*	*EPA 8270C*	*sk*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-1M-VOC-3-032807

0701696-23 (Soil)

3/28/07 9:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**37**	0.050	0.010	% Wt	B7D0015	4/2/07	4/3/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**5.7**	1.3	0.043	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	**18**	1.3	0.094	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	**4.4**	1.3	0.13	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.3	0.16	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Benzene	ND	1.3	0.059	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	1.3	0.075	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Ethylbenzene	**21**	1.3	0.14	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
m,p-Xylenes	**15**	1.3	0.17	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
o-Xylene	**8.3**	1.3	0.19	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	1.3	0.057	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Styrene	ND	1.3	0.062	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Toluene	**5.3**	1.3	0.23	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Trichloroethene	ND	1.3	0.10	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*107 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*92.8 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.4 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*98.4 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blanks (DI)

0701696-24 (Water)

3/28/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7D0045	4/2/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*104 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*88.0 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.0 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7D0045*	*4/2/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blank (MeOH)

0701696-25 (Soil)

3/28/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*84.8 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.0 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7D0015 - Default Prep GenChem

Method Blank (B7D0015-BLK1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7D0015-SRM1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	87.9			% Wt	88.8	NA	99.0	90-110	NA	NA	

Batch B7D0060 - Default Prep GenChem

Method Blank (B7D0060-BLK1)

Prepared: 04/03/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7D0060-BS1)

Prepared: 04/03/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	233			mg/L	250	NA	93.2	80-120	NA	NA	

Batch B7D0111 - Default Prep GenChem

Method Blank (B7D0111-BLK1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5b
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample (B7C0494-BS1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

Laboratory Control Sample Duplicate (B7C0494-BSD1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0728	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	0.0133 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.142	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	0.0509 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5b
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.188	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	0.0402 J	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	0.0309 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.629*			mg/kg	*0.831*	*NA*	*75.7*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.468*			mg/kg	*0.831*	*NA*	*56.3*	*30-90*			
Surrogate: Terphenyl-d14	*0.715*			mg/kg	*0.831*	*NA*	*86.0*	*30-115*			

Laboratory Control Sample (B7C0507-BS1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.22	0.067	0.010	mg/kg	1.66	NA	73.5	50-115	NA	NA	
Pyrene	1.20	0.067	0.010	mg/kg	1.66	NA	72.3	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.652*			mg/kg	*0.832*	*NA*	*78.4*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.488*			mg/kg	*0.832*	*NA*	*58.7*	*30-90*			
Surrogate: Terphenyl-d14	*0.730*			mg/kg	*0.832*	*NA*	*87.7*	*30-115*			

Laboratory Control Sample Duplicate (B7C0507-BSD1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-115	0.816	25	
Pyrene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-130	2.47	25	
Surrogate: 2-Fluorobiphenyl	*0.657*			mg/kg	*0.831*	*NA*	*79.1*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.503*			mg/kg	*0.831*	*NA*	*60.5*	*30-90*			
Surrogate: Terphenyl-d14	*0.725*			mg/kg	*0.831*	*NA*	*87.2*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0045 - EPA 5030B

Method Blank (B7D0045-BLK1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*22.5*			ug/L	*25.0*	*NA*	*90.0*	*80-120*			
Surrogate: Dibromofluoromethane	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			
Surrogate: Toluene-d8	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Laboratory Control Sample (B7D0045-BS1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	28.3	1.0	0.030	ug/L	25.0	NA	113	75-125	NA	NA	
1,3,5-Trimethylbenzene	28.3	1.0	0.039	ug/L	25.0	NA	113	75-125	NA	NA	
1,4-Dichlorobenzene	26.4	1.0	0.051	ug/L	25.0	NA	106	75-125	NA	NA	
Benzene	27.7	1.0	0.042	ug/L	25.0	NA	111	75-125	NA	NA	
Carbon Tetrachloride	27.3	1.0	0.050	ug/L	25.0	NA	109	75-125	NA	NA	
Ethylbenzene	27.3	1.0	0.036	ug/L	25.0	NA	109	75-125	NA	NA	
m,p-Xylenes	54.4	1.0	0.059	ug/L	50.0	NA	109	75-125	NA	NA	
o-Xylene	27.0	1.0	0.072	ug/L	25.0	NA	108	75-125	NA	NA	
sec-Butylbenzene	28.9	1.0	0.027	ug/L	25.0	NA	116	75-125	NA	NA	
Styrene	28.0	1.0	0.049	ug/L	25.0	NA	112	75-125	NA	NA	
Toluene	26.6	1.0	0.048	ug/L	25.0	NA	106	75-125	NA	NA	
Trichloroethene	25.7	1.0	0.067	ug/L	25.0	NA	103	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			
Surrogate: Dibromofluoromethane	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0045 - EPA 5030B

Laboratory Control Sample Duplicate (B7D0045-BSD1)

Prepared: 04/02/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	28.5	1.0	0.030	ug/L	25.0	NA	114	75-125	0.704	20	
1,3,5-Trimethylbenzene	28.3	1.0	0.039	ug/L	25.0	NA	113	75-125	0.00	20	
1,4-Dichlorobenzene	26.4	1.0	0.051	ug/L	25.0	NA	106	75-125	0.00	20	
Benzene	27.5	1.0	0.042	ug/L	25.0	NA	110	75-125	0.725	20	
Carbon Tetrachloride	28.5	1.0	0.050	ug/L	25.0	NA	114	75-125	4.30	20	
Ethylbenzene	27.6	1.0	0.036	ug/L	25.0	NA	110	75-125	1.09	20	
m,p-Xylenes	55.3	1.0	0.059	ug/L	50.0	NA	111	75-125	1.64	20	
o-Xylene	27.5	1.0	0.072	ug/L	25.0	NA	110	75-125	1.83	20	
sec-Butylbenzene	29.0	1.0	0.027	ug/L	25.0	NA	116	75-125	0.345	20	
Styrene	28.5	1.0	0.049	ug/L	25.0	NA	114	75-125	1.77	20	
Toluene	26.4	1.0	0.048	ug/L	25.0	NA	106	75-125	0.755	20	
Trichloroethene	25.9	1.0	0.067	ug/L	25.0	NA	104	75-125	0.775	20	
Surrogate: 1,2-Dichloroethane-d4	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: Dibromofluoromethane	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Toluene-d8	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			

Batch B7D0142 - EPA 5035

Method Blank (B7D0142-BLK1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*21.9*			ug/L	*25.0*	*NA*	*87.6*	*80-120*			
Surrogate: Dibromofluoromethane	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0142 - EPA 5035

Laboratory Control Sample (B7D0142-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.41	0.050	0.0035	mg/kg	1.25	NA	113	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.40	0.050	0.0049	mg/kg	1.25	NA	112	75-125	NA	NA	
1,4-Dichlorobenzene	1.33	0.050	0.0060	mg/kg	1.25	NA	106	75-125	NA	NA	
Benzene	1.39	0.050	0.0022	mg/kg	1.25	NA	111	75-125	NA	NA	
Carbon Tetrachloride	1.33	0.050	0.0028	mg/kg	1.25	NA	106	75-125	NA	NA	
Ethylbenzene	1.35	0.050	0.0053	mg/kg	1.25	NA	108	75-125	NA	NA	
m,p-Xylenes	2.67	0.050	0.0063	mg/kg	2.50	NA	107	75-125	NA	NA	
o-Xylene	1.31	0.050	0.0070	mg/kg	1.25	NA	105	75-125	NA	NA	
sec-Butylbenzene	1.42	0.050	0.0021	mg/kg	1.25	NA	114	75-125	NA	NA	
Styrene	1.37	0.050	0.0023	mg/kg	1.25	NA	110	75-125	NA	NA	
Toluene	1.32	0.050	0.0086	mg/kg	1.25	NA	106	75-125	NA	NA	
Trichloroethene	1.27	0.050	0.0037	mg/kg	1.25	NA	102	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.7*			ug/L	*25.0*	*NA*	*94.8*	*80-120*			
Surrogate: Dibromofluoromethane	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			

Laboratory Control Sample Duplicate (B7D0142-BSD1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.43	0.050	0.0035	mg/kg	1.25	NA	114	75-125	1.41	20	
1,3,5-Trimethylbenzene	1.43	0.050	0.0049	mg/kg	1.25	NA	114	75-125	2.12	20	
1,4-Dichlorobenzene	1.35	0.050	0.0060	mg/kg	1.25	NA	108	75-125	1.49	20	
Benzene	1.41	0.050	0.0022	mg/kg	1.25	NA	113	75-125	1.43	20	
Carbon Tetrachloride	1.31	0.050	0.0028	mg/kg	1.25	NA	105	75-125	1.52	20	
Ethylbenzene	1.37	0.050	0.0053	mg/kg	1.25	NA	110	75-125	1.47	20	
m,p-Xylenes	2.66	0.050	0.0063	mg/kg	2.50	NA	106	75-125	0.375	20	
o-Xylene	1.32	0.050	0.0070	mg/kg	1.25	NA	106	75-125	0.760	20	
sec-Butylbenzene	1.43	0.050	0.0021	mg/kg	1.25	NA	114	75-125	0.702	20	
Styrene	1.38	0.050	0.0023	mg/kg	1.25	NA	110	75-125	0.727	20	
Toluene	1.35	0.050	0.0086	mg/kg	1.25	NA	108	75-125	2.25	20	
Trichloroethene	1.27	0.050	0.0037	mg/kg	1.25	NA	102	75-125	0.00	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.4*			ug/L	*25.0*	*NA*	*93.6*	*80-120*			
Surrogate: Dibromofluoromethane	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0153 - AIRTUBES Prep

Laboratory Control Sample (B7D0153-BS1) Prepared: 04/09/07 Analyzed: 04/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29500	0.00		ug/m³	28200	NA	105	70-130	NA	NA	
2-Methylnaphthalene filter	29500	0.00		ug/m³	28200	NA	105	70-130	NA	NA	
Acenaphthene filter	26800	0.00		ug/m³	26000	NA	103	70-130	NA	NA	
Acenaphthylene filter	26300	0.00		ug/m³	25700	NA	102	70-130	NA	NA	
Anthracene filter	26500	0.00		ug/m³	25100	NA	106	70-130	NA	NA	
Benz(a)anthracene filter	27000	0.00		ug/m³	25600	NA	105	70-130	NA	NA	
Benzo(a)pyrene filter	27000	0.00		ug/m³	25300	NA	107	70-130	NA	NA	
Benzo(b)fluoranthene filter	26500	0.00		ug/m³	25300	NA	105	70-130	NA	NA	
Benzo(g,h,i)perylene filter	30600	0.00		ug/m³	25800	NA	119	70-130	NA	NA	
Benzo(k)fluoranthene filter	29800	0.00		ug/m³	25400	NA	117	70-130	NA	NA	
Chrysene filter	46100	0.00		ug/m³	25400	NA	181	70-130	NA	NA	
Dibenz(a,h)anthracene filter	25900	0.00		ug/m³	25100	NA	103	70-130	NA	NA	
Fluoranthene filter	26600	0.00		ug/m³	25500	NA	104	70-130	NA	NA	
Fluorene filter	26400	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	29000	0.00		ug/m³	26800	NA	108	70-130	NA	NA	
Naphthalene filter	28500	0.00		ug/m³	28100	NA	101	70-130	NA	NA	
Phenanthrene filter	26700	0.00		ug/m³	25500	NA	105	70-130	NA	NA	
Pyrene filter	27000	0.00		ug/m³	25600	NA	105	70-130	NA	NA	
1-Methylnaphthalene	25900	1590		ug/m³	26600	NA	97.4	70-130	NA	NA	
2-Methylnaphthalene	25900	1590		ug/m³	26400	NA	98.1	70-130	NA	NA	
Acenaphthene	25900	3310		ug/m³	27600	NA	93.8	70-130	NA	NA	
Acenaphthylene	24100	3050		ug/m³	25500	NA	94.5	70-130	NA	NA	
Anthracene	25700	3300		ug/m³	27500	NA	93.5	70-130	NA	NA	
Benz(a)anthracene	26200	1790		ug/m³	29800	NA	87.9	70-130	NA	NA	
Benzo(a)pyrene	25400	1890		ug/m³	31500	NA	80.6	70-130	NA	NA	
Benzo(b)fluoranthene	26000	1870		ug/m³	31200	NA	83.3	70-130	NA	NA	
Benzo(g,h,i)perylene	31300	4620		ug/m³	38500	NA	81.3	70-130	NA	NA	
Benzo(k)fluoranthene	29400	1890		ug/m³	31600	NA	93.0	70-130	NA	NA	
Chrysene	44800	1800		ug/m³	29900	NA	150	70-130	NA	NA	
Dibenz(a,h)anthracene	23500	19300		ug/m³	32100	NA	73.2	70-130	NA	NA	
Fluoranthene	26000	3420		ug/m³	28500	NA	91.2	70-130	NA	NA	
Fluorene	25700	3250		ug/m³	27100	NA	94.8	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	26200	2030		ug/m³	33900	NA	77.3	70-130	NA	NA	
Naphthalene	26500	1660		ug/m³	27700	NA	95.7	70-130	NA	NA	
Phenanthrene	25900	3320		ug/m³	27700	NA	93.5	70-130	NA	NA	
Pyrene	25600	3480		ug/m³	29000	NA	88.3	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0153 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0153-BSD1) Prepared: 04/09/07 Analyzed: 04/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	28900	0.00		ug/m³	28200	NA	102	70-130	2.05	20	
2-Methylnaphthalene filter	29000	0.00		ug/m³	28200	NA	103	70-130	1.71	20	
Acenaphthene filter	26200	0.00		ug/m³	26000	NA	101	70-130	2.26	20	
Acenaphthylene filter	25400	0.00		ug/m³	25700	NA	98.8	70-130	3.48	20	
Anthracene filter	25800	0.00		ug/m³	25100	NA	103	70-130	2.68	20	
Benz(a)anthracene filter	26300	0.00		ug/m³	25600	NA	103	70-130	2.63	20	
Benzo(a)pyrene filter	26400	0.00		ug/m³	25300	NA	104	70-130	2.25	20	
Benzo(b)fluoranthene filter	25900	0.00		ug/m³	25300	NA	102	70-130	2.29	20	
Benzo(g,h,i)perylene filter	29700	0.00		ug/m³	25800	NA	115	70-130	2.99	20	
Benzo(k)fluoranthene filter	29100	0.00		ug/m³	25400	NA	115	70-130	2.38	20	
Chrysene filter	45100	0.00		ug/m³	25400	NA	178	70-130	2.19	20	
Dibenz(a,h)anthracene filter	24900	0.00		ug/m³	25100	NA	99.2	70-130	3.94	20	
Fluoranthene filter	26100	0.00		ug/m³	25500	NA	102	70-130	1.90	20	
Fluorene filter	25800	0.00		ug/m³	25600	NA	101	70-130	2.30	20	
Indeno(1,2,3-cd)pyrene filter	27900	0.00		ug/m³	26800	NA	104	70-130	3.87	20	
Naphthalene filter	28000	0.00		ug/m³	28100	NA	99.6	70-130	1.77	20	
Phenanthrene filter	26100	0.00		ug/m³	25500	NA	102	70-130	2.27	20	
Pyrene filter	26100	0.00		ug/m³	25600	NA	102	70-130	3.39	20	
1-Methylnaphthalene	26700	1590		ug/m³	26600	NA	100	70-130	3.04	20	
2-Methylnaphthalene	26600	1590		ug/m³	26400	NA	101	70-130	2.67	20	
Acenaphthene	27000	3310		ug/m³	27600	NA	97.8	70-130	4.16	20	
Acenaphthylene	25000	3050		ug/m³	25500	NA	98.0	70-130	3.67	20	
Anthracene	26900	3300		ug/m³	27500	NA	97.8	70-130	4.56	20	
Benz(a)anthracene	28100	1790		ug/m³	29800	NA	94.3	70-130	7.00	20	
Benzo(a)pyrene	28300	1890		ug/m³	31500	NA	89.8	70-130	10.8	20	
Benzo(b)fluoranthene	28300	1870		ug/m³	31200	NA	90.7	70-130	8.47	20	
Benzo(g,h,i)perylene	36000	4620		ug/m³	38500	NA	93.5	70-130	14.0	20	
Benzo(k)fluoranthene	32000	1890		ug/m³	31600	NA	101	70-130	8.47	20	
Chrysene	48200	1800		ug/m³	29900	NA	161	70-130	7.31	20	
Dibenz(a,h)anthracene	26700	19300		ug/m³	32100	NA	83.2	70-130	12.7	20	
Fluoranthene	27400	3420		ug/m³	28500	NA	96.1	70-130	5.24	20	
Fluorene	26600	3250		ug/m³	27100	NA	98.2	70-130	3.44	20	
Indeno(1,2,3-cd)pyrene	29700	2030		ug/m³	33900	NA	87.6	70-130	12.5	20	
Naphthalene	27200	1660		ug/m³	27700	NA	98.2	70-130	2.61	20	
Phenanthrene	27100	3320		ug/m³	27700	NA	97.8	70-130	4.53	20	
Pyrene	27300	3480		ug/m³	29000	NA	94.1	70-130	6.43	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample (B7D0206-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	5880	5880	ug/m³	110000	NA	90.0	75-125	NA	NA	
Xylenes, Total	289000	5990	2990	ug/m³	337000	NA	85.8	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	103000	2970	2970	ug/m³	99100	NA	104	75-125	NA	NA	
Styrene	122000	3920	3920	ug/m³	131000	NA	93.1	75-125	NA	NA	
Toluene	107000	3020	3020	ug/m³	101000	NA	106	75-125	NA	NA	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	82400	3030	3030	ug/m³	90200	NA	91.4	75-125	NA	NA	
1,2,4-Trimethylbenzene	85700	2970	2970	ug/m³	91600	NA	93.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	92500	2880	2880	ug/m³	94100	NA	98.3	75-125	NA	NA	
1,4-Dichlorobenzene	62800	3470	3470	ug/m³	65400	NA	96.0	75-125	NA	NA	
Carbon Tetrachloride	97000	6120	6120	ug/m³	102000	NA	95.1	75-125	NA	NA	
sec-Butylbenzene	100000	2940	2940	ug/m³	97000	NA	103	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0206-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	109000	5880	5880	ug/m³	110000	NA	99.1	75-125	9.62	20	
Xylenes, Total	329000	5990	2990	ug/m³	337000	NA	97.6	75-125	12.9	20	

Laboratory Control Sample Duplicate (B7D0206-BSD2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	98100	2970	2970	ug/m³	99100	NA	99.0	75-125	4.87	20	
Styrene	120000	3920	3920	ug/m³	131000	NA	91.6	75-125	1.65	20	
Toluene	100000	3020	3020	ug/m³	101000	NA	99.0	75-125	6.76	20	
Trichloroethene	98700	2990	2990	ug/m³	99800	NA	98.9	75-125	5.23	20	

Laboratory Control Sample Duplicate (B7D0206-BSD3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	93300	3030	3030	ug/m³	90200	NA	103	75-125	12.4	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0206-BSD3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	96000	2970	2970	ug/m³	91600	NA	105	75-125	11.3	20	
1,3,5-Trimethylbenzene	102000	2880	2880	ug/m³	94100	NA	108	75-125	9.77	20	
1,4-Dichlorobenzene	71400	3470	3470	ug/m³	65400	NA	109	75-125	12.8	20	
Carbon Tetrachloride	107000	6120	6120	ug/m³	102000	NA	105	75-125	9.80	20	
sec-Butylbenzene	110000	2940	2940	ug/m³	97000	NA	113	75-125	9.52	20	

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample (B7D0415-BS1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	88100	2940	2940	ug/m³	98000	NA	89.9	75-125	NA	NA	
Xylenes, Total	261000	2990	2990	ug/m³	299000	NA	87.3	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	NA	NA	
Styrene	97300	3920	3920	ug/m³	131000	NA	74.3	75-125	NA	NA	
Toluene	99700	3020	3020	ug/m³	101000	NA	98.7	75-125	NA	NA	
Trichloroethene	99400	2990	2990	ug/m³	99800	NA	99.6	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86300	3030	3030	ug/m³	90200	NA	95.7	75-125	NA	NA	
1,2,4-Trimethylbenzene	90100	2970	2970	ug/m³	91600	NA	98.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	95800	2880	2880	ug/m³	94100	NA	102	75-125	NA	NA	
1,4-Dichlorobenzene	64000	3470	3470	ug/m³	65400	NA	97.9	75-125	NA	NA	
Carbon Tetrachloride	103000	30600	3060	ug/m³	102000	NA	101	75-125	NA	NA	
sec-Butylbenzene	102000	2940	2940	ug/m³	97000	NA	105	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0415-BSD1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	85700	2940	2940	ug/m³	98000	NA	87.4	75-125	2.76	20	
Xylenes, Total	258000	2990	2990	ug/m³	299000	NA	86.3	75-125	1.16	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0415-BSD2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	0.00	20	
Styrene	108000	3920	3920	ug/m³	131000	NA	82.4	75-125	10.4	20	
Toluene	98400	3020	3020	ug/m³	101000	NA	97.4	75-125	1.31	20	
Trichloroethene	98100	2990	2990	ug/m³	99800	NA	98.3	75-125	1.32	20	

Laboratory Control Sample Duplicate (B7D0415-BSD3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86800	3030	3030	ug/m³	90200	NA	96.2	75-125	0.578	20	
1,2,4-Trimethylbenzene	89000	2970	2970	ug/m³	91600	NA	97.2	75-125	1.23	20	
1,3,5-Trimethylbenzene	93700	2880	2880	ug/m³	94100	NA	99.6	75-125	2.22	20	
1,4-Dichlorobenzene	64600	3470	3470	ug/m³	65400	NA	98.8	75-125	0.933	20	
Carbon Tetrachloride	100000	30600	3060	ug/m³	102000	NA	98.0	75-125	2.96	20	
sec-Butylbenzene	99300	2940	2940	ug/m³	97000	NA	102	75-125	2.68	20	

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample (B7D0431-BS1)

Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	25900	1590		ug/m³	26600	NA	97.4	70-130	NA	NA	
2-Methylnaphthalene	26100	1590		ug/m³	26400	NA	98.9	70-130	NA	NA	
Acenaphthene	25600	1660		ug/m³	27600	NA	92.8	70-130	NA	NA	
Acenaphthylene	24000	1530		ug/m³	25500	NA	94.1	70-130	NA	NA	
Anthracene	25100	3300		ug/m³	27500	NA	91.3	70-130	NA	NA	
Benz(a)anthracene	23600	1790		ug/m³	29800	NA	79.2	70-130	NA	NA	
Benzo(a)pyrene	20900	1890		ug/m³	31500	NA	66.3	70-130	NA	NA	
Benzo(b)fluoranthene	22700	1870		ug/m³	31200	NA	72.8	70-130	NA	NA	
Benzo(g,h,i)perylene	11400	2310		ug/m³	38500	NA	29.6	70-130	NA	NA	
Benzo(k)fluoranthene	22100	1890		ug/m³	31600	NA	69.9	70-130	NA	NA	
Chrysene	16400	1800		ug/m³	29900	NA	54.8	70-130	NA	NA	
Dibenz(a,h)anthracene	19400	19300		ug/m³	32100	NA	60.4	70-130	NA	NA	
Fluoranthene	24600	1710		ug/m³	28500	NA	86.3	70-130	NA	NA	
Fluorene	25400	1630		ug/m³	27100	NA	93.7	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	20600	4070		ug/m³	33900	NA	60.8	70-130	NA	NA	
Naphthalene	27200	1660		ug/m³	27700	NA	98.2	70-130	NA	NA	
Phenanthrene	25000	1660		ug/m³	27700	NA	90.3	70-130	NA	NA	
Pyrene	24000	1740		ug/m³	29000	NA	82.8	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0431-BSD1) Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	26800	1590		ug/m³	26600	NA	101	70-130	3.42	20	
2-Methylnaphthalene	26900	1590		ug/m³	26400	NA	102	70-130	3.02	20	
Acenaphthene	27000	1660		ug/m³	27600	NA	97.8	70-130	5.32	20	
Acenaphthylene	25000	1530		ug/m³	25500	NA	98.0	70-130	4.08	20	
Anthracene	27000	3300		ug/m³	27500	NA	98.2	70-130	7.29	20	
Benz(a)anthracene	27400	1790		ug/m³	29800	NA	91.9	70-130	14.9	20	
Benzo(a)pyrene	26400	1890		ug/m³	31500	NA	83.8	70-130	23.3	20	
Benzo(b)fluoranthene	27500	1870		ug/m³	31200	NA	88.1	70-130	19.1	20	
Benzo(g,h,i)perylene	18000	2310		ug/m³	38500	NA	46.8	70-130	44.9	20	
Benzo(k)fluoranthene	27600	1890		ug/m³	31600	NA	87.3	70-130	22.1	20	
Chrysene	22100	1800		ug/m³	29900	NA	73.9	70-130	29.6	20	
Dibenz(a,h)anthracene	25800	19300		ug/m³	32100	NA	80.4	70-130	28.3	20	
Fluoranthene	27100	1710		ug/m³	28500	NA	95.1	70-130	9.67	20	
Fluorene	26600	1630		ug/m³	27100	NA	98.2	70-130	4.62	20	
Indeno(1,2,3-cd)pyrene	27300	4070		ug/m³	33900	NA	80.5	70-130	28.0	20	
Naphthalene	27900	1660		ug/m³	27700	NA	101	70-130	2.54	20	
Phenanthrene	26800	1660		ug/m³	27700	NA	96.8	70-130	6.95	20	
Pyrene	27300	1740		ug/m³	29000	NA	94.1	70-130	12.9	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701696

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS Corp
Mailing Address: 700 3rd St. S. Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: 612-370-0700 Fax #: 612-373-6800
E-mail: hubert_huls@urscorp.com

Project ID/Name: Ashland NSP
P.O. #/Project #: 25688375-35000

SEND INVOICE TO
Contact Name:
Company:
Address: Same
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Agitate Line Item #7 prior to analysis
Filter Line Item #8 prior to analysis.

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH	VOC	TSS	Percent Solids	TOC	DOC				FOR LAB USE ONLY
1	NSP-2A-1M-PAH-2-032707	03/27/07	11:57	Air	301.26	3	N	X									0701696 - 1,2
2	NSP-2A-1M-VOC-2-032707		11:57		301.26	2	N		X								- 3,4
3	NSP-2A-1M-PAH-5-032707		16:02		602.46	3	N	X									- 5,6
4	NSP-2A-1M-VOC-5-032707	03/27/07	16:02		602.46	2	N		X								- 7,8
5	NSP-2A-1M-PAH-6-032807	03/28/07	08:06		2409.66	3	N	X									- 9,10
6	NSP-2A-1M-VOC-6-032807		08:06	Air	2409.66	2	N		X								- 11,12
7	NSP-2A-1M-PAH-8-032807		08:20	Slurry		3	N	X									- 13
8	NSP-2A-1M-PAH-8-032807					3	N	X									- 14
9	NSP-2A-1M-VOC-8-032807					6	N		X								- 15
10	NSP-2A-1M-TSS-8-032807					1	N			X	X						- 16
11	NSP-2A-1M-TOC-8-032807					1	N					X					- 17
12	NSP-2A-1M-DOC-8-032807		08:20	Slurry		1	N						X				- 18
13	NSP-2A-10M-TOC-1-032807		09:10	Soil		1	N					X					- 19
14	NSP-2A-10M-PAH-1-032807					2	N	X									- 20
15	NSP-2A-10M-VOC-1-032807	03/28/07	09:10	Soil		2	N		X								- 21

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/28/07 10:10
Received by: [signature] Date/Time 03/28/07 1010
Relinquished by: [signature] Date/Time 03/28/07 1204
Received Contents Not Verified: [signature] Date/Time 3/28/07 1208
Received Contents Verified: Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 10.4 °C

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/05

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701696
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701696

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Project ID/Name: Ashland NSP
P.O. #/Project #: 25685375-75000
Company: URS Corp
Mailing Address: 700 3rd St. S. Suite 600
City, State, Zip: Minneapolis MN 55415
Telephone #: 612-370-0700 Fax #: 612-373-6800
E-mail: hubert_huls@urscorp.com

SEND INVOICE TO
Contact Name: Same
Company:
Address:
City, State, Zip:
Telephone #: Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH	VOC								FOR LAB USE ONLY
1	WSP-2A-1M-PAH-3-032807	03/28/07	09:45	Soil		2	N	X									0701696-22
2	WSP-2A-1M-VOC-3-032807	03/28/07	09:45	Soil		2	N		X								-23
3	Trip Blanks (DI)					2											-24
4	Trip Blank (MeOH)					1											-25
5	Temp Blank					1											
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

CHAIN OF CUSTODY
Collected by: (Print) William G. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/28/07 10:10
Received by: [signature] Date/Time 3/28/07 1010
Relinquished by: [signature] Date/Time 3/28/07 1204
Received Contents Not Verified: [signature] Date/Time 3/28/07 1208
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 10.4 °C
Comments:

Form # CS02.02 F:/Groups/QA-QC/Forms/clientservices/COC-CS02 Effective Date: 11/17/05

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

May 02, 2007

Work Order #: 0701706

RE: Ashland/NSP
25688375.75000

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 29, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Qualifiers and Abbreviations

A5b	The Laboratory Control Sample has a recovery of 69.9%, which is below the laboratory limits of 70-130%.
A1a	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 62.2% and 63.8%, which are below the laboratory limits of 70-130%.
A1b	The Laboratory Control Sample has a recovery of 66.3%, which is below laboratory limits of 70-130%.
A1c	The Laboratory Control Sample recovery is 74.3%, which is below the laboratory limits of 75-125%.
A2	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 29.6% and 46.8%, which are below the laboratory limits of 70-130%.
A2a	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 67.9% and 69.9%, which are below the laboratory limits of 70-130%.
A3	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 42.6% and 47.5%, which are below the laboratory limits of 70-130%.
A3a	The Laboratory Control Sample has a recovery of 54.8%, which is below the laboratory limits of 70-130%.
A4	The Laboratory Control Sample has a recovery of 60.4%, which is below the laboratory limits of 70-130%.
A4a	The Laboratory Control Sample has a recovery of 68.7%, which is below the laboratory limits of 70-130%.
A1	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 55.2% and 56.9%, which are below the laboratory limits of 70-130%.
A5a	The Laboratory Control Sample has a recovery of 60.8%, which is below laboratory limits of 70-130%.
vn	The surrogate recovery is below the laboratory generated control limits.
A5c	The MDL value for this analyte is an estimated value; no statistical value has been determined.
go	The laboratory control sample recovery is outside of laboratory control limits.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
ia	The back section of the sample tube contained greater than 10 percent of the amount collected on the front section. This indicates possible analyte breakthrough (loss) during field sampling.
ib	Unidentified compounds are present in the sample.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
sk	The surrogate recovery is outside of laboratory control limits due to matrix interference.
ts	This analysis was performed by a subcontract laboratory.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
A5	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 60.1% and 63.6%, which are below the laboratory limits of 70-130%.
COC	Chain of Custody

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-2A-1M-PAH-4-032807	0701706-01	Water	03/28/07 11:00	03/29/07 13:08
NSP-2A-1M-VOC-4-032807	0701706-02	Slurry	03/28/07 11:00	03/29/07 13:08
NSP-2A-10M-PAH-2-032807 Front	0701706-03	Air Tube	03/28/07 11:32	03/29/07 13:08
NSP-2A-10M-VOC-2-032807 Front	0701706-05	Air Tube	03/28/07 11:32	03/29/07 13:08
NSP-2A-10M-PAH-5-032807 Front	0701706-07	Air Tube	03/28/07 15:36	03/29/07 13:08
NSP-2A-10M-PAH-5-032807 Back	0701706-08	Air Tube	03/28/07 15:36	03/29/07 13:08
NSP-2A-10M-VOC-5-032807 Front	0701706-09	Air Tube	03/28/07 15:36	03/29/07 13:08
NSP-2A-10M-PAH-6-032907 Front	0701706-11	Air Tube	03/29/07 07:40	03/29/07 13:08
NSP-2A-10M-PAH-6-032907 Back	0701706-12	Air Tube	03/29/07 07:40	03/29/07 13:08
NSP-2A-10M-VOC-6-032907 Front	0701706-13	Air Tube	03/29/07 07:40	03/29/07 13:08
NSP-2A-10M-VOC-6-032907 Back	0701706-14	Air Tube	03/29/07 07:40	03/29/07 13:08
NSP-2A-10M-PAH-8-032907 Total	0701706-15	Slurry	03/29/07 07:50	03/29/07 13:08
NSP-2A-10M-PAH-8-032907 Dissolved	0701706-16	Slurry	03/29/07 07:50	03/29/07 13:08
NSP-2A-10M-VOC-8-032907	0701706-17	Slurry	03/29/07 07:50	03/29/07 13:08
NSP-2A-10M-TSS-8-032907	0701706-18	Slurry	03/29/07 07:50	03/29/07 13:08
NSP-2A-10M-DOC-8-032907	0701706-19	Slurry	03/29/07 07:50	03/29/07 13:08
NSP-2A-10M-TOC-8-032907	0701706-20	Slurry	03/29/07 07:50	03/29/07 13:08
NSP-2A-10M-PAH-3-032907	0701706-21	Soil	03/29/07 08:45	03/29/07 13:08
NSP-2A-10M-VOC-3-032907	0701706-22	Soil	03/29/07 08:45	03/29/07 13:08
Trip Blanks (DI)	0701706-23	Water	03/28/07 00:00	03/29/07 13:08
Trip Blank (MeOH)	0701706-24	Soil	03/28/07 00:00	03/29/07 13:08

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	8.9 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1M-PAH-4-032807

0701706-01 (Water)

3/28/07 11:00

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**870**	50	36	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
1-Methylphenanthrene	ND	50	18	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**57**	50	32	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
2,6-Dimethylnaphthalene	**370**	50	35	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	gp
2-Methylnaphthalene	**1200**	500	28	ng/L	B7D0063	4/4/07	4/17/07	EPA 8270C	
Acenaphthene	**220**	10	1.9	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Acenaphthylene	ND	10	2.1	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	gp
Anthracene	ND	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Benz(a)anthracene	ND	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Benzo(a)pyrene	ND	100	2.1	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	go
Benzo(b)fluoranthene	ND	100	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Benzo(e)pyrene	ND	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	gp
Benzo(k)fluoranthene	ND	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Biphenyl	**150**	50	36	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Chrysene	ND	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	100	3.5	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	go
Fluoranthene	**27**	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Fluorene	**120**	10	2.1	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	10	2.5	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Naphthalene	**220**	50	1.9	ng/L	B7D0063	4/4/07	4/17/07	EPA 8270C	gp
Perylene	ND	20	11	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Phenanthrene	**190**	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Pyrene	**16**	10	5.0	ng/L	B7D0063	4/4/07	4/13/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*83.5 %*	*Limits: 30-120%*			*B7D0063*	*4/4/07*	*4/13/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*101 %*	*Limits: 30-120%*			*B7D0063*	*4/4/07*	*4/13/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*82.0 %*	*Limits: 30-120%*			*B7D0063*	*4/4/07*	*4/13/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1M-VOC-4-032807

0701706-02 (Slurry)

3/28/07 11:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*106 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*84.0 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.4 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-2-032807 Front

0701706-03 (Air Tube)

3/28/07 11:32

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
2-Methylnaphthalene	**21.6**	5.26		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1a
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A2a
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A3
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A4a
Chrysene	ND	5.96		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	12.8		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A5
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1
Naphthalene	**19.3**	5.52		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-VOC-2-032807 Front

0701706-05 (Air Tube)

3/28/07 11:32

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**58.3**	10.1		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**42.8**	9.85		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	**14.0**	9.58		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**38.3**	9.87		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**670**	20.3		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**24.7**	19.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**28.2**	13.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**79.8**	10.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**106**	19.9		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-5-032807 Front

0701706-07 (Air Tube)

3/28/07 15:36

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
2-Methylnaphthalene	**12.4**	2.63		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthene	ND	2.75		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthylene	ND	2.54		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Anthracene	ND	2.74		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1a
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A2a
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A3
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A4a
Chrysene	ND	2.98		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	6.40		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A5
Fluoranthene	ND	2.84		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Fluorene	ND	2.70		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1
Naphthalene	**12.2**	2.76		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	ia
Phenanthrene	ND	2.76		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Pyrene	ND	2.89		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-5-032807 Back

0701706-08 (Air Tube)

3/28/07 15:36

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthene	ND	2.75		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthylene	ND	2.54		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A1b, gp
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	3.84		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A2, gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5b, gp
Chrysene	ND	2.98		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A3a, gp
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A4, gp
Fluoranthene	ND	2.84		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Fluorene	ND	2.70		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5a, gp
Naphthalene	**4.08**	2.76		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Phenanthrene	ND	2.76		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Pyrene	ND	2.89		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-VOC-5-032807 Front

0701706-09 (Air Tube)

3/28/07 15:36

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**6.48**	5.03		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**22.6**	4.93		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	**7.23**	4.79		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	5.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**26.6**	4.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**116**	10.2		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**13.3**	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**12.2**	6.51		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**67.7**	5.02		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**16.9**	4.97		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**63.6**	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-6-032907 Front

0701706-11 (Air Tube)

3/29/07 7:40

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**2.81**	0.662		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
2-Methylnaphthalene	**8.23**	0.658		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	ia
Acenaphthene	ND	0.688		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthylene	ND	0.634		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Anthracene	ND	0.686		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1a
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A2a
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A3
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A4a
Chrysene	ND	0.746		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	1.60		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A5
Fluoranthene	ND	0.710		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Fluorene	ND	0.675		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1
Naphthalene	**4.37**	0.689		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	ia
Phenanthrene	ND	0.689		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Pyrene	ND	0.721		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-6-032907 Back

0701706-12 (Air Tube)

3/29/07 7:40

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1.25**	0.662		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
2-Methylnaphthalene	**1.95**	0.658		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthene	ND	0.688		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthylene	ND	0.634		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A1b, gp
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	0.959		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A2, gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5b, gp
Chrysene	ND	0.746		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A3a, gp
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A4, gp
Fluoranthene	ND	0.710		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Fluorene	ND	0.675		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	1.69		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5a, gp
Naphthalene	**2.11**	0.689		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Phenanthrene	ND	0.689		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Pyrene	ND	0.721		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-VOC-6-032907 Front

0701706-13 (Air Tube)

3/29/07 7:40

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**9.03**	1.26		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**20.8**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	**6.44**	1.20		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	**1.54**	1.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**19.5**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ia
Carbon Tetrachloride	**53.6**	2.54		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**11.2**	2.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**8.29**	1.63		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**60.4**	1.25		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**7.61**	1.24		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**58.0**	2.49		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-VOC-6-032907 Back

0701706-14 (Air Tube)

3/29/07 7:40

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.26		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	ib
1,2,4-Trimethylbenzene	ND	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Benzene	**1.41**	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Carbon Tetrachloride	ND	12.7		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Ethyl Benzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Styrene	ND	1.63		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	A1c
Toluene	ND	1.25		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Xylenes, Total	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-8-032907 Total

0701706-15 (Slurry)

3/29/07 7:50

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**210**	34	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	ND	34	2.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	34	3.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	9.2 J	34	3.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**200**	34	2.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**87**	14	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	3.2 J	14	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	ND	14	1.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	ND	14	4.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	ND	14	5.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	ND	14	2.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	ND	34	5.5	ug/L	B7C0494	3/30/07	4/11/07	EPA 8270C	A5c
Benzo(g,h,i)perylene	ND	14	4.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	ND	14	5.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	6.6 J	34	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	ND	14	4.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	14	5.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	ND	14	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	3.8 J	14	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	14	5.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	**570**	340	22	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Perylene	ND	34	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	ND	14	1.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Pyrene	ND	14	3.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*67.4 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*57.2 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*87.8 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-8-032907 Dissolved

0701706-16 (Slurry)

3/29/07 7:50

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1300**	340	18	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**170**	34	2.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**130**	34	3.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**680**	34	3.5	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**2000**	340	27	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**1100**	140	18	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Acenaphthylene	**76**	14	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	**570**	14	1.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	**210**	14	4.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	**170**	14	5.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	**96**	14	2.9	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	**86**	34	5.5	ug/L	B7C0494	3/30/07	4/11/07	EPA 8270C	A5c
Benzo(g,h,i)perylene	**55**	14	4.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	**120**	14	5.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	**140**	34	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	**210**	14	4.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	**42**	14	5.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	**520**	14	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	**520**	14	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**59**	14	5.4	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	**1600**	340	22	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Perylene	20 J	34	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	**1500**	140	14	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Pyrene	**550**	140	35	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*40.1 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*sk*
Surrogate: Nitrobenzene-d5	*32.4 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*sk*
Surrogate: Terphenyl-d14	*40.9 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	*sk*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-VOC-8-032907

0701706-17 (Slurry)

3/29/07 7:50

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**81**	40	2.8	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,2,4-Trimethylbenzene	**200**	40	1.2	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,3,5-Trimethylbenzene	**42**	40	1.6	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,4-Dichlorobenzene	ND	40	2.0	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Benzene	**250**	40	1.7	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Carbon Tetrachloride	ND	40	2.0	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Ethylbenzene	**270**	40	1.4	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
m,p-Xylenes	**410**	40	2.4	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
o-Xylene	**260**	40	2.9	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
sec-Butylbenzene	ND	40	1.1	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Styrene	ND	40	2.0	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Toluene	**410**	40	1.9	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Trichloroethene	ND	40	2.7	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*104 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*90.4 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*100 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*99.2 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-TSS-8-032907

0701706-18 (Slurry)

3/29/07 7:50

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**680**	10	3.6	mg/L	B7D0107	4/5/07	4/5/07	EPA 160.2	
Total Solids	**1600**	20	1.0	mg/L	B7D0111	4/4/07	4/4/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-DOC-8-032907

0701706-19 (Slurry)

3/29/07 7:50

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**10**	1.5	0.50	mg/L	B7D0196	4/9/07	4/9/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-TOC-8-032907

0701706-20 (Slurry)

3/29/07 7:50

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**31**	15	5.0	mg/L	B7D0196	4/9/07	4/9/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-PAH-3-032907

0701706-21 (Soil)

3/29/07 8:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**27**	0.050	0.010	% Wt	B7D0103	4/5/07	4/5/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1000**	47	7.8	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**100**	4.7	0.56	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**170**	4.7	0.56	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**530**	47	7.1	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**1500**	47	16	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**780**	47	7.1	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthylene	**54**	4.7	0.49	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Anthracene	**370**	47	7.1	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benz(a)anthracene	**130**	4.7	0.71	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(a)pyrene	**86**	4.7	0.56	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(b)fluoranthene	**66**	4.7	1.2	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(e)pyrene	**110**	4.7	0.71	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	A5c
Benzo(g,h,i)perylene	**22**	4.7	0.42	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(k)fluoranthene	**62**	4.7	0.99	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Biphenyl	**160**	4.7	0.85	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Chrysene	**120**	4.7	0.71	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Dibenz(a,h)anthracene	**9.6**	4.7	1.5	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Fluoranthene	**310**	47	4.9	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Fluorene	**510**	47	2.8	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**23**	4.7	0.63	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Naphthalene	**1600**	47	3.5	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Perylene	**13**	4.7	0.78	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Phenanthrene	**1200**	47	5.6	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Pyrene	**420**	47	7.1	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*68.4 %*	*Limits: 30-104%*			*B7C0507*	*3/30/07*	*4/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*60.4 %*	*Limits: 30-90%*			*B7C0507*	*3/30/07*	*4/12/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*61.9 %*	*Limits: 30-115%*			*B7C0507*	*3/30/07*	*4/12/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-10M-VOC-3-032907

0701706-22 (Soil)

3/29/07 8:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**23**	0.050	0.010	% Wt	B7D0061	4/3/07	4/4/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**12**	2.2	0.069	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	**39**	2.2	0.15	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	**9.8**	2.2	0.21	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	2.2	0.26	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Benzene	**6.4**	2.2	0.095	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	2.2	0.12	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Ethylbenzene	**49**	2.2	0.23	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
m,p-Xylenes	**39**	2.2	0.27	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
o-Xylene	**22**	2.2	0.30	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	2.2	0.091	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Styrene	ND	2.2	0.099	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Toluene	**18**	2.2	0.37	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Trichloroethene	ND	2.2	0.16	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*90.8 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.8 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Trip Blanks (DI)

0701706-23 (Water)

3/28/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*82.8 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*97.2 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Trip Blank (MeOH)

0701706-24 (Soil)

3/28/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Toluene	**0.11**	0.050	0.0086	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*86.8 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*99.2 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*100 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7D0061 - % Solids

Method Blank (B7D0061-BLK1)

Prepared: 04/03/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7D0061-SRM1)

Prepared: 04/03/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	87.6			% Wt	88.8	NA	98.6	90-110	NA	NA	

Batch B7D0103 - % Solids

Method Blank (B7D0103-BLK1)

Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7D0103-SRM1)

Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	89.6			% Wt	88.8	NA	101	90-110	NA	NA	

Batch B7D0107 - Default Prep GenChem

Method Blank (B7D0107-BLK1)

Prepared: 04/05/07 Analyzed: 04/06/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7D0107-BS1)

Prepared: 04/05/07 Analyzed: 04/06/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	283			mg/L	250	NA	113	80-120	NA	NA	

Batch B7D0111 - Default Prep GenChem

Method Blank (B7D0111-BLK1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5c
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample (B7C0494-BS1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

Laboratory Control Sample Duplicate (B7C0494-BSD1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0728	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	0.0133 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.142	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	0.0509 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5c
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.188	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	0.0402 J	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	0.0309 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.629*			mg/kg	*0.831*	*NA*	*75.7*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.468*			mg/kg	*0.831*	*NA*	*56.3*	*30-90*			
Surrogate: Terphenyl-d14	*0.715*			mg/kg	*0.831*	*NA*	*86.0*	*30-115*			

Laboratory Control Sample (B7C0507-BS1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.22	0.067	0.010	mg/kg	1.66	NA	73.5	50-115	NA	NA	
Pyrene	1.20	0.067	0.010	mg/kg	1.66	NA	72.3	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.652*			mg/kg	*0.832*	*NA*	*78.4*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.488*			mg/kg	*0.832*	*NA*	*58.7*	*30-90*			
Surrogate: Terphenyl-d14	*0.730*			mg/kg	*0.832*	*NA*	*87.7*	*30-115*			

Laboratory Control Sample Duplicate (B7C0507-BSD1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-115	0.816	25	
Pyrene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-130	2.47	25	
Surrogate: 2-Fluorobiphenyl	*0.657*			mg/kg	*0.831*	*NA*	*79.1*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.503*			mg/kg	*0.831*	*NA*	*60.5*	*30-90*			
Surrogate: Terphenyl-d14	*0.725*			mg/kg	*0.831*	*NA*	*87.2*	*30-115*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Method Blank (B7D0063-BLK1)

Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	13.4	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	16.1	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	5.59	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	100	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	100	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	23.9	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	100	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	12.0	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	16.8	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	12.3	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*180*			ng/L	*250*	*NA*	*72.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*194*			ng/L	*250*	*NA*	*77.6*	*30-120*			
Surrogate: Terphenyl-d14	*234*			ng/L	*250*	*NA*	*93.6*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Laboratory Control Sample (B7D0063-BS1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	439	50	36	ng/L	500	NA	87.8	70-130	NA	NA	
1-Methylphenanthrene	449	50	18	ng/L	500	NA	89.8	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	448	50	32	ng/L	500	NA	89.6	70-130	NA	NA	
2,6-Dimethylnaphthalene	450	50	35	ng/L	500	NA	90.0	70-130	NA	NA	
2-Methylnaphthalene	428	50	2.8	ng/L	500	NA	85.6	70-130	NA	NA	
Acenaphthene	457	10	1.9	ng/L	500	NA	91.4	43-120	NA	NA	
Acenaphthylene	500	10	2.1	ng/L	500	NA	100	70-130	NA	NA	
Anthracene	495	10	5.0	ng/L	500	NA	99.0	70-130	NA	NA	
Benz(a)anthracene	464	10	5.0	ng/L	500	NA	92.8	70-130	NA	NA	
Benzo(a)pyrene	394	10	2.1	ng/L	500	NA	78.8	75-148	NA	NA	
Benzo(b)fluoranthene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Benzo(e)pyrene	434	10	5.0	ng/L	500	NA	86.8	70-130	NA	NA	
Benzo(g,h,i)perylene	514	10	5.6	ng/L	500	NA	103	70-130	NA	NA	
Benzo(k)fluoranthene	412	10	5.0	ng/L	500	NA	82.4	70-130	NA	NA	
Biphenyl	466	50	36	ng/L	500	NA	93.2	70-130	NA	NA	
Chrysene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Dibenz(a,h)anthracene	405	10	3.5	ng/L	500	NA	81.0	70-130	NA	NA	
Fluoranthene	465	10	5.0	ng/L	500	NA	93.0	67-130	NA	NA	
Fluorene	473	10	2.1	ng/L	500	NA	94.6	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	493	10	2.5	ng/L	500	NA	98.6	70-130	NA	NA	
Naphthalene	441	50	1.9	ng/L	500	NA	88.2	70-130	NA	NA	
Perylene	411	20	11	ng/L	500	NA	82.2	70-130	NA	NA	
Phenanthrene	441	10	5.0	ng/L	500	NA	88.2	70-130	NA	NA	
Pyrene	458	10	5.0	ng/L	500	NA	91.6	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*197*			ng/L	*250*	*NA*	*78.8*	*30-120*			
Surrogate: Nitrobenzene-d5	*209*			ng/L	*250*	*NA*	*83.6*	*30-120*			
Surrogate: Terphenyl-d14	*221*			ng/L	*250*	*NA*	*88.4*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Laboratory Control Sample Duplicate (B7D0063-BSD1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	368	50	36	ng/L	500	NA	73.6	70-130	17.6	20	
1-Methylphenanthrene	410	50	18	ng/L	500	NA	82.0	70-130	9.08	20	
2,3,5-Trimethylnaphthalene	387	50	32	ng/L	500	NA	77.4	70-130	14.6	20	
2,6-Dimethylnaphthalene	366	50	35	ng/L	500	NA	73.2	70-130	20.6	20	
2-Methylnaphthalene	357	50	2.8	ng/L	500	NA	71.4	70-130	18.1	20	
Acenaphthene	404	10	1.9	ng/L	500	NA	80.8	43-120	12.3	20	
Acenaphthylene	400	10	2.1	ng/L	500	NA	80.0	70-130	22.2	20	
Anthracene	436	10	5.0	ng/L	500	NA	87.2	70-130	12.7	20	
Benz(a)anthracene	433	10	5.0	ng/L	500	NA	86.6	70-130	6.91	20	
Benzo(a)pyrene	366	10	2.1	ng/L	500	NA	73.2	75-148	7.37	20	
Benzo(b)fluoranthene	396	10	5.0	ng/L	500	NA	79.2	70-130	10.1	20	
Benzo(e)pyrene	416	10	5.0	ng/L	500	NA	83.2	70-130	4.24	20	
Benzo(g,h,i)perylene	399	10	5.6	ng/L	500	NA	79.8	70-130	25.2	20	
Benzo(k)fluoranthene	408	10	5.0	ng/L	500	NA	81.6	70-130	0.976	20	
Biphenyl	394	50	36	ng/L	500	NA	78.8	70-130	16.7	20	
Chrysene	425	10	5.0	ng/L	500	NA	85.0	70-130	3.01	20	
Dibenz(a,h)anthracene	335	10	3.5	ng/L	500	NA	67.0	70-130	18.9	20	
Fluoranthene	430	10	5.0	ng/L	500	NA	86.0	67-130	7.82	20	
Fluorene	423	10	2.1	ng/L	500	NA	84.6	70-130	11.2	20	
Indeno(1,2,3-cd)pyrene	404	10	2.5	ng/L	500	NA	80.8	70-130	19.8	20	
Naphthalene	355	50	1.9	ng/L	500	NA	71.0	70-130	21.6	20	
Perylene	400	20	11	ng/L	500	NA	80.0	70-130	2.71	20	
Phenanthrene	399	10	5.0	ng/L	500	NA	79.8	70-130	10.0	20	
Pyrene	423	10	5.0	ng/L	500	NA	84.6	70-130	7.95	20	
Surrogate: 2-Fluorobiphenyl	*155*			ng/L	*250*	*NA*	*62.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*183*			ng/L	*250*	*NA*	*73.2*	*30-120*			
Surrogate: Terphenyl-d14	*204*			ng/L	*250*	*NA*	*81.6*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Matrix Spike (B7D0063-MS1) **Source: 0701706-01** Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1630	94	67	ng/L	943	870	80.6	70-130	NA	NA	
1-Methylphenanthrene	888	94	34	ng/L	943	ND	94.2	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	931	94	61	ng/L	943	57	92.7	70-130	NA	NA	
2,6-Dimethylnaphthalene	1190	94	66	ng/L	943	370	87.0	70-130	NA	NA	
2-Methylnaphthalene	1880	94	5.3	ng/L	943	1200	72.1	70-130	NA	NA	
Acenaphthene	1030	19	3.6	ng/L	943	220	85.9	43-120	NA	NA	
Acenaphthylene	845	19	4.0	ng/L	943	ND	89.6	70-130	NA	NA	
Anthracene	919	19	9.4	ng/L	943	ND	97.5	70-130	NA	NA	
Benz(a)anthracene	933	19	9.4	ng/L	943	ND	98.9	70-130	NA	NA	
Benzo(a)pyrene	769	19	4.0	ng/L	943	ND	81.5	75-148	NA	NA	
Benzo(b)fluoranthene	885	19	9.4	ng/L	943	ND	93.8	70-130	NA	NA	
Benzo(e)pyrene	821	19	9.4	ng/L	943	ND	87.1	70-130	NA	NA	
Benzo(g,h,i)perylene	787	19	11	ng/L	943	ND	83.5	70-130	NA	NA	
Benzo(k)fluoranthene	765	19	9.4	ng/L	943	ND	81.1	70-130	NA	NA	
Biphenyl	1020	94	68	ng/L	943	150	92.3	70-130	NA	NA	
Chrysene	848	19	9.4	ng/L	943	ND	89.9	70-130	NA	NA	
Dibenz(a,h)anthracene	794	19	6.6	ng/L	943	ND	84.2	70-130	NA	NA	
Fluoranthene	916	19	9.4	ng/L	943	27	94.3	67-130	NA	NA	
Fluorene	1050	19	4.0	ng/L	943	120	98.6	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	896	19	4.7	ng/L	943	ND	95.0	70-130	NA	NA	
Naphthalene	2710	94	3.6	ng/L	943	220	264	70-130	NA	NA	
Perylene	787	38	22	ng/L	943	ND	83.5	70-130	NA	NA	
Phenanthrene	966	19	9.4	ng/L	943	190	82.3	70-130	NA	NA	
Pyrene	880	19	9.4	ng/L	943	16	91.6	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*438*			ng/L	*472*	*NA*	*92.8*	*30-120*			
Surrogate: Nitrobenzene-d5	*468*			ng/L	*472*	*NA*	*99.2*	*30-120*			
Surrogate: Terphenyl-d14	*499*			ng/L	*472*	*NA*	*106*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Matrix Spike Duplicate (B7D0063-MSD1) **Source: 0701706-01** Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1700	110	76	ng/L	1060	870	78.3	70-130	4.20	20	
1-Methylphenanthrene	939	110	38	ng/L	1060	ND	88.6	70-130	5.58	20	
2,3,5-Trimethylnaphthalene	997	110	69	ng/L	1060	57	88.7	70-130	6.85	20	
2,6-Dimethylnaphthalene	1230	110	74	ng/L	1060	370	81.1	70-130	3.31	20	
2-Methylnaphthalene	1950	110	6.0	ng/L	1060	1200	70.8	70-130	3.66	20	
Acenaphthene	1110	21	4.0	ng/L	1060	220	84.0	43-120	7.48	20	
Acenaphthylene	911	21	4.5	ng/L	1060	ND	85.9	70-130	7.52	20	
Anthracene	970	21	11	ng/L	1060	ND	91.5	70-130	5.40	20	
Benz(a)anthracene	1060	21	11	ng/L	1060	ND	100	70-130	12.7	20	
Benzo(a)pyrene	892	21	4.5	ng/L	1060	ND	84.2	75-148	14.8	20	
Benzo(b)fluoranthene	1000	21	11	ng/L	1060	ND	94.3	70-130	12.2	20	
Benzo(e)pyrene	953	21	11	ng/L	1060	ND	89.9	70-130	14.9	20	
Benzo(g,h,i)perylene	948	21	12	ng/L	1060	ND	89.4	70-130	18.6	20	
Benzo(k)fluoranthene	901	21	11	ng/L	1060	ND	85.0	70-130	16.3	20	
Biphenyl	1080	110	77	ng/L	1060	150	87.7	70-130	5.71	20	
Chrysene	946	21	11	ng/L	1060	ND	89.2	70-130	10.9	20	
Dibenz(a,h)anthracene	924	21	7.4	ng/L	1060	ND	87.2	70-130	15.1	20	
Fluoranthene	968	21	11	ng/L	1060	27	88.8	67-130	5.52	20	
Fluorene	1080	21	4.5	ng/L	1060	120	90.6	70-130	2.82	20	
Indeno(1,2,3-cd)pyrene	1060	21	5.3	ng/L	1060	ND	100	70-130	16.8	20	
Naphthalene	2800	110	4.0	ng/L	1060	220	243	70-130	3.27	20	
Perylene	911	43	24	ng/L	1060	ND	85.9	70-130	14.6	20	
Phenanthrene	1040	21	11	ng/L	1060	190	80.2	70-130	7.38	20	
Pyrene	930	21	11	ng/L	1060	16	86.2	70-130	5.52	20	
Surrogate: 2-Fluorobiphenyl	*465*			ng/L	*532*	*NA*	*87.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*508*			ng/L	*532*	*NA*	*95.5*	*30-120*			
Surrogate: Terphenyl-d14	*512*			ng/L	*532*	*NA*	*96.2*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0142 - EPA 5035

Method Blank (B7D0142-BLK1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*21.9*			ug/L	*25.0*	*NA*	*87.6*	*80-120*			
Surrogate: Dibromofluoromethane	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Laboratory Control Sample (B7D0142-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.41	0.050	0.0035	mg/kg	1.25	NA	113	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.40	0.050	0.0049	mg/kg	1.25	NA	112	75-125	NA	NA	
1,4-Dichlorobenzene	1.33	0.050	0.0060	mg/kg	1.25	NA	106	75-125	NA	NA	
Benzene	1.39	0.050	0.0022	mg/kg	1.25	NA	111	75-125	NA	NA	
Carbon Tetrachloride	1.33	0.050	0.0028	mg/kg	1.25	NA	106	75-125	NA	NA	
Ethylbenzene	1.35	0.050	0.0053	mg/kg	1.25	NA	108	75-125	NA	NA	
m,p-Xylenes	2.67	0.050	0.0063	mg/kg	2.50	NA	107	75-125	NA	NA	
o-Xylene	1.31	0.050	0.0070	mg/kg	1.25	NA	105	75-125	NA	NA	
sec-Butylbenzene	1.42	0.050	0.0021	mg/kg	1.25	NA	114	75-125	NA	NA	
Styrene	1.37	0.050	0.0023	mg/kg	1.25	NA	110	75-125	NA	NA	
Toluene	1.32	0.050	0.0086	mg/kg	1.25	NA	106	75-125	NA	NA	
Trichloroethene	1.27	0.050	0.0037	mg/kg	1.25	NA	102	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.7*			ug/L	*25.0*	*NA*	*94.8*	*80-120*			
Surrogate: Dibromofluoromethane	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0142 - EPA 5035

Laboratory Control Sample Duplicate (B7D0142-BSD1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.43	0.050	0.0035	mg/kg	1.25	NA	114	75-125	1.41	20	
1,3,5-Trimethylbenzene	1.43	0.050	0.0049	mg/kg	1.25	NA	114	75-125	2.12	20	
1,4-Dichlorobenzene	1.35	0.050	0.0060	mg/kg	1.25	NA	108	75-125	1.49	20	
Benzene	1.41	0.050	0.0022	mg/kg	1.25	NA	113	75-125	1.43	20	
Carbon Tetrachloride	1.31	0.050	0.0028	mg/kg	1.25	NA	105	75-125	1.52	20	
Ethylbenzene	1.37	0.050	0.0053	mg/kg	1.25	NA	110	75-125	1.47	20	
m,p-Xylenes	2.66	0.050	0.0063	mg/kg	2.50	NA	106	75-125	0.375	20	
o-Xylene	1.32	0.050	0.0070	mg/kg	1.25	NA	106	75-125	0.760	20	
sec-Butylbenzene	1.43	0.050	0.0021	mg/kg	1.25	NA	114	75-125	0.702	20	
Styrene	1.38	0.050	0.0023	mg/kg	1.25	NA	110	75-125	0.727	20	
Toluene	1.35	0.050	0.0086	mg/kg	1.25	NA	108	75-125	2.25	20	
Trichloroethene	1.27	0.050	0.0037	mg/kg	1.25	NA	102	75-125	0.00	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.4*			ug/L	*25.0*	*NA*	*93.6*	*80-120*			
Surrogate: Dibromofluoromethane	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

Batch B7D0143 - EPA 5030B

Method Blank (B7D0143-BLK1)

Prepared: 04/04/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*21.4*			ug/L	*25.0*	*NA*	*85.6*	*80-120*			
Surrogate: Dibromofluoromethane	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: Toluene-d8	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0143 - EPA 5030B

Laboratory Control Sample (B7D0143-BS1)

Prepared: 04/04/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	28.5	1.0	0.030	ug/L	25.0	NA	114	75-125	NA	NA	
1,3,5-Trimethylbenzene	28.6	1.0	0.039	ug/L	25.0	NA	114	75-125	NA	NA	
1,4-Dichlorobenzene	27.2	1.0	0.051	ug/L	25.0	NA	109	75-125	NA	NA	
Benzene	29.1	1.0	0.042	ug/L	25.0	NA	116	75-125	NA	NA	
Carbon Tetrachloride	25.7	1.0	0.050	ug/L	25.0	NA	103	75-125	NA	NA	
Ethylbenzene	27.6	1.0	0.036	ug/L	25.0	NA	110	75-125	NA	NA	
m,p-Xylenes	52.9	1.0	0.059	ug/L	50.0	NA	106	75-125	NA	NA	
o-Xylene	26.5	1.0	0.072	ug/L	25.0	NA	106	75-125	NA	NA	
sec-Butylbenzene	28.6	1.0	0.027	ug/L	25.0	NA	114	75-125	NA	NA	
Styrene	27.7	1.0	0.049	ug/L	25.0	NA	111	75-125	NA	NA	
Toluene	27.2	1.0	0.048	ug/L	25.0	NA	109	75-125	NA	NA	
Trichloroethene	25.9	1.0	0.067	ug/L	25.0	NA	104	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.1*			ug/L	*25.0*	*NA*	*92.4*	*80-120*			
Surrogate: Dibromofluoromethane	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			

Laboratory Control Sample Duplicate (B7D0143-BSD1)

Prepared: 04/04/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	29.5	1.0	0.030	ug/L	25.0	NA	118	75-125	3.45	20	
1,3,5-Trimethylbenzene	29.3	1.0	0.039	ug/L	25.0	NA	117	75-125	2.42	20	
1,4-Dichlorobenzene	27.5	1.0	0.051	ug/L	25.0	NA	110	75-125	1.10	20	
Benzene	29.6	1.0	0.042	ug/L	25.0	NA	118	75-125	1.70	20	
Carbon Tetrachloride	26.5	1.0	0.050	ug/L	25.0	NA	106	75-125	3.07	20	
Ethylbenzene	28.3	1.0	0.036	ug/L	25.0	NA	113	75-125	2.50	20	
m,p-Xylenes	54.4	1.0	0.059	ug/L	50.0	NA	109	75-125	2.80	20	
o-Xylene	27.0	1.0	0.072	ug/L	25.0	NA	108	75-125	1.87	20	
sec-Butylbenzene	29.5	1.0	0.027	ug/L	25.0	NA	118	75-125	3.10	20	
Styrene	28.3	1.0	0.049	ug/L	25.0	NA	113	75-125	2.14	20	
Toluene	27.9	1.0	0.048	ug/L	25.0	NA	112	75-125	2.54	20	
Trichloroethene	26.7	1.0	0.067	ug/L	25.0	NA	107	75-125	3.04	20	
Surrogate: 1,2-Dichloroethane-d4	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.0*			ug/L	*25.0*	*NA*	*92.0*	*80-120*			
Surrogate: Dibromofluoromethane	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0204 - AIRTUBES Prep

Laboratory Control Sample (B7D0204-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	28800	0.00		ug/m³	28200	NA	102	70-130	NA	NA	
2-Methylnaphthalene filter	28900	0.00		ug/m³	28200	NA	102	70-130	NA	NA	
Acenaphthene filter	26500	0.00		ug/m³	26000	NA	102	70-130	NA	NA	
Acenaphthylene filter	26200	0.00		ug/m³	25700	NA	102	70-130	NA	NA	
Anthracene filter	26200	0.00		ug/m³	25100	NA	104	70-130	NA	NA	
Benz(a)anthracene filter	26000	0.00		ug/m³	25600	NA	102	70-130	NA	NA	
Benzo(a)pyrene filter	25600	0.00		ug/m³	25300	NA	101	70-130	NA	NA	
Benzo(b)fluoranthene filter	25700	0.00		ug/m³	25300	NA	102	70-130	NA	NA	
Benzo(g,h,i)perylene filter	22800	0.00		ug/m³	25800	NA	88.4	70-130	NA	NA	
Benzo(k)fluoranthene filter	25800	0.00		ug/m³	25400	NA	102	70-130	NA	NA	
Chrysene filter	25800	0.00		ug/m³	25400	NA	102	70-130	NA	NA	
Dibenz(a,h)anthracene filter	25600	0.00		ug/m³	25100	NA	102	70-130	NA	NA	
Fluoranthene filter	25900	0.00		ug/m³	25500	NA	102	70-130	NA	NA	
Fluorene filter	26100	0.00		ug/m³	25600	NA	102	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	27100	0.00		ug/m³	26800	NA	101	70-130	NA	NA	
Naphthalene filter	29000	0.00		ug/m³	28100	NA	103	70-130	NA	NA	
Phenanthrene filter	26000	0.00		ug/m³	25500	NA	102	70-130	NA	NA	
Pyrene filter	26300	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
1-Methylnaphthalene	24700	1590		ug/m³	26600	NA	92.9	70-130	NA	NA	
2-Methylnaphthalene	24600	1590		ug/m³	26400	NA	93.2	70-130	NA	NA	
Acenaphthene	24600	1660		ug/m³	27600	NA	89.1	70-130	NA	NA	
Acenaphthylene	23000	1530		ug/m³	25500	NA	90.2	70-130	NA	NA	
Anthracene	24200	1650		ug/m³	27500	NA	88.0	70-130	NA	NA	
Benz(a)anthracene	22300	1790		ug/m³	29800	NA	74.8	70-130	NA	NA	
Benzo(a)pyrene	19600	1890		ug/m³	31500	NA	62.2	70-130	NA	NA	
Benzo(b)fluoranthene	21200	1870		ug/m³	31200	NA	67.9	70-130	NA	NA	
Benzo(g,h,i)perylene	16400	4620		ug/m³	38500	NA	42.6	70-130	NA	NA	
Benzo(k)fluoranthene	21700	1890		ug/m³	31600	NA	68.7	70-130	NA	NA	
Chrysene	22500	1800		ug/m³	29900	NA	75.3	70-130	NA	NA	
Dibenz(a,h)anthracene	19300	3860		ug/m³	32100	NA	60.1	70-130	NA	NA	
Fluoranthene	23400	1710		ug/m³	28500	NA	82.1	70-130	NA	NA	
Fluorene	24500	1630		ug/m³	27100	NA	90.4	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	18700	2030		ug/m³	33900	NA	55.2	70-130	NA	NA	
Naphthalene	26300	1660		ug/m³	27700	NA	94.9	70-130	NA	NA	
Phenanthrene	24000	1660		ug/m³	27700	NA	86.6	70-130	NA	NA	
Pyrene	22800	1740		ug/m³	29000	NA	78.6	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0204 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0204-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	28700	0.00		ug/m³	28200	NA	102	70-130	0.348	20	
2-Methylnaphthalene filter	28800	0.00		ug/m³	28200	NA	102	70-130	0.347	20	
Acenaphthene filter	26400	0.00		ug/m³	26000	NA	102	70-130	0.378	20	
Acenaphthylene filter	26200	0.00		ug/m³	25700	NA	102	70-130	0.00	20	
Anthracene filter	26100	0.00		ug/m³	25100	NA	104	70-130	0.382	20	
Benz(a)anthracene filter	25900	0.00		ug/m³	25600	NA	101	70-130	0.385	20	
Benzo(a)pyrene filter	25500	0.00		ug/m³	25300	NA	101	70-130	0.391	20	
Benzo(b)fluoranthene filter	25600	0.00		ug/m³	25300	NA	101	70-130	0.390	20	
Benzo(g,h,i)perylene filter	23200	0.00		ug/m³	25800	NA	89.9	70-130	1.74	20	
Benzo(k)fluoranthene filter	25800	0.00		ug/m³	25400	NA	102	70-130	0.00	20	
Chrysene filter	25700	0.00		ug/m³	25400	NA	101	70-130	0.388	20	
Dibenz(a,h)anthracene filter	25100	0.00		ug/m³	25100	NA	100	70-130	1.97	20	
Fluoranthene filter	25800	0.00		ug/m³	25500	NA	101	70-130	0.387	20	
Fluorene filter	26000	0.00		ug/m³	25600	NA	102	70-130	0.384	20	
Indeno(1,2,3-cd)pyrene filter	26600	0.00		ug/m³	26800	NA	99.3	70-130	1.86	20	
Naphthalene filter	29000	0.00		ug/m³	28100	NA	103	70-130	0.00	20	
Phenanthrene filter	25900	0.00		ug/m³	25500	NA	102	70-130	0.385	20	
Pyrene filter	26000	0.00		ug/m³	25600	NA	102	70-130	1.15	20	
1-Methylnaphthalene	24900	1590		ug/m³	26600	NA	93.6	70-130	0.806	20	
2-Methylnaphthalene	24700	1590		ug/m³	26400	NA	93.6	70-130	0.406	20	
Acenaphthene	24800	1660		ug/m³	27600	NA	89.9	70-130	0.810	20	
Acenaphthylene	23300	1530		ug/m³	25500	NA	91.4	70-130	1.30	20	
Anthracene	24500	1650		ug/m³	27500	NA	89.1	70-130	1.23	20	
Benz(a)anthracene	22700	1790		ug/m³	29800	NA	76.2	70-130	1.78	20	
Benzo(a)pyrene	20100	1890		ug/m³	31500	NA	63.8	70-130	2.52	20	
Benzo(b)fluoranthene	21800	1870		ug/m³	31200	NA	69.9	70-130	2.79	20	
Benzo(g,h,i)perylene	18300	4620		ug/m³	38500	NA	47.5	70-130	11.0	20	
Benzo(k)fluoranthene	22200	1890		ug/m³	31600	NA	70.3	70-130	2.28	20	
Chrysene	23000	1800		ug/m³	29900	NA	76.9	70-130	2.20	20	
Dibenz(a,h)anthracene	20400	3860		ug/m³	32100	NA	63.6	70-130	5.54	20	
Fluoranthene	23700	1710		ug/m³	28500	NA	83.2	70-130	1.27	20	
Fluorene	24700	1630		ug/m³	27100	NA	91.1	70-130	0.813	20	
Indeno(1,2,3-cd)pyrene	19300	2030		ug/m³	33900	NA	56.9	70-130	3.16	20	
Naphthalene	26400	1660		ug/m³	27700	NA	95.3	70-130	0.380	20	
Phenanthrene	24300	1660		ug/m³	27700	NA	87.7	70-130	1.24	20	
Pyrene	23500	1740		ug/m³	29000	NA	81.0	70-130	3.02	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample (B7D0206-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	5880	5880	ug/m³	110000	NA	90.0	75-125	NA	NA	
Xylenes, Total	289000	5990	2990	ug/m³	337000	NA	85.8	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	103000	2970	2970	ug/m³	99100	NA	104	75-125	NA	NA	
Styrene	122000	3920	3920	ug/m³	131000	NA	93.1	75-125	NA	NA	
Toluene	107000	3020	3020	ug/m³	101000	NA	106	75-125	NA	NA	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	82400	3030	3030	ug/m³	90200	NA	91.4	75-125	NA	NA	
1,2,4-Trimethylbenzene	85700	2970	2970	ug/m³	91600	NA	93.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	92500	2880	2880	ug/m³	94100	NA	98.3	75-125	NA	NA	
1,4-Dichlorobenzene	62800	3470	3470	ug/m³	65400	NA	96.0	75-125	NA	NA	
Carbon Tetrachloride	97000	6120	6120	ug/m³	102000	NA	95.1	75-125	NA	NA	
sec-Butylbenzene	100000	2940	2940	ug/m³	97000	NA	103	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0206-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	109000	5880	5880	ug/m³	110000	NA	99.1	75-125	9.62	20	
Xylenes, Total	329000	5990	2990	ug/m³	337000	NA	97.6	75-125	12.9	20	

Laboratory Control Sample Duplicate (B7D0206-BSD2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	98100	2970	2970	ug/m³	99100	NA	99.0	75-125	4.87	20	
Styrene	120000	3920	3920	ug/m³	131000	NA	91.6	75-125	1.65	20	
Toluene	100000	3020	3020	ug/m³	101000	NA	99.0	75-125	6.76	20	
Trichloroethene	98700	2990	2990	ug/m³	99800	NA	98.9	75-125	5.23	20	

Laboratory Control Sample Duplicate (B7D0206-BSD3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	93300	3030	3030	ug/m³	90200	NA	103	75-125	12.4	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0206-BSD3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	96000	2970	2970	ug/m³	91600	NA	105	75-125	11.3	20	
1,3,5-Trimethylbenzene	102000	2880	2880	ug/m³	94100	NA	108	75-125	9.77	20	
1,4-Dichlorobenzene	71400	3470	3470	ug/m³	65400	NA	109	75-125	12.8	20	
Carbon Tetrachloride	107000	6120	6120	ug/m³	102000	NA	105	75-125	9.80	20	
sec-Butylbenzene	110000	2940	2940	ug/m³	97000	NA	113	75-125	9.52	20	

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample (B7D0415-BS1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	88100	2940	2940	ug/m³	98000	NA	89.9	75-125	NA	NA	
Xylenes, Total	261000	2990	2990	ug/m³	299000	NA	87.3	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	NA	NA	
Styrene	97300	3920	3920	ug/m³	131000	NA	74.3	75-125	NA	NA	
Toluene	99700	3020	3020	ug/m³	101000	NA	98.7	75-125	NA	NA	
Trichloroethene	99400	2990	2990	ug/m³	99800	NA	99.6	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86300	3030	3030	ug/m³	90200	NA	95.7	75-125	NA	NA	
1,2,4-Trimethylbenzene	90100	2970	2970	ug/m³	91600	NA	98.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	95800	2880	2880	ug/m³	94100	NA	102	75-125	NA	NA	
1,4-Dichlorobenzene	64000	3470	3470	ug/m³	65400	NA	97.9	75-125	NA	NA	
Carbon Tetrachloride	103000	30600	3060	ug/m³	102000	NA	101	75-125	NA	NA	
sec-Butylbenzene	102000	2940	2940	ug/m³	97000	NA	105	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0415-BSD1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	85700	2940	2940	ug/m³	98000	NA	87.4	75-125	2.76	20	
Xylenes, Total	258000	2990	2990	ug/m³	299000	NA	86.3	75-125	1.16	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0415-BSD2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	0.00	20	
Styrene	108000	3920	3920	ug/m³	131000	NA	82.4	75-125	10.4	20	
Toluene	98400	3020	3020	ug/m³	101000	NA	97.4	75-125	1.31	20	
Trichloroethene	98100	2990	2990	ug/m³	99800	NA	98.3	75-125	1.32	20	

Laboratory Control Sample Duplicate (B7D0415-BSD3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86800	3030	3030	ug/m³	90200	NA	96.2	75-125	0.578	20	
1,2,4-Trimethylbenzene	89000	2970	2970	ug/m³	91600	NA	97.2	75-125	1.23	20	
1,3,5-Trimethylbenzene	93700	2880	2880	ug/m³	94100	NA	99.6	75-125	2.22	20	
1,4-Dichlorobenzene	64600	3470	3470	ug/m³	65400	NA	98.8	75-125	0.933	20	
Carbon Tetrachloride	100000	30600	3060	ug/m³	102000	NA	98.0	75-125	2.96	20	
sec-Butylbenzene	99300	2940	2940	ug/m³	97000	NA	102	75-125	2.68	20	

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample (B7D0431-BS1)

Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	25900	1590		ug/m³	26600	NA	97.4	70-130	NA	NA	
2-Methylnaphthalene	26100	1590		ug/m³	26400	NA	98.9	70-130	NA	NA	
Acenaphthene	25600	1660		ug/m³	27600	NA	92.8	70-130	NA	NA	
Acenaphthylene	24000	1530		ug/m³	25500	NA	94.1	70-130	NA	NA	
Anthracene	25100	3300		ug/m³	27500	NA	91.3	70-130	NA	NA	
Benz(a)anthracene	23600	1790		ug/m³	29800	NA	79.2	70-130	NA	NA	
Benzo(a)pyrene	20900	1890		ug/m³	31500	NA	66.3	70-130	NA	NA	
Benzo(b)fluoranthene	22700	1870		ug/m³	31200	NA	72.8	70-130	NA	NA	
Benzo(g,h,i)perylene	11400	2310		ug/m³	38500	NA	29.6	70-130	NA	NA	
Benzo(k)fluoranthene	22100	1890		ug/m³	31600	NA	69.9	70-130	NA	NA	
Chrysene	16400	1800		ug/m³	29900	NA	54.8	70-130	NA	NA	
Dibenz(a,h)anthracene	19400	19300		ug/m³	32100	NA	60.4	70-130	NA	NA	
Fluoranthene	24600	1710		ug/m³	28500	NA	86.3	70-130	NA	NA	
Fluorene	25400	1630		ug/m³	27100	NA	93.7	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	20600	4070		ug/m³	33900	NA	60.8	70-130	NA	NA	
Naphthalene	27200	1660		ug/m³	27700	NA	98.2	70-130	NA	NA	
Phenanthrene	25000	1660		ug/m³	27700	NA	90.3	70-130	NA	NA	
Pyrene	24000	1740		ug/m³	29000	NA	82.8	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0431-BSD1) Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	26800	1590		ug/m³	26600	NA	101	70-130	3.42	20	
2-Methylnaphthalene	26900	1590		ug/m³	26400	NA	102	70-130	3.02	20	
Acenaphthene	27000	1660		ug/m³	27600	NA	97.8	70-130	5.32	20	
Acenaphthylene	25000	1530		ug/m³	25500	NA	98.0	70-130	4.08	20	
Anthracene	27000	3300		ug/m³	27500	NA	98.2	70-130	7.29	20	
Benz(a)anthracene	27400	1790		ug/m³	29800	NA	91.9	70-130	14.9	20	
Benzo(a)pyrene	26400	1890		ug/m³	31500	NA	83.8	70-130	23.3	20	
Benzo(b)fluoranthene	27500	1870		ug/m³	31200	NA	88.1	70-130	19.1	20	
Benzo(g,h,i)perylene	18000	2310		ug/m³	38500	NA	46.8	70-130	44.9	20	
Benzo(k)fluoranthene	27600	1890		ug/m³	31600	NA	87.3	70-130	22.1	20	
Chrysene	22100	1800		ug/m³	29900	NA	73.9	70-130	29.6	20	
Dibenz(a,h)anthracene	25800	19300		ug/m³	32100	NA	80.4	70-130	28.3	20	
Fluoranthene	27100	1710		ug/m³	28500	NA	95.1	70-130	9.67	20	
Fluorene	26600	1630		ug/m³	27100	NA	98.2	70-130	4.62	20	
Indeno(1,2,3-cd)pyrene	27300	4070		ug/m³	33900	NA	80.5	70-130	28.0	20	
Naphthalene	27900	1660		ug/m³	27700	NA	101	70-130	2.54	20	
Phenanthrene	26800	1660		ug/m³	27700	NA	96.8	70-130	6.95	20	
Pyrene	27300	1740		ug/m³	29000	NA	94.1	70-130	12.9	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701706

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquiries:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS Corp
Mailing Address: 700 3rd St. S., Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: 612-370-0700 Fax #: 612-373-6800
E-mail: hubert-huls@urscorp.com

Project ID/Name: Ashland NSP
P.O. #/Project #: 25688375.75000

SEND INVOICE TO
Contact Name: Same
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Agitate Line Item 9 prior to analysis, Extract line 9, 10, & 15 on Friday.
Filter Line Item 10 prior to analysis

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH	VOC	TSS	Percent Solids	DOC	TOC				FOR LAB USE ONLY
1	NSP-2A-1M-PAH-4-032807	03/28/07	11:00	water		3	N	X									0701706-1
2	NSP-2A-1M-VOC-4-032807		11:00	water		3	N		X								-2
3	NSP-2A-10M-PAH-2-032807		11:32	Air	301.2 L	3	N	X									-3,4
4	NSP-2A-10M-VOC-2-032807		11:32		301.2 L	2	N		X								-5,6
5	NSP-2A-10M-PAH-5-032807		15:36		602.4 L	3	N	X									-7,8
6	NSP-2A-10M-VOC-5-032807	03/28/07	15:36		602.4 L	2	N		X								-9,10
7	NSP-2A-10M-PAH-6-032907	03/29/07	07:40		2409.6 L	3	N	X									-11,12
8	NSP-2A-10M-VOC-6-032907		07:40	Air	2409.6 L	2	N		X								-13,14
9	NSP-2A-10M-PAH-8-032907		07:50	Slurry		3	N	X									-15
10	NSP-2A-10M-PAH-8-032907					3	N	X									-16
11	NSP-2A-10M-VOC-8-032907					6	N		X								-17
12	NSP-2A-10M-TSS-8-032907					1	N			X	X						-18
13	NSP-2A-10M-DOC-8-032907					1						X					-19
14	NSP-2A-10M-TOC-8-032907		7:50	Slurry		1							X				-20
15	NSP-2A-10M-PAH-3-032907	03/29/07	08:45	Soil		2	N	X									-21

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/29/07 09:30
Received by: [signature] Date/Time 03/29/07 0930
Relinquished by: [signature] Date/Time 03/29/07 1305
Received Contents Not Verified: [signature] Date/Time 3/29/07 1308
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 8.9 °C
Comments:

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701706
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701706

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ___ Yes ___ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS Corp
Mailing Address 700 3rd St. S. Suite 600
City, State, Zip Minneapolis, MN 55415
Telephone # 612-370-0700 Fax # 612-373-6800
E-mail hubert_huls@urscorp.com

Project ID/Name Ashland NSP
P.O. #/Project # 25688375.75000

SEND INVOICE TO
Contact Name
Company
Address
City, State, Zip SAME
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	VOC	FOR LAB USE ONLY
1	NSP-2A-10M-VOC-3-032907	03/29/07	08:45	Soil		2	N	X	0701706-22
2	Trip Blanks (DI)					2			-23
3	Trip Blank (MeOH)					1			-24
4	Temp Blank					1			
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

CHAIN OF CUSTODY
Collected by: (Print) William C. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/29/07 09:30
Received by: [signature] Date/Time 03/29/07 0930
Relinquished by: [signature] Date/Time 03/29/07 1305
Received Contents Not Verified: [signature] Date/Time 3/29/07 1305
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 8.9 °C
Comments:

Form # CS02.02 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 11/17/06

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

May 02, 2007

Work Order #: 0701731

RE: Ashland/NSP
25688375.75000

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 30, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Qualifiers and Abbreviations

A5a	The Laboratory Control Sample has a recovery of 60.8%, which is below the laboratory limits of 70-130%.
A1a	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 62.2% & 63.8%, which are below the laboratory limits of 70-130%.
A1b	The Laboratory Control Sample has a recovery of 66.3%, which is below laboratory limits of 70-130%.
A2	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 29.6% and 46.8%, which are below the laboratory limits fo 70-130%.
A2a	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 67.9% & 69.9%, which are below the laboratory limits of 70-130%.
A3	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 42.6% & 47.5%, which are below the laboratory limits of 70-130%.
A3a	The Laboratory Control Sample has a recovery of 54.8%, which is below the laboratory limits of 70-130%.
A4	The Laboratory Control Sample has a recovery of 60.4%, which is below the laboratory limits of 70-130%.
A1	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 55.2% & 56.9%, which are below the laboratory limits of 70-130%.
A5	The Laboratory Control Sample and Laboratory Control Sample Duplicate have recoveries of 60.1% & 63.6%, which are below the laboratory limits of 70-130%.
vn	The surrogate recovery is below the laboratory generated control limits.
A5b	The Laboratory Control Sample has a recovery of 69.9%, which is below the laboratory limits of 70-130%.
A5c	The MDL value for this analyte is an estimated value; no statistical value has been determined.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
ia	The back section of the sample tube contained greater than 10 percent of the amount collected on the front section. This indicates possible analyte breakthrough (loss) during field sampling.
ib	Unidentified compounds are present in the sample.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
ts	This analysis was performed by a subcontract laboratory.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
A4a	The Laboratory Control Sample has a recovery of 68.7%, which is below the laboratory limits of 70-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-2A-1Q-TSS-7-032907	0701731-01	Slurry	03/29/07 09:55	03/30/07 11:45
NSP-2A-1Q-TOC-7-032907	0701731-02	Slurry	03/29/07 09:55	03/30/07 11:45
NSP-2A-1Q-PAH-2-032907 Front	0701731-03	Air Tube	03/29/07 12:41	03/30/07 11:45
NSP-2A-1Q-VOC-2-032907 Front	0701731-05	Air Tube	03/29/07 12:41	03/30/07 11:45
NSP-2A-1Q-PAH-5-032907 Front	0701731-07	Air Tube	03/29/07 16:46	03/30/07 11:45
NSP-2A-1Q-VOC-5-032907 Front	0701731-09	Air Tube	03/29/07 16:46	03/30/07 11:45
NSP-2A-1Q-PAH-6-033007 Front	0701731-11	Air Tube	03/30/07 08:50	03/30/07 11:45
NSP-2A-1Q-PAH-6-033007 Back	0701731-12	Air Tube	03/30/07 08:50	03/30/07 11:45
NSP-2A-1Q-VOC-6-033007 Front	0701731-13	Air Tube	03/30/07 08:50	03/30/07 11:45
NSP-2A-1Q-PAH-8-033007 Total	0701731-15	Slurry	03/30/07 09:10	03/30/07 11:45
NSP-2A-1Q-PAH-8-033007 Dissolved	0701731-16	Slurry	03/30/07 09:10	03/30/07 11:45
NSP-2A-1Q-TSS-8-033007	0701731-17	Slurry	03/30/07 09:10	03/30/07 11:45
NSP-2A-1Q-DOC-8-033007	0701731-18	Slurry	03/30/07 09:10	03/30/07 11:45
NSP-2A-1Q-TOC-8-033007	0701731-19	Slurry	03/30/07 09:10	03/30/07 11:45
NSP-2A-1Q-VOC-8-033007	0701731-20	Slurry	03/30/07 09:10	03/30/07 11:45
NSP-2A-1Q-VOC-3-033007	0701731-21	Soil	03/30/07 09:25	03/30/07 11:45
NSP-2A-1Q-PAH-3-033007	0701731-22	Soil	03/30/07 09:25	03/30/07 11:45
Trip Blanks (DI)	0701731-23	Water	03/29/07 00:00	03/30/07 11:45
Trip Blank (MeOH)	0701731-24	Soil	03/29/07 00:00	03/30/07 11:45

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	3.3 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	No	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-TSS-7-032907

0701731-01 (Slurry)

3/29/07 9:55

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**1600**	10	3.6	mg/L	B7D0107	4/5/07	4/5/07	EPA 160.2	
Total Solids	**2200**	20	1.0	mg/L	B7D0111	4/4/07	4/4/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-TOC-7-032907

0701731-02 (Slurry)

3/29/07 9:55

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**16**	15	5.0	mg/L	B7D0196	4/9/07	4/9/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-PAH-2-032907 Front

0701731-03 (Air Tube)

3/29/07 12:41

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	3.97		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
2-Methylnaphthalene	**10.7**	3.95		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthene	ND	4.13		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthylene	ND	3.80		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Anthracene	ND	4.11		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benz(a)anthracene	ND	4.46		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benzo(a)pyrene	ND	4.71		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1a
Benzo(b)fluoranthene	ND	4.66		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A2a
Benzo(g,h,i)perylene	ND	11.5		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A3
Benzo(k)fluoranthene	ND	4.72		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A4a
Chrysene	ND	4.47		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	9.60		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A5
Fluoranthene	ND	4.26		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Fluorene	ND	4.05		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	5.06		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1
Naphthalene	**8.36**	4.14		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Phenanthrene	ND	4.14		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Pyrene	ND	4.33		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-VOC-2-032907 Front

0701731-05 (Air Tube)

3/29/07 12:41

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	7.54		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**17.5**	7.39		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	7.18		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	8.65		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**17.0**	7.40		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**56.0**	15.2		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	ND	14.6		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	7.32		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**9.97**	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**42.7**	7.52		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	ND	7.46		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**42.5**	14.9		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-PAH-5-032907 Front

0701731-07 (Air Tube)

3/29/07 16:46

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**3.06**	2.65		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
2-Methylnaphthalene	**6.23**	2.63		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthene	ND	2.75		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthylene	ND	2.54		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Anthracene	ND	2.74		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1a
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A2a
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A3
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A4a
Chrysene	ND	2.98		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	6.40		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A5
Fluoranthene	ND	2.84		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Fluorene	ND	2.70		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1
Naphthalene	**4.23**	2.76		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Phenanthrene	ND	2.76		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Pyrene	ND	2.89		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-VOC-5-032907 Front

0701731-09 (Air Tube)

3/29/07 16:46

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	5.03		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**12.5**	4.93		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	5.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**14.2**	4.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**24.0**	10.2		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**31.6**	5.02		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	ND	4.97		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**29.1**	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-PAH-6-033007 Front

0701731-11 (Air Tube)

3/30/07 8:50

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**2.63**	0.662		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
2-Methylnaphthalene	**6.11**	0.658		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	ia
Acenaphthene	ND	0.688		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Acenaphthylene	ND	0.634		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Anthracene	ND	0.686		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1a
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A2a
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A3
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A4a
Chrysene	ND	0.746		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	1.60		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A5
Fluoranthene	ND	0.710		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Fluorene	ND	0.675		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	A1
Naphthalene	**3.65**	0.689		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	ia
Phenanthrene	ND	0.689		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	
Pyrene	ND	0.721		ug/m³	[CALC]	4/11/07	4/12/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-PAH-6-033007 Back

0701731-12 (Air Tube)

3/30/07 8:50

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**0.740**	0.662		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
2-Methylnaphthalene	**1.93**	0.658		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthene	ND	0.688		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Acenaphthylene	ND	0.634		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A1b, gp
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	0.959		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A2, gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5b, gp
Chrysene	ND	0.746		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A3a, gp
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A4, gp
Fluoranthene	ND	0.710		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Fluorene	ND	0.675		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	1.69		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	A5a, gp
Naphthalene	**1.53**	0.689		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Phenanthrene	ND	0.689		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	
Pyrene	ND	0.721		ug/m³	[CALC]	4/24/07	4/25/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-VOC-6-033007 Front

0701731-13 (Air Tube)

3/30/07 8:50

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**5.59**	1.26		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**9.73**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**9.38**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**15.2**	2.54		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**4.39**	2.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**4.34**	1.63		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**27.1**	1.25		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**3.93**	1.24		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**23.7**	2.49		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-PAH-8-033007 Total

0701731-15 (Slurry)

3/30/07 9:10

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**540**	200	10	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**62**	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**51**	20	2.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**240**	20	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	**450**	200	16	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**390**	80	10	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Acenaphthylene	**33**	8.0	0.75	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	**170**	8.0	0.83	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	**70**	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	**58**	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	**40**	8.0	1.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	**32**	20	3.2	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	A5c
Benzo(g,h,i)perylene	**19**	8.0	2.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	**38**	8.0	3.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	**51**	20	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	**72**	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	**18**	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	**170**	8.0	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	**140**	8.0	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**25**	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	**230**	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Perylene	7.8 J	20	1.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	**430**	80	8.2	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	
Pyrene	**250**	8.0	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*69.6 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*62.0 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*78.3 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-PAH-8-033007 Dissolved

0701731-16 (Slurry)

3/30/07 9:10

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**240**	20	1.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
1-Methylphenanthrene	ND	20	1.3	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	20	2.3	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
2,6-Dimethylnaphthalene	**27**	20	2.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
2-Methylnaphthalene	**77**	20	1.6	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Acenaphthene	**130**	8.0	1.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Acenaphthylene	3.6 J	8.0	0.75	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Anthracene	2.1 J	8.0	0.83	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Benz(a)anthracene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Benzo(a)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Benzo(b)fluoranthene	ND	8.0	1.7	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Benzo(e)pyrene	ND	20	3.2	ug/L	B7C0494	3/30/07	4/12/07	EPA 8270C	A5c
Benzo(g,h,i)perylene	ND	8.0	2.7	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Benzo(k)fluoranthene	ND	8.0	3.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Biphenyl	10 J	20	1.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Chrysene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Fluoranthene	ND	8.0	1.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Fluorene	**21**	8.0	1.8	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Naphthalene	6.0 J	20	1.3	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Perylene	ND	20	1.1	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Phenanthrene	**14**	8.0	0.82	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Pyrene	ND	8.0	2.0	ug/L	B7C0494	3/30/07	4/10/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*83.1 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/10/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*55.8 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/10/07*	*EPA 8270C*	*vn*
Surrogate: Terphenyl-d14	*84.0 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/10/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-TSS-8-033007

0701731-17 (Slurry)

3/30/07 9:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**130**	10	3.6	mg/L	B7D0107	4/5/07	4/5/07	EPA 160.2	
Total Solids	**730**	20	1.0	mg/L	B7D0111	4/4/07	4/4/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-DOC-8-033007

0701731-18 (Slurry)

3/30/07 9:10

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**30**	1.5	0.50	mg/L	B7D0196	4/9/07	4/9/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-TOC-8-033007

0701731-19 (Slurry)

3/30/07 9:10

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**31**	1.5	0.50	mg/L	B7D0196	4/9/07	4/9/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-VOC-8-033007

0701731-20 (Slurry)

3/30/07 9:10

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**28**	2.0	0.14	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,2,4-Trimethylbenzene	**87**	2.0	0.060	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,3,5-Trimethylbenzene	**21**	2.0	0.078	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,4-Dichlorobenzene	ND	2.0	0.10	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Benzene	**20**	2.0	0.084	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Carbon Tetrachloride	ND	2.0	0.10	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Ethylbenzene	ND	2.0	0.072	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
m,p-Xylenes	**110**	2.0	0.12	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
o-Xylene	**72**	2.0	0.14	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
sec-Butylbenzene	ND	2.0	0.054	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Styrene	ND	2.0	0.098	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Toluene	**13**	2.0	0.096	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Trichloroethene	ND	2.0	0.13	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*88.4 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*99.2 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*106 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-VOC-3-033007

0701731-21 (Soil)

3/30/07 9:25

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**28**	0.050	0.010	% Wt	B7D0103	4/5/07	4/5/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**8.1**	3.5	0.11	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	**23**	3.5	0.25	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	**5.8**	3.5	0.35	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	3.5	0.42	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Benzene	ND	3.5	0.16	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	3.5	0.20	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Ethylbenzene	**18**	3.5	0.37	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
m,p-Xylenes	**19**	3.5	0.45	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
o-Xylene	**10**	3.5	0.49	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	3.5	0.15	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Styrene	ND	3.5	0.16	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Toluene	**6.7**	3.5	0.61	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Trichloroethene	ND	3.5	0.26	mg/kg dry	B7D0142	4/4/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*91.2 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*96.8 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

NSP-2A-1Q-PAH-3-033007

0701731-22 (Soil)

3/30/07 9:25

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**31**	0.050	0.010	% Wt	B7D0103	4/5/07	4/5/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**440**	21	3.5	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**83**	4.3	0.51	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**62**	4.3	0.51	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**230**	21	3.2	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**610**	21	7.3	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthene	**350**	21	3.2	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Acenaphthylene	**27**	4.3	0.45	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Anthracene	**160**	4.3	0.64	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benz(a)anthracene	**60**	4.3	0.64	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(a)pyrene	**43**	4.3	0.51	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(b)fluoranthene	**29**	4.3	1.1	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(e)pyrene	**28**	4.3	0.64	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	A5c
Benzo(g,h,i)perylene	**14**	4.3	0.38	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Benzo(k)fluoranthene	**31**	4.3	0.89	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Biphenyl	**62**	4.3	0.77	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Chrysene	**57**	4.3	0.64	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Dibenz(a,h)anthracene	**4.6**	4.3	1.3	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Fluoranthene	**140**	21	2.2	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Fluorene	**220**	21	1.3	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**13**	4.3	0.58	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Naphthalene	**540**	21	1.6	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Perylene	**6.5**	4.3	0.70	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Phenanthrene	**540**	21	2.6	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Pyrene	**130**	4.3	0.64	mg/kg dry	B7C0507	3/30/07	4/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*64.5 %*	*Limits: 30-104%*			*B7C0507*	*3/30/07*	*4/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*52.4 %*	*Limits: 30-90%*			*B7C0507*	*3/30/07*	*4/12/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*39.7 %*	*Limits: 30-115%*			*B7C0507*	*3/30/07*	*4/12/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Trip Blanks (DI)

0701731-23 (Water)

3/29/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7D0143	4/4/07	4/5/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*82.4 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.4 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0143*	*4/4/07*	*4/5/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Trip Blank (MeOH)

0701731-24 (Soil)

3/29/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7D0142	4/4/07	4/4/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*84.8 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*97.2 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0142*	*4/4/07*	*4/4/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7D0103 - % Solids

Method Blank (B7D0103-BLK1)

Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Standard Reference Material (B7D0103-SRM1)

Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	89.6			% Wt	88.8	NA	101	90-110	NA	NA	

Batch B7D0107 - Default Prep GenChem

Method Blank (B7D0107-BLK1)

Prepared: 04/05/07 Analyzed: 04/06/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7D0107-BS1)

Prepared: 04/05/07 Analyzed: 04/06/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	283			mg/L	250	NA	113	80-120	NA	NA	

Batch B7D0111 - Default Prep GenChem

Method Blank (B7D0111-BLK1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5c
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample (B7C0494-BS1)

Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

Laboratory Control Sample Duplicate (B7C0494-BSD1)

Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1)

Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.0728	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	0.0133 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.142	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	0.0509 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	A5c
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	ND	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0507 - EPA 3545

Method Blank (B7C0507-BLK1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.188	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	0.0402 J	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	0.0309 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.629*			mg/kg	*0.831*	*NA*	*75.7*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.468*			mg/kg	*0.831*	*NA*	*56.3*	*30-90*			
Surrogate: Terphenyl-d14	*0.715*			mg/kg	*0.831*	*NA*	*86.0*	*30-115*			

Laboratory Control Sample (B7C0507-BS1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.22	0.067	0.010	mg/kg	1.66	NA	73.5	50-115	NA	NA	
Pyrene	1.20	0.067	0.010	mg/kg	1.66	NA	72.3	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.652*			mg/kg	*0.832*	*NA*	*78.4*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.488*			mg/kg	*0.832*	*NA*	*58.7*	*30-90*			
Surrogate: Terphenyl-d14	*0.730*			mg/kg	*0.832*	*NA*	*87.7*	*30-115*			

Laboratory Control Sample Duplicate (B7C0507-BSD1) Prepared: 03/30/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-115	0.816	25	
Pyrene	1.23	0.067	0.010	mg/kg	1.66	NA	74.1	50-130	2.47	25	
Surrogate: 2-Fluorobiphenyl	*0.657*			mg/kg	*0.831*	*NA*	*79.1*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.503*			mg/kg	*0.831*	*NA*	*60.5*	*30-90*			
Surrogate: Terphenyl-d14	*0.725*			mg/kg	*0.831*	*NA*	*87.2*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0142 - EPA 5035

Method Blank (B7D0142-BLK1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.050	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*21.9*			ug/L	*25.0*	*NA*	*87.6*	*80-120*			
Surrogate: Dibromofluoromethane	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Laboratory Control Sample (B7D0142-BS1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.41	0.050	0.0035	mg/kg	1.25	NA	113	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.40	0.050	0.0049	mg/kg	1.25	NA	112	75-125	NA	NA	
1,4-Dichlorobenzene	1.33	0.050	0.0060	mg/kg	1.25	NA	106	75-125	NA	NA	
Benzene	1.39	0.050	0.0022	mg/kg	1.25	NA	111	75-125	NA	NA	
Carbon Tetrachloride	1.33	0.050	0.0028	mg/kg	1.25	NA	106	75-125	NA	NA	
Ethylbenzene	1.35	0.050	0.0053	mg/kg	1.25	NA	108	75-125	NA	NA	
m,p-Xylenes	2.67	0.050	0.0063	mg/kg	2.50	NA	107	75-125	NA	NA	
o-Xylene	1.31	0.050	0.0070	mg/kg	1.25	NA	105	75-125	NA	NA	
sec-Butylbenzene	1.42	0.050	0.0021	mg/kg	1.25	NA	114	75-125	NA	NA	
Styrene	1.37	0.050	0.0023	mg/kg	1.25	NA	110	75-125	NA	NA	
Toluene	1.32	0.050	0.0086	mg/kg	1.25	NA	106	75-125	NA	NA	
Trichloroethene	1.27	0.050	0.0037	mg/kg	1.25	NA	102	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.7*			ug/L	*25.0*	*NA*	*94.8*	*80-120*			
Surrogate: Dibromofluoromethane	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0142 - EPA 5035

Laboratory Control Sample Duplicate (B7D0142-BSD1)

Prepared & Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.43	0.050	0.0035	mg/kg	1.25	NA	114	75-125	1.41	20	
1,3,5-Trimethylbenzene	1.43	0.050	0.0049	mg/kg	1.25	NA	114	75-125	2.12	20	
1,4-Dichlorobenzene	1.35	0.050	0.0060	mg/kg	1.25	NA	108	75-125	1.49	20	
Benzene	1.41	0.050	0.0022	mg/kg	1.25	NA	113	75-125	1.43	20	
Carbon Tetrachloride	1.31	0.050	0.0028	mg/kg	1.25	NA	105	75-125	1.52	20	
Ethylbenzene	1.37	0.050	0.0053	mg/kg	1.25	NA	110	75-125	1.47	20	
m,p-Xylenes	2.66	0.050	0.0063	mg/kg	2.50	NA	106	75-125	0.375	20	
o-Xylene	1.32	0.050	0.0070	mg/kg	1.25	NA	106	75-125	0.760	20	
sec-Butylbenzene	1.43	0.050	0.0021	mg/kg	1.25	NA	114	75-125	0.702	20	
Styrene	1.38	0.050	0.0023	mg/kg	1.25	NA	110	75-125	0.727	20	
Toluene	1.35	0.050	0.0086	mg/kg	1.25	NA	108	75-125	2.25	20	
Trichloroethene	1.27	0.050	0.0037	mg/kg	1.25	NA	102	75-125	0.00	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.4*			ug/L	*25.0*	*NA*	*93.6*	*80-120*			
Surrogate: Dibromofluoromethane	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

Batch B7D0143 - EPA 5030B

Method Blank (B7D0143-BLK1)

Prepared: 04/04/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*21.4*			ug/L	*25.0*	*NA*	*85.6*	*80-120*			
Surrogate: Dibromofluoromethane	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: Toluene-d8	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0143 - EPA 5030B

Laboratory Control Sample (B7D0143-BS1)

Prepared: 04/04/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	28.5	1.0	0.030	ug/L	25.0	NA	114	75-125	NA	NA	
1,3,5-Trimethylbenzene	28.6	1.0	0.039	ug/L	25.0	NA	114	75-125	NA	NA	
1,4-Dichlorobenzene	27.2	1.0	0.051	ug/L	25.0	NA	109	75-125	NA	NA	
Benzene	29.1	1.0	0.042	ug/L	25.0	NA	116	75-125	NA	NA	
Carbon Tetrachloride	25.7	1.0	0.050	ug/L	25.0	NA	103	75-125	NA	NA	
Ethylbenzene	27.6	1.0	0.036	ug/L	25.0	NA	110	75-125	NA	NA	
m,p-Xylenes	52.9	1.0	0.059	ug/L	50.0	NA	106	75-125	NA	NA	
o-Xylene	26.5	1.0	0.072	ug/L	25.0	NA	106	75-125	NA	NA	
sec-Butylbenzene	28.6	1.0	0.027	ug/L	25.0	NA	114	75-125	NA	NA	
Styrene	27.7	1.0	0.049	ug/L	25.0	NA	111	75-125	NA	NA	
Toluene	27.2	1.0	0.048	ug/L	25.0	NA	109	75-125	NA	NA	
Trichloroethene	25.9	1.0	0.067	ug/L	25.0	NA	104	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.1*			ug/L	*25.0*	*NA*	*92.4*	*80-120*			
Surrogate: Dibromofluoromethane	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Toluene-d8	*24.5*			ug/L	*25.0*	*NA*	*98.0*	*80-120*			

Laboratory Control Sample Duplicate (B7D0143-BSD1)

Prepared: 04/04/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	29.5	1.0	0.030	ug/L	25.0	NA	118	75-125	3.45	20	
1,3,5-Trimethylbenzene	29.3	1.0	0.039	ug/L	25.0	NA	117	75-125	2.42	20	
1,4-Dichlorobenzene	27.5	1.0	0.051	ug/L	25.0	NA	110	75-125	1.10	20	
Benzene	29.6	1.0	0.042	ug/L	25.0	NA	118	75-125	1.70	20	
Carbon Tetrachloride	26.5	1.0	0.050	ug/L	25.0	NA	106	75-125	3.07	20	
Ethylbenzene	28.3	1.0	0.036	ug/L	25.0	NA	113	75-125	2.50	20	
m,p-Xylenes	54.4	1.0	0.059	ug/L	50.0	NA	109	75-125	2.80	20	
o-Xylene	27.0	1.0	0.072	ug/L	25.0	NA	108	75-125	1.87	20	
sec-Butylbenzene	29.5	1.0	0.027	ug/L	25.0	NA	118	75-125	3.10	20	
Styrene	28.3	1.0	0.049	ug/L	25.0	NA	113	75-125	2.14	20	
Toluene	27.9	1.0	0.048	ug/L	25.0	NA	112	75-125	2.54	20	
Trichloroethene	26.7	1.0	0.067	ug/L	25.0	NA	107	75-125	3.04	20	
Surrogate: 1,2-Dichloroethane-d4	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*23.0*			ug/L	*25.0*	*NA*	*92.0*	*80-120*			
Surrogate: Dibromofluoromethane	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Toluene-d8	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0204 - AIRTUBES Prep

Laboratory Control Sample (B7D0204-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	28800	0.00		ug/m³	28200	NA	102	70-130	NA	NA	
2-Methylnaphthalene filter	28900	0.00		ug/m³	28200	NA	102	70-130	NA	NA	
Acenaphthene filter	26500	0.00		ug/m³	26000	NA	102	70-130	NA	NA	
Acenaphthylene filter	26200	0.00		ug/m³	25700	NA	102	70-130	NA	NA	
Anthracene filter	26200	0.00		ug/m³	25100	NA	104	70-130	NA	NA	
Benz(a)anthracene filter	26000	0.00		ug/m³	25600	NA	102	70-130	NA	NA	
Benzo(a)pyrene filter	25600	0.00		ug/m³	25300	NA	101	70-130	NA	NA	
Benzo(b)fluoranthene filter	25700	0.00		ug/m³	25300	NA	102	70-130	NA	NA	
Benzo(g,h,i)perylene filter	22800	0.00		ug/m³	25800	NA	88.4	70-130	NA	NA	
Benzo(k)fluoranthene filter	25800	0.00		ug/m³	25400	NA	102	70-130	NA	NA	
Chrysene filter	25800	0.00		ug/m³	25400	NA	102	70-130	NA	NA	
Dibenz(a,h)anthracene filter	25600	0.00		ug/m³	25100	NA	102	70-130	NA	NA	
Fluoranthene filter	25900	0.00		ug/m³	25500	NA	102	70-130	NA	NA	
Fluorene filter	26100	0.00		ug/m³	25600	NA	102	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	27100	0.00		ug/m³	26800	NA	101	70-130	NA	NA	
Naphthalene filter	29000	0.00		ug/m³	28100	NA	103	70-130	NA	NA	
Phenanthrene filter	26000	0.00		ug/m³	25500	NA	102	70-130	NA	NA	
Pyrene filter	26300	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
1-Methylnaphthalene	24700	1590		ug/m³	26600	NA	92.9	70-130	NA	NA	
2-Methylnaphthalene	24600	1590		ug/m³	26400	NA	93.2	70-130	NA	NA	
Acenaphthene	24600	1660		ug/m³	27600	NA	89.1	70-130	NA	NA	
Acenaphthylene	23000	1530		ug/m³	25500	NA	90.2	70-130	NA	NA	
Anthracene	24200	1650		ug/m³	27500	NA	88.0	70-130	NA	NA	
Benz(a)anthracene	22300	1790		ug/m³	29800	NA	74.8	70-130	NA	NA	
Benzo(a)pyrene	19600	1890		ug/m³	31500	NA	62.2	70-130	NA	NA	
Benzo(b)fluoranthene	21200	1870		ug/m³	31200	NA	67.9	70-130	NA	NA	
Benzo(g,h,i)perylene	16400	4620		ug/m³	38500	NA	42.6	70-130	NA	NA	
Benzo(k)fluoranthene	21700	1890		ug/m³	31600	NA	68.7	70-130	NA	NA	
Chrysene	22500	1800		ug/m³	29900	NA	75.3	70-130	NA	NA	
Dibenz(a,h)anthracene	19300	3860		ug/m³	32100	NA	60.1	70-130	NA	NA	
Fluoranthene	23400	1710		ug/m³	28500	NA	82.1	70-130	NA	NA	
Fluorene	24500	1630		ug/m³	27100	NA	90.4	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	18700	2030		ug/m³	33900	NA	55.2	70-130	NA	NA	
Naphthalene	26300	1660		ug/m³	27700	NA	94.9	70-130	NA	NA	
Phenanthrene	24000	1660		ug/m³	27700	NA	86.6	70-130	NA	NA	
Pyrene	22800	1740		ug/m³	29000	NA	78.6	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0204 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0204-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	28700	0.00		ug/m³	28200	NA	102	70-130	0.348	20	
2-Methylnaphthalene filter	28800	0.00		ug/m³	28200	NA	102	70-130	0.347	20	
Acenaphthene filter	26400	0.00		ug/m³	26000	NA	102	70-130	0.378	20	
Acenaphthylene filter	26200	0.00		ug/m³	25700	NA	102	70-130	0.00	20	
Anthracene filter	26100	0.00		ug/m³	25100	NA	104	70-130	0.382	20	
Benz(a)anthracene filter	25900	0.00		ug/m³	25600	NA	101	70-130	0.385	20	
Benzo(a)pyrene filter	25500	0.00		ug/m³	25300	NA	101	70-130	0.391	20	
Benzo(b)fluoranthene filter	25600	0.00		ug/m³	25300	NA	101	70-130	0.390	20	
Benzo(g,h,i)perylene filter	23200	0.00		ug/m³	25800	NA	89.9	70-130	1.74	20	
Benzo(k)fluoranthene filter	25800	0.00		ug/m³	25400	NA	102	70-130	0.00	20	
Chrysene filter	25700	0.00		ug/m³	25400	NA	101	70-130	0.388	20	
Dibenz(a,h)anthracene filter	25100	0.00		ug/m³	25100	NA	100	70-130	1.97	20	
Fluoranthene filter	25800	0.00		ug/m³	25500	NA	101	70-130	0.387	20	
Fluorene filter	26000	0.00		ug/m³	25600	NA	102	70-130	0.384	20	
Indeno(1,2,3-cd)pyrene filter	26600	0.00		ug/m³	26800	NA	99.3	70-130	1.86	20	
Naphthalene filter	29000	0.00		ug/m³	28100	NA	103	70-130	0.00	20	
Phenanthrene filter	25900	0.00		ug/m³	25500	NA	102	70-130	0.385	20	
Pyrene filter	26000	0.00		ug/m³	25600	NA	102	70-130	1.15	20	
1-Methylnaphthalene	24900	1590		ug/m³	26600	NA	93.6	70-130	0.806	20	
2-Methylnaphthalene	24700	1590		ug/m³	26400	NA	93.6	70-130	0.406	20	
Acenaphthene	24800	1660		ug/m³	27600	NA	89.9	70-130	0.810	20	
Acenaphthylene	23300	1530		ug/m³	25500	NA	91.4	70-130	1.30	20	
Anthracene	24500	1650		ug/m³	27500	NA	89.1	70-130	1.23	20	
Benz(a)anthracene	22700	1790		ug/m³	29800	NA	76.2	70-130	1.78	20	
Benzo(a)pyrene	20100	1890		ug/m³	31500	NA	63.8	70-130	2.52	20	
Benzo(b)fluoranthene	21800	1870		ug/m³	31200	NA	69.9	70-130	2.79	20	
Benzo(g,h,i)perylene	18300	4620		ug/m³	38500	NA	47.5	70-130	11.0	20	
Benzo(k)fluoranthene	22200	1890		ug/m³	31600	NA	70.3	70-130	2.28	20	
Chrysene	23000	1800		ug/m³	29900	NA	76.9	70-130	2.20	20	
Dibenz(a,h)anthracene	20400	3860		ug/m³	32100	NA	63.6	70-130	5.54	20	
Fluoranthene	23700	1710		ug/m³	28500	NA	83.2	70-130	1.27	20	
Fluorene	24700	1630		ug/m³	27100	NA	91.1	70-130	0.813	20	
Indeno(1,2,3-cd)pyrene	19300	2030		ug/m³	33900	NA	56.9	70-130	3.16	20	
Naphthalene	26400	1660		ug/m³	27700	NA	95.3	70-130	0.380	20	
Phenanthrene	24300	1660		ug/m³	27700	NA	87.7	70-130	1.24	20	
Pyrene	23500	1740		ug/m³	29000	NA	81.0	70-130	3.02	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample (B7D0206-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	5880	5880	ug/m³	110000	NA	90.0	75-125	NA	NA	
Xylenes, Total	289000	5990	2990	ug/m³	337000	NA	85.8	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	103000	2970	2970	ug/m³	99100	NA	104	75-125	NA	NA	
Styrene	122000	3920	3920	ug/m³	131000	NA	93.1	75-125	NA	NA	
Toluene	107000	3020	3020	ug/m³	101000	NA	106	75-125	NA	NA	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	82400	3030	3030	ug/m³	90200	NA	91.4	75-125	NA	NA	
1,2,4-Trimethylbenzene	85700	2970	2970	ug/m³	91600	NA	93.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	92500	2880	2880	ug/m³	94100	NA	98.3	75-125	NA	NA	
1,4-Dichlorobenzene	62800	3470	3470	ug/m³	65400	NA	96.0	75-125	NA	NA	
Carbon Tetrachloride	97000	6120	6120	ug/m³	102000	NA	95.1	75-125	NA	NA	
sec-Butylbenzene	100000	2940	2940	ug/m³	97000	NA	103	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0206-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	109000	5880	5880	ug/m³	110000	NA	99.1	75-125	9.62	20	
Xylenes, Total	329000	5990	2990	ug/m³	337000	NA	97.6	75-125	12.9	20	

Laboratory Control Sample Duplicate (B7D0206-BSD2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	98100	2970	2970	ug/m³	99100	NA	99.0	75-125	4.87	20	
Styrene	120000	3920	3920	ug/m³	131000	NA	91.6	75-125	1.65	20	
Toluene	100000	3020	3020	ug/m³	101000	NA	99.0	75-125	6.76	20	
Trichloroethene	98700	2990	2990	ug/m³	99800	NA	98.9	75-125	5.23	20	

Laboratory Control Sample Duplicate (B7D0206-BSD3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	93300	3030	3030	ug/m³	90200	NA	103	75-125	12.4	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0206-BSD3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	96000	2970	2970	ug/m³	91600	NA	105	75-125	11.3	20	
1,3,5-Trimethylbenzene	102000	2880	2880	ug/m³	94100	NA	108	75-125	9.77	20	
1,4-Dichlorobenzene	71400	3470	3470	ug/m³	65400	NA	109	75-125	12.8	20	
Carbon Tetrachloride	107000	6120	6120	ug/m³	102000	NA	105	75-125	9.80	20	
sec-Butylbenzene	110000	2940	2940	ug/m³	97000	NA	113	75-125	9.52	20	

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample (B7D0431-BS1)

Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	25900	1590		ug/m³	26600	NA	97.4	70-130	NA	NA	
2-Methylnaphthalene	26100	1590		ug/m³	26400	NA	98.9	70-130	NA	NA	
Acenaphthene	25600	1660		ug/m³	27600	NA	92.8	70-130	NA	NA	
Acenaphthylene	24000	1530		ug/m³	25500	NA	94.1	70-130	NA	NA	
Anthracene	25100	3300		ug/m³	27500	NA	91.3	70-130	NA	NA	
Benz(a)anthracene	23600	1790		ug/m³	29800	NA	79.2	70-130	NA	NA	
Benzo(a)pyrene	20900	1890		ug/m³	31500	NA	66.3	70-130	NA	NA	
Benzo(b)fluoranthene	22700	1870		ug/m³	31200	NA	72.8	70-130	NA	NA	
Benzo(g,h,i)perylene	11400	2310		ug/m³	38500	NA	29.6	70-130	NA	NA	
Benzo(k)fluoranthene	22100	1890		ug/m³	31600	NA	69.9	70-130	NA	NA	
Chrysene	16400	1800		ug/m³	29900	NA	54.8	70-130	NA	NA	
Dibenz(a,h)anthracene	19400	19300		ug/m³	32100	NA	60.4	70-130	NA	NA	
Fluoranthene	24600	1710		ug/m³	28500	NA	86.3	70-130	NA	NA	
Fluorene	25400	1630		ug/m³	27100	NA	93.7	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	20600	4070		ug/m³	33900	NA	60.8	70-130	NA	NA	
Naphthalene	27200	1660		ug/m³	27700	NA	98.2	70-130	NA	NA	
Phenanthrene	25000	1660		ug/m³	27700	NA	90.3	70-130	NA	NA	
Pyrene	24000	1740		ug/m³	29000	NA	82.8	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0431 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0431-BSD1) Prepared & Analyzed: 04/24/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	26800	1590		ug/m³	26600	NA	101	70-130	3.42	20	
2-Methylnaphthalene	26900	1590		ug/m³	26400	NA	102	70-130	3.02	20	
Acenaphthene	27000	1660		ug/m³	27600	NA	97.8	70-130	5.32	20	
Acenaphthylene	25000	1530		ug/m³	25500	NA	98.0	70-130	4.08	20	
Anthracene	27000	3300		ug/m³	27500	NA	98.2	70-130	7.29	20	
Benz(a)anthracene	27400	1790		ug/m³	29800	NA	91.9	70-130	14.9	20	
Benzo(a)pyrene	26400	1890		ug/m³	31500	NA	83.8	70-130	23.3	20	
Benzo(b)fluoranthene	27500	1870		ug/m³	31200	NA	88.1	70-130	19.1	20	
Benzo(g,h,i)perylene	18000	2310		ug/m³	38500	NA	46.8	70-130	44.9	20	
Benzo(k)fluoranthene	27600	1890		ug/m³	31600	NA	87.3	70-130	22.1	20	
Chrysene	22100	1800		ug/m³	29900	NA	73.9	70-130	29.6	20	
Dibenz(a,h)anthracene	25800	19300		ug/m³	32100	NA	80.4	70-130	28.3	20	
Fluoranthene	27100	1710		ug/m³	28500	NA	95.1	70-130	9.67	20	
Fluorene	26600	1630		ug/m³	27100	NA	98.2	70-130	4.62	20	
Indeno(1,2,3-cd)pyrene	27300	4070		ug/m³	33900	NA	80.5	70-130	28.0	20	
Naphthalene	27900	1660		ug/m³	27700	NA	101	70-130	2.54	20	
Phenanthrene	26800	1660		ug/m³	27700	NA	96.8	70-130	6.95	20	
Pyrene	27300	1740		ug/m³	29000	NA	94.1	70-130	12.9	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

For Braun Intertec Use Only
Braun Intertec Project No.
0701731

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquiries:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 1 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Company: URS Corp
Mailing Address: 700 3rd St. S. Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: 612-370-0700 Fax #: 612-373-6800
E-mail: hubert_huls@urscorp.com

Project ID/Project Name: Ashland NSP
P.O. #: 25688375.75000

SEND INVOICE TO
Contact Name: Same
Company:
Address:
City, State, Zip:
Telephone #:
Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Agitate Line Item 9 prior to analysis
Filter Line Item 10 prior to analysis

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	TSS	Percent Solids	TOC	PAH	VOC	DOC					FOR LAB USE ONLY
1	NSP-2A-1Q-TSS-7-032907	03/29/07	09:55	Slurry		1	N	X	X									0701731-1
2	NSP-2A-1Q-TOC-7-032907		09:55	Slurry		1	N			X								-2
3	NSP-2A-1Q-PAH-2-032907		12:41	Air	401.6 L	3	N				X							-3,4
4	NSP-2A-1Q-VOC-2-032907		12:41		401.6 L	2	N					X						-5,6
5	NSP-2A-1Q-PAH-5-032907		16:46		602.4 L	3	N				X							-7,8
6	NSP-2A-1Q-VOC-5-032907	03/29/07	16:46		602.4 L	2	N					X						-9,10
7	NSP-2A-1Q-PAH-6-033007	03/30/07	08:50		2409.6 L	3	N				X							-11,12
8	NSP-2A-1Q-VOC-6-033007		08:50	Air	2409.6 L	2	N					X						-13,14
9	NSP-2A-1Q-PAH-8-033007		09:10	Slurry		3	N				X							-15
10	NSP-2A-1Q-PAH-8-033007					3	N				X							-16
11	NSP-2A-1Q-TSS-8-033007					1	N	X	X									-17
12	NSP-2A-1Q-DOC-8-033007					1	N						X					-18
13	NSP-2A-1Q-TOC-8-033007					1	N			X								-19
14	NSP-2A-1Q-VOC-8-033007		09:10	Slurry		6	N					X						-20
15	NSP-2A-1Q-VOC-3-033007	03/30/07	09:25	Soil		2	N					X						-21

CHAIN OF CUSTODY
Collected by: (Print) William C. Flynn Jr.
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/30/07 09:45
Received by: [signature] Date/Time 3/30/07 09:45
Relinquished by: [signature] Date/Time 3/30/07 11:45
Received Contents Not Verified: [signature] Date/Time 3/30/07 11:45
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☐ Yes ☐ No
Temp Blank ☐ Yes ☐ No
Temp: 3.3 °C
Comments:

Form # C592.01 F:\Groups\QA-QC\Forms\clientservices\COC-C592 Effective Date: 7/22/05

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701731
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number: 25688375.75000	Account ID: B03123

For Braun Intertec Use Only
Braun Intertec Project No.
6701731

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ___ Yes ___ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS Corp
Mailing Address 700 3rd St. S. Suite 600
City, State, Zip Minneapolis, MN 55415
Telephone # 612-370-0700 Fax # 612-373-6800
E-mail hubert-huls@urscorp.com

Project ID/Project Name Ashland NSP
P.O. # 25688375.75000

SEND INVOICE TO
Contact Name
Company
Address
City, State, Zip Same
Telephone #
Fax #

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH										FOR LAB USE ONLY
1	NSP-2A-1Q-PAH-3-033007	03/30/07	09:25	Soil		2	N	X								070		1731-22
2	Trip Blanks (DI)					2												-23
3	Trip Blank (MeOH)					1												-24
4	Temp Blank					1												
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr.
Collector's Signature:
Relinquished by: Date/Time 03/30/07 09:45
Received by: Date/Time 3/30/07 0945
Relinquished by: Date/Time 03/30/07 1145
Received Contents Not Verified: Date/Time 3/30/07 11:45
Received Contents Verified: Date/Time
Custody Seal Intact ☐ Yes ☐ No ☐ N/A
On Ice ☐ Yes ☐ No
Temp Blank ☐ Yes ☐ No
Temp: 3.3 °C
Comments:

Form # CS02.01 F:\Groups\QA-QC\Forms\clientservices\COC-CS02 Effective Date: 7/22/05

Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Mr. Hubert Huls
URS Corporation
700 South Third Street
Minneapolis, MN 55415

July 17, 2007

Work Order #: 0701628
(Revised)

RE: Ashland/NSP

Dear Hubert Huls:

Braun Intertec Corporation received samples for the project identified above on March 26, 2007. Analytical results are summarized in the following report.

All routine quality assurance procedures were followed, unless otherwise noted.

Analytical results are reported on an "as received" basis unless otherwise noted. Where possible, the samples will be retained by the laboratory for 14 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use Braun Intertec Corporation for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Thomas P. Wagner For Steven J. Albrecht
Associate Principal

Certification/Accreditation Numbers

Minnesota Department of Health: 027-053-117 Wisconsin DNR: 999462640 NVLAP: 101234-0 AIHA: 101103

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

How to Use this Report

In order to get the most out of the information presented in this report please refer to the following explanations as to how the data in this report is tied together and how some of the terms are defined.

Qualifiers and Abbreviations are defined in the following section. You will find these codes used throughout the report in headers and in note sections to designate a unique fact about the data to which they are associated.

The Case Narrative gives a "story" about the analysis and results. Here you will find greater elaboration on relevant qualifiers as well as an explanation of anything of particular note in the data. This is a discussion of the data in terms of quality control and chemistry. It is a summary of any deviations that could affect the usefulness of the data. This is not an interpretation as to how this information relates to regulatory compliance, toxicity, or hazardous characterization. These items are beyond the scope of this report.

The Sample Summary provides detail on sample receipt. The association between Client sample ID and the Laboratory sample ID are defined here; this information is valuable to have when discussing results with your project manager. Sample collection and receipt dates and times are provided here as well. General notes regarding the work order are also documented here. This is a mini "case narrative" that describes any anomalies regarding the condition of the samples upon arrival to the laboratory or special circumstances regarding the work order.

The Conditions Upon Receipt summarizes the results of specific checks that have been performed at sample receipt. This includes items like custody documentation, sample condition, and temperature at receipt. Each "cooler" is identified and the conditions associated with that cooler are documented. A "cooler" is defined as the larger container used to transport the individual samples. In most cases this is a standard recreational cooler but it can be a box, plastic bag, or other container.

The laboratory results are summarized in the following sections. Data is broken down into major categories for convenience. An example of such a category would be "Total Petroleum Hydrocarbons." Here you would find data that references the testing of such parameters as diesel range organics and gasoline range organics. Other categories are similarly mapped. The batch number is associated with each sample. This is important to evaluate Quality Control (QC) data. Surrogate results samples are provided with each sample. Laboratory control limits are provided for comparison (see below). The reference method is also identified. If a method is denoted with an "M" (e.g. EPA 1234(M)) this means that it has been modified. An explanation of the modification will be found in the Case Narrative. A result is given with appropriate units. If a soil sample is dry-weight corrected then the word "dry" will appear next to the units. If the word "dry" does not appear then the result is "as received."

The Method Reporting Limit (MRL) and Method Detection Limit (MDL) are provided. It is important to understand these terms. The MRL is a level that has been empirically verified to provide reliable quantitation of results. Results that are equal to or greater than this value will show up as bolded. They are considered "hits." The MDL is a statistically derived number that indicates, with high confidence, that an analyte can be detected above noise level. If a result is less than this value it is marked as "ND" for "Non-Detect." If a result is less than the MRL but greater than the MDL then it is considered an estimate. Such a result is reported with a "J" flag denoting that it has been detected but that the result is an estimate. This is consistent with the *CLP Statement of Work* and the *National Functional Guidelines.*

The Quality Control (QC) samples are documented in the following section. Here you will find the preparation batches associated with each sample from the results section. The sample preparation method is also defined here. Accuracy is represented here in terms of a percent recovery as compared to a known value. Precision is represented as a relative percent difference between two duplicate sample aliquots. The laboratory control limits are provided as a means to evaluate the quality control data. If the result falls outside the laboratory control limits this simply means that it is outside what is typical for the laboratory and is noted accordingly. This does not mean that the data is invalid. Laboratory control limits are generally tighter than most program limits. This is a very important distinction. How the data is ultimately used determines its validity. Program requirements are defined in the Quality Assurance Project Plan (QAPP) governing the project. If your project manager is aware of your specific program requirements then a note will be made in the case narrative if the data fails to meet any of these requirements.

The last section contains copies of important documents and/or instrument printouts relavent to the report. This includes the chain of custody. It also may include items like chromatograms or spectra.

Please note that this report is paginated and must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Qualifiers and Abbreviations

vn	The surrogate recovery is below the laboratory generated control limits.
vfa	The method reporting limit (MRL) was raised for one or more analytes; a dilution of the sample was necessary due to high analyte levels and/or matrix interferences.
ts	This analysis was performed by a subcontract laboratory.
sk	The surrogate recovery is outside of laboratory control limits due to matrix interference.
S-01	The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interferences.
J	Detected but below the Method Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag).
ib	Unidentified compounds are present in the sample.
ia	The back section of the sample tube contained greater than 10 percent of the amount collected on the front section. This indicates possible analyte breakthrough (loss) during field sampling.
gp	The relative percent difference (RPD) for the laboratory control sample and laboratory control sample duplicate is outside of laboratory control limits.
B	Analyte is found in the associated blank as well as in the sample (CLP B-flag).
A5	The MDL value for this analyte is an estimated value; no statistical value has been determined.
A2	The Laboratory Control Sample recovered at 69.6%, which is outside the laboratory limits of 70-130%.
A1a	The Laboratory Control Sample recovery is 74.3%, which is below the laboratory limits of 75-125%.
A1	The Laboratory Control Sample and Laboratory Control Sample Duplicate for the filters recovered at 141% and 143%. These are outside the laboratory limits of 70-130%.
COC	Chain of Custody
dry	Sample results reported on a dry weight basis
MDL	Method Detection Limit
MRL	Method Reporting Limit
NA	Not Applicable
ND	Analyte NOT DETECTED
NR	Not Reported
%Rec	Percent Recovery
RPD	Relative Percent Difference
VOC	Volatile Organic Compound

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
NSP-1-10Q-VOC-3-032307	0701628-01	Soil	03/23/07 09:10	03/26/07 14:09
NSP-1-10Q-PAH-3-032307	0701628-02	Soil	03/23/07 09:10	03/26/07 14:09
NSP-1-1M-PAH-1-032307	0701628-03	Soil	03/23/07 09:20	03/26/07 14:09
NSP-1-1M-TSS-7-032307	0701628-04	Slurry	03/23/07 09:40	03/26/07 14:09
NSP-1-1M-TOC-7-032307	0701628-05	Slurry	03/23/07 09:40	03/26/07 14:09
NSP-1-1M-VOC-1-032307	0701628-06	Soil	03/23/07 09:55	03/26/07 14:09
NSP-1-10Q-PAH-4-032307	0701628-07	Water	03/23/07 11:20	03/26/07 14:09
NSP-1-10Q-VOC-4-032307	0701628-08	Slurry	03/23/07 11:20	03/26/07 14:09
NSP-1-1M-PAH-2-032307 Front	0701628-09	Air Tube	03/23/07 11:40	03/26/07 14:09
NSP-1-1M-VOC-2-032307 Front	0701628-11	Air Tube	03/23/07 11:40	03/26/07 14:09
NSP-1-1M-PAH-5-032307 Front	0701628-13	Air Tube	03/23/07 15:44	03/26/07 14:09
NSP-1-1M-VOC-5-032307 Front	0701628-15	Air Tube	03/23/07 15:44	03/26/07 14:09
NSP-1-1M-PAH-6-032407 Front	0701628-17	Air Tube	03/24/07 07:48	03/26/07 14:09
NSP-1-1M-VOC-6-032407 Front	0701628-19	Air Tube	03/24/07 07:48	03/26/07 14:09
NSP-1-1M-VOC-6-032407 Back	0701628-20	Air Tube	03/24/07 07:48	03/26/07 14:09
NSP-1-1M-VOC-8-032407	0701628-21	Slurry	03/24/07 08:10	03/26/07 14:09
NSP-1-1M-PAH-8-032407 Total	0701628-22	Water	03/24/07 08:00	03/26/07 14:09
NSP-1-1M-PAH-8-032407 dissolved	0701628-23	Water	03/24/07 08:00	03/26/07 14:09
NSP-1-1M-TSS-8-032407	0701628-24	Slurry	03/24/07 08:10	03/26/07 14:09
NSP-1-1M-TOC-8-032407	0701628-25	Slurry	03/24/07 08:10	03/26/07 14:09
NSP-1-1M-DOC-8-032407	0701628-26	Slurry	03/24/07 08:10	03/26/07 14:09
NSP-1-1M-VOC-3-032407	0701628-27	Soil	03/24/07 08:50	03/26/07 14:09
NSP-1-1M-PAH-3-032407	0701628-28	Soil	03/24/07 08:50	03/26/07 14:09
NSP-1-1M-VOC-4-032407	0701628-29	Slurry	03/24/07 09:45	03/26/07 14:09
NSP-1-1M-PAH-4-032407	0701628-30	Water	03/24/07 09:45	03/26/07 14:09
Trip Blanks (DI)	0701628-31	Water	03/24/07 00:00	03/26/07 14:09
Trip Blank (MeOH)	0701628-32	Soil	03/24/07 00:00	03/26/07 14:09
NSP-2A-10Q-PAH-1-032607	0701628-33	Soil	03/26/07 09:30	03/26/07 14:09

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-1-032607	0701628-34	Soil	03/26/07 09:45	03/26/07 14:09
NSP-2A-10Q-TOC-7-032607	0701628-35	Slurry	03/26/07 10:00	03/26/07 14:09

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Conditions Upon Receipt

Cooler: Cooler #1

Temperature:	1.5 °C	**Received on Ice:**	Yes	**Preservation Confirmed:**	Yes
COC Included:	Yes	**Hand Delivered by Sampler:**	No	**Temperature Blank:**	Yes
Custody Seals Used:	No	**Sufficient Sample Provided:**	Yes	**COC Complete:**	Yes
Custody Seals Intact:	NA	**Headspace Present (VOC):**	No	**COC & Labels Agree:**	Yes

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-VOC-3-032307

0701628-01 (Soil)

3/23/07 9:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**74**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**1.8**	1.4	0.043	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	**4.2**	1.4	0.095	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.4	0.13	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.4	0.16	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Benzene	ND	1.4	0.060	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	3.4	0.076	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Ethylbenzene	ND	1.4	0.14	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
m,p-Xylenes	**2.6**	1.4	0.17	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
o-Xylene	ND	1.4	0.19	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	1.4	0.057	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Styrene	ND	1.4	0.062	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Toluene	ND	1.4	0.23	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Trichloroethene	ND	1.4	0.10	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*94.0 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.8 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*100 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-PAH-3-032307

0701628-02 (Soil)

3/23/07 9:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**72**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**79**	3.5	0.57	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**7.7**	0.70	0.083	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**10**	0.70	0.083	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**40**	3.5	0.52	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**110**	3.5	1.2	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Acenaphthene	**27**	0.70	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Acenaphthylene	**4.9**	0.70	0.073	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Anthracene	**27**	0.70	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benz(a)anthracene	**11**	0.70	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**8.5**	0.70	0.083	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**4.4**	0.70	0.18	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**4.6**	0.70	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**1.7**	0.70	0.062	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**5.7**	0.70	0.15	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Biphenyl	**11**	0.70	0.12	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Chrysene	**10**	0.70	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	0.66 J	0.70	0.22	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Fluoranthene	**28**	3.5	0.36	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Fluorene	**44**	3.5	0.21	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**1.8**	0.70	0.093	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Naphthalene	**94**	3.5	0.26	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Perylene	**1.2**	0.70	0.11	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Phenanthrene	**110**	3.5	0.42	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Pyrene	**20**	0.70	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*79.2 %*	*Limits: 30-104%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*56.0 %*	*Limits: 30-90%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*76.3 %*	*Limits: 30-115%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-1-032307

0701628-03 (Soil)

3/23/07 9:20

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**70**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**56**	1.4	0.23	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
1-Methylphenanthrene	**19**	1.4	0.17	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**12**	1.4	0.17	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**53**	1.4	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2-Methylnaphthalene	**170**	14	4.8	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Acenaphthene	**45**	1.4	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Acenaphthylene	**6.9**	1.4	0.15	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Anthracene	**32**	1.4	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benz(a)anthracene	**14**	1.4	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**11**	1.4	0.17	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**5.3**	1.4	0.36	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**6.1**	1.4	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**3.3**	1.4	0.13	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**8.0**	1.4	0.29	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Biphenyl	**14**	1.4	0.25	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Chrysene	**14**	1.4	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	1.1 J	1.4	0.44	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Fluoranthene	**34**	1.4	0.15	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Fluorene	**51**	14	0.84	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**3.1**	1.4	0.19	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Naphthalene	**120**	14	1.1	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Perylene	**1.6**	1.4	0.23	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Phenanthrene	**130**	14	1.7	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Pyrene	**30**	1.4	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*81.7 %*	*Limits: 30-104%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*54.1 %*	*Limits: 30-90%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*61.1 %*	*Limits: 30-115%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-TSS-7-032307

0701628-04 (Slurry)

3/23/07 9:40

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**740**	10	3.6	mg/L	B7D0002	3/30/07	3/30/07	EPA 160.2	
Total Solids	**750**	20	1.0	mg/L	B7C0486	3/29/07	3/29/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-TOC-7-032307

0701628-05 (Slurry)

3/23/07 9:40

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	7.0 J	15	5.0	mg/L	B7D0048	4/2/07	4/2/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-1-032307

0701628-06 (Soil)

3/23/07 9:55

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**69**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**4.0**	1.5	0.047	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	**11**	1.5	0.10	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	**3.1**	1.5	0.14	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.5	0.17	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Benzene	ND	1.5	0.064	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	3.6	0.081	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Ethylbenzene	**3.3**	1.5	0.15	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
m,p-Xylenes	**7.6**	1.5	0.18	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
o-Xylene	**4.1**	1.5	0.20	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	1.5	0.061	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Styrene	ND	1.5	0.067	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Toluene	ND	1.5	0.25	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Trichloroethene	ND	1.5	0.11	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*94.8 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*99.6 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-PAH-4-032307

0701628-07 (Water)

3/23/07 11:20

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**1000**	50	36	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
1-Methylphenanthrene	36 J	50	18	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2,6-Dimethylnaphthalene	**230**	50	35	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2-Methylnaphthalene	**1200**	500	28	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Acenaphthene	**310**	10	1.9	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Acenaphthylene	**13**	10	2.1	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Anthracene	**14**	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benz(a)anthracene	**10**	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(a)pyrene	9.8 J	10	2.1	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(b)fluoranthene	7.6 J	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(e)pyrene	7.2 J	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(g,h,i)perylene	8.3 J	10	5.6	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(k)fluoranthene	**11**	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Biphenyl	**180**	50	36	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Chrysene	**19**	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Fluoranthene	**72**	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Fluorene	**300**	10	2.1	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	6.9 J	10	2.5	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Naphthalene	**2400**	500	19	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Perylene	ND	20	11	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Phenanthrene	**430**	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Pyrene	**50**	10	5.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Surrogate: 2-Fluorobiphenyl	*98.8 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*136 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	*sk*
Surrogate: Terphenyl-d14	*121 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	*sk*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-10Q-VOC-4-032307

0701628-08 (Slurry)

3/23/07 11:20

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*103 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*100 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*110 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-2-032307 Front

0701628-09 (Air Tube)

3/23/07 11:40

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	5.29		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
2-Methylnaphthalene	ND	5.26		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthene	ND	11.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthylene	ND	10.1		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Anthracene	ND	11.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benz(a)anthracene	ND	5.94		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(a)pyrene	ND	6.28		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	6.21		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	15.3		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	6.29		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Chrysene	ND	5.96		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	64.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A1, gp
Fluoranthene	ND	11.4		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Fluorene	ND	10.8		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	6.75		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A2, gp
Naphthalene	**7.80**	5.52		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Phenanthrene	ND	11.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Pyrene	ND	11.5		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-2-032307 Front

0701628-11 (Air Tube)

3/23/07 11:40

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	10.1		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**11.6**	9.85		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	9.58		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	11.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**22.3**	9.87		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	ND	20.3		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	ND	19.5		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	ND	13.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**54.0**	10.0		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	ND	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	ND	19.9		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-5-032307 Front

0701628-13 (Air Tube)

3/23/07 15:44

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	2.65		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
2-Methylnaphthalene	ND	2.63		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthene	ND	5.50		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthylene	ND	5.07		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Anthracene	ND	5.48		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benz(a)anthracene	ND	2.97		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(a)pyrene	ND	3.14		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	3.10		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	7.67		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	3.14		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Chrysene	ND	2.98		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	32.0		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A1, gp
Fluoranthene	ND	5.68		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Fluorene	ND	5.40		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	3.37		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A2, gp
Naphthalene	**5.20**	2.76		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Phenanthrene	ND	5.52		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Pyrene	ND	5.77		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-5-032307 Front

0701628-15 (Air Tube)

3/23/07 15:44

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	5.03		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**12.9**	4.93		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	4.79		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	5.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**20.8**	4.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Carbon Tetrachloride	**21.2**	10.2		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	ND	9.76		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	4.88		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	ND	6.51		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**48.8**	5.02		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**7.08**	4.97		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**38.1**	9.94		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-6-032407 Front

0701628-17 (Air Tube)

3/24/07 7:48

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**2.04**	0.662		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
2-Methylnaphthalene	**4.28**	0.658		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthene	ND	1.38		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Acenaphthylene	ND	1.27		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Anthracene	ND	1.37		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benz(a)anthracene	ND	0.743		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(a)pyrene	ND	0.785		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(b)fluoranthene	ND	0.776		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Benzo(g,h,i)perylene	ND	1.92		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	gp
Benzo(k)fluoranthene	ND	0.786		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Chrysene	ND	0.746		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Dibenz(a,h)anthracene	ND	8.00		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A1, gp
Fluoranthene	ND	1.42		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Fluorene	ND	1.35		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Indeno(1,2,3-cd)pyrene	ND	0.844		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	A2, gp
Naphthalene	**3.24**	0.689		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Phenanthrene	ND	1.38		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	
Pyrene	ND	1.44		ug/m³	[CALC]	4/5/07	4/6/07	NIOSH 5506	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-6-032407 Front

0701628-19 (Air Tube)

3/24/07 7:48

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**2.36**	1.26		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ib
1,2,4-Trimethylbenzene	**9.22**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,3,5-Trimethylbenzene	**2.69**	1.20		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Benzene	**11.6**	1.23		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	ia
Carbon Tetrachloride	**11.7**	2.54		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Ethyl Benzene	**4.99**	2.44		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Styrene	**2.92**	1.63		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Toluene	**31.8**	1.25		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Trichloroethene	**2.94**	1.24		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	
Xylenes, Total	**24.4**	2.49		ug/m³	[CALC]	4/11/07	4/12/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-6-032407 Back

0701628-20 (Air Tube)

3/24/07 7:48

Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.26		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	ib
1,2,4-Trimethylbenzene	ND	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,3,5-Trimethylbenzene	ND	1.20		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
1,4-Dichlorobenzene	ND	1.44		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Benzene	**1.26**	1.23		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Carbon Tetrachloride	ND	12.7		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Ethyl Benzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
sec-Butylbenzene	ND	1.22		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Styrene	ND	1.63		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	A1a
Toluene	ND	1.25		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Trichloroethene	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	
Xylenes, Total	ND	1.24		ug/m³	[CALC]	4/23/07	4/23/07	IH VOCS	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-8-032407

0701628-21 (Slurry)

3/24/07 8:10

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**4.2**	1.0	0.069	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
1,2,4-Trimethylbenzene	**3.4**	1.0	0.030	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
1,3,5-Trimethylbenzene	**2.2**	1.0	0.039	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
m,p-Xylenes	**1.8**	1.0	0.059	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
o-Xylene	**1.4**	1.0	0.072	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0496	3/29/07	3/30/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/30/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*98.4 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/30/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*110 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/30/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*104 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/30/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-8-032407 Total

0701628-22 (Water)

3/24/07 8:00

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	4.2 J	25	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	**27**	25	1.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	9.6 J	25	2.8	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	**28**	25	2.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	4.4 J	25	2.0	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthene	**66**	10	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Acenaphthylene	**14**	10	0.94	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Anthracene	**32**	10	1.0	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benz(a)anthracene	**28**	10	3.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	**26**	10	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	**30**	25	2.1	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	**25**	25	4.0	ug/L	B7C0455	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**11**	10	3.4	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	**18**	10	3.7	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Biphenyl	1.5 J	25	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Chrysene	**29**	10	3.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	20 J	25	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Fluoranthene	**55**	10	1.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Fluorene	9.4 J	10	2.3	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	23 J	25	3.9	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Naphthalene	6.4 J	25	1.6	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Perylene	3.7 J	25	1.4	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Phenanthrene	**20**	10	1.0	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Pyrene	**80**	10	2.5	ug/L	B7C0455	3/28/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*74.5 %*	*Limits: 59-101%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*61.1 %*	*Limits: 57-101%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*88.0 %*	*Limits: 65-100%*			*B7C0455*	*3/28/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-8-032407 dissolved

0701628-23 (Water)

3/24/07 8:00

Semivolatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	20	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
1-Methylphenanthrene	ND	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	20	2.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2,6-Dimethylnaphthalene	4.6 J	20	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
2-Methylnaphthalene	ND	20	1.6	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthene	**22**	8.0	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Acenaphthylene	2.6 J	8.0	0.75	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Anthracene	ND	8.0	0.83	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benz(a)anthracene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(a)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(b)fluoranthene	ND	8.0	1.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(e)pyrene	ND	20	3.2	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	A5
Benzo(g,h,i)perylene	ND	8.0	2.7	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Benzo(k)fluoranthene	ND	8.0	3.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Biphenyl	ND	20	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Chrysene	ND	8.0	2.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Dibenz(a,h)anthracene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluoranthene	ND	8.0	1.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Fluorene	ND	8.0	1.8	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	ND	8.0	3.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Naphthalene	1.6 J	20	1.3	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Perylene	ND	20	1.1	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Phenanthrene	ND	8.0	0.82	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Pyrene	ND	8.0	2.0	ug/L	B7C0494	3/30/07	4/5/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*73.3 %*	*Limits: 59-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*63.3 %*	*Limits: 57-101%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*89.8 %*	*Limits: 65-100%*			*B7C0494*	*3/30/07*	*4/5/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-TSS-8-032407

0701628-24 (Slurry)

3/24/07 8:10

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Suspended Solids	**91**	10	3.6	mg/L	B7D0002	3/30/07	3/30/07	EPA 160.2	
Total Solids	**510**	20	1.0	mg/L	B7C0486	3/29/07	3/29/07	EPA 160.3	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-TOC-8-032407

0701628-25 (Slurry)

3/24/07 8:10

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	9.0 J	15	5.0	mg/L	B7D0048	4/2/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-DOC-8-032407

0701628-26 (Slurry)

3/24/07 8:10

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Dissolved Organic Carbon	**5.7**	1.5	0.50	mg/L	B7D0048	3/28/07	3/28/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-3-032407

0701628-27 (Soil)

3/24/07 8:50

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**69**	0.050	0.010	% Wt	B7C0415	3/26/07	3/26/07	EPA 3545 7.2	

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**0.16**	0.072	0.0023	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,2,4-Trimethylbenzene	**0.39**	0.072	0.0051	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,3,5-Trimethylbenzene	**0.12**	0.072	0.0071	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.072	0.0087	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Benzene	ND	0.072	0.0032	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Carbon Tetrachloride	ND	0.18	0.0040	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Ethylbenzene	**0.16**	0.072	0.0076	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
m,p-Xylenes	**0.20**	0.072	0.0091	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
o-Xylene	**0.099**	0.072	0.010	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
sec-Butylbenzene	ND	0.072	0.0030	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Styrene	ND	0.072	0.0033	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Toluene	ND	0.072	0.012	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Trichloroethene	ND	0.072	0.0053	mg/kg dry	B7D0021	3/30/07	4/3/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*94.4 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*98.8 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*101 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*4/3/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-3-032407

0701628-28 (Soil)

3/24/07 8:50

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**74**	0.050	0.010	% Wt	B7C0460	3/28/07	3/29/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**9.1**	0.68	0.11	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
1-Methylphenanthrene	**6.6**	0.68	0.081	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**1.8**	0.68	0.081	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2,6-Dimethylnaphthalene	**6.2**	0.68	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
2-Methylnaphthalene	**9.9**	0.68	0.23	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Acenaphthene	**9.3**	0.68	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Acenaphthylene	**1.1**	0.68	0.071	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Anthracene	**5.9**	0.68	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benz(a)anthracene	**2.6**	0.68	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(a)pyrene	**2.1**	0.68	0.081	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(b)fluoranthene	**1.1**	0.68	0.17	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(e)pyrene	**1.1**	0.68	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**0.73**	0.68	0.061	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Benzo(k)fluoranthene	**1.4**	0.68	0.14	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Biphenyl	**1.5**	0.68	0.12	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Chrysene	**2.7**	0.68	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Dibenz(a,h)anthracene	0.21 J	0.68	0.21	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Fluoranthene	**6.5**	0.68	0.071	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Fluorene	**7.0**	0.68	0.041	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	0.62 J	0.68	0.091	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Naphthalene	**7.7**	0.68	0.051	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Perylene	0.34 J	0.68	0.11	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Phenanthrene	**19**	0.68	0.081	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Pyrene	**7.8**	0.68	0.10	mg/kg dry	B7C0446	3/28/07	4/11/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*85.2 %*	*Limits: 30-104%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*52.0 %*	*Limits: 30-90%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*71.6 %*	*Limits: 30-115%*			*B7C0446*	*3/28/07*	*4/11/07*	*EPA 8270C*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-VOC-4-032407

0701628-29 (Slurry)

3/24/07 9:45

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*101 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*99.6 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*110 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*102 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-1-1M-PAH-4-032407

0701628-30 (Water)

3/24/07 9:45

Polyaromatic Hydrocarbons by Selected Ion Monitoring

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**410**	53	38	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
1-Methylphenanthrene	ND	53	19	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	ND	53	35	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2,6-Dimethylnaphthalene	**94**	53	37	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
2-Methylnaphthalene	**320**	53	3.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Acenaphthene	**190**	11	2.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Acenaphthylene	7.0 J	11	2.2	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Anthracene	**260**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benz(a)anthracene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(a)pyrene	2.9 J	11	2.2	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(b)fluoranthene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(e)pyrene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(g,h,i)perylene	ND	11	6.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Benzo(k)fluoranthene	ND	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Biphenyl	**62**	53	39	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Chrysene	8.6 J	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Dibenz(a,h)anthracene	**17**	11	3.7	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Fluoranthene	**50**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Fluorene	**110**	11	2.2	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Indeno(1,2,3-cd)pyrene	5.4 J	11	2.7	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Naphthalene	**350**	53	2.0	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Perylene	ND	21	12	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	
Phenanthrene	**220**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Pyrene	**35**	11	5.3	ng/L	B7C0481	3/29/07	4/3/07	EPA 8270C	B
Surrogate: 2-Fluorobiphenyl	*92.9 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*118 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*121 %*	*Limits: 30-120%*			*B7C0481*	*3/29/07*	*4/3/07*	*EPA 8270C*	*sk*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blanks (DI)

0701628-31 (Water)

3/24/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Benzene	ND	1.0	0.042	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Carbon Tetrachloride	ND	1.0	0.050	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Ethylbenzene	ND	1.0	0.036	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
m,p-Xylenes	ND	1.0	0.059	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
o-Xylene	ND	1.0	0.072	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
sec-Butylbenzene	ND	1.0	0.027	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Styrene	ND	1.0	0.049	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Toluene	ND	1.0	0.048	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Trichloroethene	ND	1.0	0.067	ug/L	B7C0496	3/29/07	3/29/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*98.8 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*108 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*104 %*	*Limits: 80-120%*			*B7C0496*	*3/29/07*	*3/29/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Trip Blank (MeOH)

0701628-32 (Soil)

3/24/07 0:00

Volatile Organic Compounds

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
Benzene	ND	0.050	0.0022	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
Carbon Tetrachloride	ND	0.12	0.0028	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
Ethylbenzene	ND	0.050	0.0053	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
o-Xylene	ND	0.050	0.0070	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
Styrene	ND	0.050	0.0023	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
Toluene	ND	0.050	0.0086	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
Trichloroethene	ND	0.050	0.0037	mg/kg	B7D0021	3/30/07	3/30/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*100 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*96.0 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*109 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*104 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-PAH-1-032607

0701628-33 (Soil)

3/26/07 9:30

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**48**	0.050	0.010	% Wt	B7C0460	3/28/07	3/29/07	EPA 3545 7.2	

Semivolatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	**330**	10	1.7	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
1-Methylphenanthrene	**81**	10	1.2	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
2,3,5-Trimethylnaphthalene	**47**	10	1.2	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
2,6-Dimethylnaphthalene	**210**	10	1.5	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
2-Methylnaphthalene	**660**	100	35	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Acenaphthene	**260**	10	1.5	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Acenaphthylene	**24**	10	1.1	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Anthracene	**170**	10	1.5	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Benz(a)anthracene	**53**	10	1.5	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Benzo(a)pyrene	**44**	10	1.2	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Benzo(b)fluoranthene	**24**	10	2.6	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Benzo(e)pyrene	**380**	10	1.5	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	A5
Benzo(g,h,i)perylene	**18**	10	0.92	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Benzo(k)fluoranthene	**32**	10	2.1	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Biphenyl	**54**	10	1.8	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Chrysene	**56**	10	1.5	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Dibenz(a,h)anthracene	5.0 J	10	3.2	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Fluoranthene	**140**	10	1.1	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Fluorene	**210**	10	0.61	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Indeno(1,2,3-cd)pyrene	**15**	10	1.4	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Naphthalene	**650**	100	7.6	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Perylene	6.7 J	10	1.7	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Phenanthrene	**410**	100	12	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Pyrene	**160**	10	1.5	mg/kg dry	B7C0446	3/28/07	4/12/07	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	*84.3 %*	*Limits: 30-104%*			*B7C0446*	*3/28/07*	*4/12/07*	*EPA 8270C*	
Surrogate: Nitrobenzene-d5	*53.9 %*	*Limits: 30-90%*			*B7C0446*	*3/28/07*	*4/12/07*	*EPA 8270C*	
Surrogate: Terphenyl-d14	*0.0 %*	*Limits: 30-115%*			*B7C0446*	*3/28/07*	*4/12/07*	*EPA 8270C*	*S-01*

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-VOC-1-032607

0701628-34 (Soil)

3/26/07 9:45

Classical Chemistry Parameters

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
% Solids	**50**	0.050	0.010	% Wt	B7C0460	3/28/07	3/29/07	EPA 3545 7.2	

Volatile Organic Compounds

vfa

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
1,2,3-Trimethylbenzene	**13**	5.0	0.16	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
1,2,4-Trimethylbenzene	**30**	5.0	0.35	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
1,3,5-Trimethylbenzene	**7.3**	5.0	0.49	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
1,4-Dichlorobenzene	ND	5.0	0.60	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
Benzene	ND	5.0	0.22	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
Carbon Tetrachloride	ND	13	0.28	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
Ethylbenzene	**49**	5.0	0.53	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
m,p-Xylenes	**34**	5.0	0.63	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
o-Xylene	**18**	5.0	0.70	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
sec-Butylbenzene	ND	5.0	0.21	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
Styrene	ND	5.0	0.23	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
Toluene	**14**	5.0	0.87	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
Trichloroethene	ND	5.0	0.37	mg/kg dry	B7D0021	3/30/07	3/30/07	EPA 8260B	
Surrogate: 1,2-Dichloroethane-d4	*102 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	
Surrogate: 4-Bromofluorobenzene	*100 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	
Surrogate: Dibromofluoromethane	*110 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	
Surrogate: Toluene-d8	*103 %*	*Limits: 80-120%*			*B7D0021*	*3/30/07*	*3/30/07*	*EPA 8260B*	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

NSP-2A-10Q-TOC-7-032607

0701628-35 (Slurry)

3/26/07 10:00

Subcontracted to ERA Laboratories, Inc. (MDH # 027-137-152)

Analyte	Result	MRL	MDL	Units	Batch	Prepared	Analyzed	Method	Notes
Total Organic Carbon	**150**	80	30	mg/L	B7D0048	4/2/07	4/3/07	EPA 415.1	ts

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7C0415 - Default Prep GenChem

Method Blank (B7C0415-BLK1) Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Duplicate (B7C0415-DUP1) **Source: 0701628-27** Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	68.9	0.050	0.010	% Wt	NA	69	NA	NA	0.145	20	

Standard Reference Material (B7C0415-SRM1) Prepared & Analyzed: 03/26/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	91.1			% Wt	88.8	NA	103	90-110	NA	NA	

Batch B7C0460 - % Solids

Method Blank (B7C0460-BLK1) Prepared: 03/28/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	ND	0.050	0.010	% Wt	NA	NA	NA	NA	NA	NA	

Duplicate (B7C0460-DUP1) **Source: 0701661-01** Prepared: 03/28/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	97.7	0.050	0.010	% Wt	NA	98	NA	NA	0.307	20	

Standard Reference Material (B7C0460-SRM1) Prepared: 03/28/07 Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
% Solids	89.9			% Wt	88.8	NA	101	90-110	NA	NA	

Batch B7C0486 - Default Prep GenChem

Method Blank (B7C0486-BLK1) Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	ND	20	1.0	mg/L	NA	NA	NA	NA	NA	NA	

Duplicate (B7C0486-DUP1) **Source: 0701595-21** Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Classical Chemistry Parameters - Quality Control

Batch B7C0486 - Default Prep GenChem

Duplicate (B7C0486-DUP1) **Source: 0701595-21** Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Solids	1240	20	1.0	mg/L	NA	1100	NA	NA	12.0	20	

Batch B7D0002 - Default Prep GenChem

Method Blank (B7D0002-BLK1) Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	ND	10	3.6	mg/L	NA	NA	NA	NA	NA	NA	

Laboratory Control Sample (B7D0002-BS1) Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	268			mg/L	250	NA	107	80-120	NA	NA	

Duplicate (B7D0002-DUP1) **Source: 0701627-01** Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Total Suspended Solids	84.0	10	3.6	mg/L	NA	70	NA	NA	18.2	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0446 - EPA 3545

Method Blank (B7C0446-BLK1) Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	0.144	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	0.0359 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	0.312	0.067	0.023	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthene	0.0443 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Acenaphthylene	0.0359 J	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	0.067	0.017	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	0.00	0.067		mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	0.067	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	0.067	0.014	mg/kg	NA	NA	NA	NA	NA	NA	
Biphenyl	0.0210 J	0.067	0.012	mg/kg	NA	NA	NA	NA	NA	NA	
Chrysene	ND	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	0.067	0.021	mg/kg	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	0.067	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
Fluorene	0.0176 J	0.067	0.0040	mg/kg	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	0.067	0.0090	mg/kg	NA	NA	NA	NA	NA	NA	
Naphthalene	0.606	0.067	0.0050	mg/kg	NA	NA	NA	NA	NA	NA	
Perylene	ND	0.067	0.011	mg/kg	NA	NA	NA	NA	NA	NA	
Phenanthrene	0.0639 J	0.067	0.0080	mg/kg	NA	NA	NA	NA	NA	NA	
Pyrene	0.0303 J	0.067	0.010	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.572*			mg/kg	*0.832*	*NA*	*68.8*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.416*			mg/kg	*0.832*	*NA*	*50.0*	*30-90*			
Surrogate: Terphenyl-d14	*0.722*			mg/kg	*0.832*	*NA*	*86.8*	*30-115*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0446 - EPA 3545

Laboratory Control Sample (B7C0446-BS1) Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	NA	NA	
Pyrene	1.18	0.067	0.010	mg/kg	1.67	NA	70.7	50-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*0.630*			mg/kg	*0.833*	*NA*	*75.6*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.416*			mg/kg	*0.833*	*NA*	*49.9*	*30-90*			
Surrogate: Terphenyl-d14	*0.728*			mg/kg	*0.833*	*NA*	*87.4*	*30-115*			

Laboratory Control Sample Duplicate (B7C0446-BSD1) Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	1.26	0.067	0.010	mg/kg	1.67	NA	75.4	50-115	0.00	25	
Pyrene	1.23	0.067	0.010	mg/kg	1.67	NA	73.7	50-130	4.15	25	
Surrogate: 2-Fluorobiphenyl	*0.682*			mg/kg	*0.833*	*NA*	*81.9*	*30-104*			
Surrogate: Nitrobenzene-d5	*0.472*			mg/kg	*0.833*	*NA*	*56.7*	*30-90*			
Surrogate: Terphenyl-d14	*0.737*			mg/kg	*0.833*	*NA*	*88.5*	*30-115*			

Matrix Spike (B7C0446-MS1) **Source: 0701628-03** Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	87.5	2.8	0.42	mg/kg dry	3.54	45	NR	30-115	NA	NA	
Pyrene	60.5	2.8	0.42	mg/kg dry	3.54	30	862	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*3.04*			mg/kg dry	*1.77*	*NA*	*172*	*30-104*			
Surrogate: Nitrobenzene-d5	*2.16*			mg/kg dry	*1.77*	*NA*	*122*	*30-90*			
Surrogate: Terphenyl-d14	*2.29*			mg/kg dry	*1.77*	*NA*	*129*	*30-115*			

Matrix Spike Duplicate (B7C0446-MSD1) **Source: 0701628-03** Prepared: 03/28/07 Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	95.5	2.8	0.42	mg/kg dry	3.53	45	NR	30-115	8.74	30	
Pyrene	67.7	2.8	0.42	mg/kg dry	3.53	30	NR	30-130	11.2	35	
Surrogate: 2-Fluorobiphenyl	*3.11*			mg/kg dry	*1.77*	*NA*	*176*	*30-104*			
Surrogate: Nitrobenzene-d5	*2.18*			mg/kg dry	*1.77*	*NA*	*123*	*30-90*			
Surrogate: Terphenyl-d14	*2.50*			mg/kg dry	*1.77*	*NA*	*141*	*30-115*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0455 - EPA 3510C

Method Blank (B7C0455-BLK1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	5.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	5.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*18.7*			ug/L	*25.0*	*NA*	*74.8*	*59-101*			
Surrogate: Nitrobenzene-d5	*16.5*			ug/L	*25.0*	*NA*	*66.0*	*57-101*			
Surrogate: Terphenyl-d14	*23.2*			ug/L	*25.0*	*NA*	*92.8*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0455 - EPA 3510C

Laboratory Control Sample (B7C0455-BS1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	39.0	2.0	0.26	ug/L	50.0	NA	78.0	50-110	NA	NA	
Pyrene	49.5	2.0	0.50	ug/L	50.0	NA	99.0	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*17.3*			ug/L	*25.0*	*NA*	*69.2*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*21.6*			ug/L	*25.0*	*NA*	*86.4*	*65-100*			

Laboratory Control Sample Duplicate (B7C0455-BSD1) Prepared: 03/28/07 Analyzed: 04/04/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	36.8	2.0	0.26	ug/L	50.0	NA	73.6	50-110	5.80	20	
Pyrene	49.0	2.0	0.50	ug/L	50.0	NA	98.0	55-120	1.02	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*22.2*			ug/L	*25.0*	*NA*	*88.8*	*65-100*			

Matrix Spike (B7C0455-MS1) **Source: 0701628-22** Prepared: 03/28/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	261	10	1.3	ug/L	250	66	78.0	30-130	NA	NA	
Pyrene	339	10	2.5	ug/L	250	80	104	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*73.8*			ug/L	*125*	*NA*	*59.0*	*59-101*			
Surrogate: Nitrobenzene-d5	*60.5*			ug/L	*125*	*NA*	*48.4*	*57-101*			
Surrogate: Terphenyl-d14	*98.8*			ug/L	*125*	*NA*	*79.0*	*65-100*			

Matrix Spike Duplicate (B7C0455-MSD1) **Source: 0701628-22** Prepared: 03/28/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	289	10	1.3	ug/L	250	66	89.2	30-130	10.2	30	
Pyrene	359	10	2.5	ug/L	250	80	112	30-130	5.73	30	
Surrogate: 2-Fluorobiphenyl	*78.4*			ug/L	*125*	*NA*	*62.7*	*59-101*			
Surrogate: Nitrobenzene-d5	*63.8*			ug/L	*125*	*NA*	*51.0*	*57-101*			
Surrogate: Terphenyl-d14	*101*			ug/L	*125*	*NA*	*80.8*	*65-100*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Method Blank (B7C0494-BLK1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	5.0	0.25	ug/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	5.0	0.57	ug/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	5.0	0.51	ug/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	5.0	0.39	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	ND	2.0	0.19	ug/L	NA	NA	NA	NA	NA	NA	
Anthracene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	2.0	0.71	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	2.0	0.77	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	2.0	0.42	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	5.0	0.80	ug/L	NA	NA	NA	NA	NA	NA	A5
Benzo(g,h,i)perylene	ND	2.0	0.67	ug/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	2.0	0.75	ug/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	5.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	2.0	0.70	ug/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	2.0	0.26	ug/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	2.0	0.46	ug/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	ND	2.0	0.78	ug/L	NA	NA	NA	NA	NA	NA	
Naphthalene	ND	5.0	0.32	ug/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	5.0	0.28	ug/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	ND	2.0	0.21	ug/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	2.0	0.50	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.4*			ug/L	*25.0*	*NA*	*57.6*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.4*			ug/L	*25.0*	*NA*	*53.6*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*21.8*			ug/L	*25.0*	*NA*	*87.2*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Semivolatile Organic Compounds - Quality Control

Batch B7C0494 - EPA 3510C

Laboratory Control Sample (B7C0494-BS1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	34.9	2.0	0.26	ug/L	50.0	NA	69.8	50-110	NA	NA	
Pyrene	47.3	2.0	0.50	ug/L	50.0	NA	94.6	55-120	NA	NA	
Surrogate: 2-Fluorobiphenyl	*14.6*			ug/L	*25.0*	*NA*	*58.4*	*59-101*			*vn*
Surrogate: Nitrobenzene-d5	*13.1*			ug/L	*25.0*	*NA*	*52.4*	*57-101*			*vn*
Surrogate: Terphenyl-d14	*20.0*			ug/L	*25.0*	*NA*	*80.0*	*65-100*			

Laboratory Control Sample Duplicate (B7C0494-BSD1) Prepared: 03/30/07 Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	38.7	2.0	0.26	ug/L	50.0	NA	77.4	50-110	10.3	20	
Pyrene	48.8	2.0	0.50	ug/L	50.0	NA	97.6	55-120	3.12	20	
Surrogate: 2-Fluorobiphenyl	*16.4*			ug/L	*25.0*	*NA*	*65.6*	*59-101*			
Surrogate: Nitrobenzene-d5	*15.7*			ug/L	*25.0*	*NA*	*62.8*	*57-101*			
Surrogate: Terphenyl-d14	*20.7*			ug/L	*25.0*	*NA*	*82.8*	*65-100*			

Matrix Spike (B7C0494-MS1) **Source: 0701628-23** Prepared: 03/30/07 Analyzed: 04/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	197	8.0	1.0	ug/L	200	22	87.5	30-130	NA	NA	
Pyrene	188	8.0	2.0	ug/L	200	ND	94.0	30-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*83.4*			ug/L	*100*	*NA*	*83.4*	*59-101*			
Surrogate: Nitrobenzene-d5	*63.6*			ug/L	*100*	*NA*	*63.6*	*57-101*			
Surrogate: Terphenyl-d14	*72.8*			ug/L	*100*	*NA*	*72.8*	*65-100*			

Matrix Spike Duplicate (B7C0494-MSD1) **Source: 0701628-23** Prepared: 03/30/07 Analyzed: 04/10/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	195	8.0	1.0	ug/L	200	22	86.5	30-130	1.02	30	
Pyrene	189	8.0	2.0	ug/L	200	ND	94.5	30-130	0.531	30	
Surrogate: 2-Fluorobiphenyl	*82.2*			ug/L	*100*	*NA*	*82.2*	*59-101*			
Surrogate: Nitrobenzene-d5	*63.6*			ug/L	*100*	*NA*	*63.6*	*57-101*			
Surrogate: Terphenyl-d14	*73.2*			ug/L	*100*	*NA*	*73.2*	*65-100*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Method Blank (B7C0481-BLK1) Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	23.3	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	20.4	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	5.29	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	7.18	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	5.23	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	4.72	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	ND	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	6.49	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	10	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	13.1	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	12.9	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	3.80	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	29.0	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	31.8	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	13.9	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*145*			ng/L	*250*	*NA*	*58.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*281*			ng/L	*250*	*NA*	*112*	*30-120*			
Surrogate: Terphenyl-d14	*280*			ng/L	*250*	*NA*	*112*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Laboratory Control Sample (B7C0481-BS1) Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	381	50	36	ng/L	500	NA	76.2	70-130	NA	NA	
1-Methylphenanthrene	488	50	18	ng/L	500	NA	97.6	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	396	50	32	ng/L	500	NA	79.2	70-130	NA	NA	
2,6-Dimethylnaphthalene	401	50	35	ng/L	500	NA	80.2	70-130	NA	NA	
2-Methylnaphthalene	368	50	2.8	ng/L	500	NA	73.6	70-130	NA	NA	
Acenaphthene	395	10	1.9	ng/L	500	NA	79.0	43-120	NA	NA	
Acenaphthylene	376	10	2.1	ng/L	500	NA	75.2	70-130	NA	NA	
Anthracene	450	10	5.0	ng/L	500	NA	90.0	70-130	NA	NA	
Benz(a)anthracene	447	10	5.0	ng/L	500	NA	89.4	70-130	NA	NA	
Benzo(a)pyrene	467	10	2.1	ng/L	500	NA	93.4	75-148	NA	NA	
Benzo(b)fluoranthene	428	10	5.0	ng/L	500	NA	85.6	70-130	NA	NA	
Benzo(e)pyrene	446	10	5.0	ng/L	500	NA	89.2	70-130	NA	NA	
Benzo(g,h,i)perylene	529	10	5.6	ng/L	500	NA	106	70-130	NA	NA	
Benzo(k)fluoranthene	467	10	5.0	ng/L	500	NA	93.4	70-130	NA	NA	
Biphenyl	405	50	36	ng/L	500	NA	81.0	70-130	NA	NA	
Chrysene	444	10	5.0	ng/L	500	NA	88.8	70-130	NA	NA	
Dibenz(a,h)anthracene	480	10	3.5	ng/L	500	NA	96.0	70-130	NA	NA	
Fluoranthene	497	10	5.0	ng/L	500	NA	99.4	67-130	NA	NA	
Fluorene	431	10	2.1	ng/L	500	NA	86.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	547	10	2.5	ng/L	500	NA	109	70-130	NA	NA	
Naphthalene	358	50	1.9	ng/L	500	NA	71.6	70-130	NA	NA	
Perylene	456	20	11	ng/L	500	NA	91.2	70-130	NA	NA	
Phenanthrene	435	10	5.0	ng/L	500	NA	87.0	70-130	NA	NA	
Pyrene	505	10	5.0	ng/L	500	NA	101	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*165*			ng/L	*250*	*NA*	*66.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*299*			ng/L	*250*	*NA*	*120*	*30-120*			
Surrogate: Terphenyl-d14	*290*			ng/L	*250*	*NA*	*116*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Laboratory Control Sample Duplicate (B7C0481-BSD1) Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	404	50	36	ng/L	500	NA	80.8	70-130	5.86	20	
1-Methylphenanthrene	494	50	18	ng/L	500	NA	98.8	70-130	1.22	20	
2,3,5-Trimethylnaphthalene	399	50	32	ng/L	500	NA	79.8	70-130	0.755	20	
2,6-Dimethylnaphthalene	419	50	35	ng/L	500	NA	83.8	70-130	4.39	20	
2-Methylnaphthalene	393	50	2.8	ng/L	500	NA	78.6	70-130	6.57	20	
Acenaphthene	409	10	1.9	ng/L	500	NA	81.8	43-120	3.48	20	
Acenaphthylene	365	10	2.1	ng/L	500	NA	73.0	70-130	2.97	20	
Anthracene	466	10	5.0	ng/L	500	NA	93.2	70-130	3.49	20	
Benz(a)anthracene	464	10	5.0	ng/L	500	NA	92.8	70-130	3.73	20	
Benzo(a)pyrene	488	10	2.1	ng/L	500	NA	97.6	75-148	4.40	20	
Benzo(b)fluoranthene	467	10	5.0	ng/L	500	NA	93.4	70-130	8.72	20	
Benzo(e)pyrene	459	10	5.0	ng/L	500	NA	91.8	70-130	2.87	20	
Benzo(g,h,i)perylene	547	10	5.6	ng/L	500	NA	109	70-130	3.35	20	
Benzo(k)fluoranthene	454	10	5.0	ng/L	500	NA	90.8	70-130	2.82	20	
Biphenyl	407	50	36	ng/L	500	NA	81.4	70-130	0.493	20	
Chrysene	456	10	5.0	ng/L	500	NA	91.2	70-130	2.67	20	
Dibenz(a,h)anthracene	505	10	3.5	ng/L	500	NA	101	70-130	5.08	20	
Fluoranthene	521	10	5.0	ng/L	500	NA	104	67-130	4.72	20	
Fluorene	435	10	2.1	ng/L	500	NA	87.0	70-130	0.924	20	
Indeno(1,2,3-cd)pyrene	571	10	2.5	ng/L	500	NA	114	70-130	4.29	20	
Naphthalene	367	50	1.9	ng/L	500	NA	73.4	70-130	2.48	20	
Perylene	469	20	11	ng/L	500	NA	93.8	70-130	2.81	20	
Phenanthrene	465	10	5.0	ng/L	500	NA	93.0	70-130	6.67	20	
Pyrene	538	10	5.0	ng/L	500	NA	108	70-130	6.33	20	
Surrogate: 2-Fluorobiphenyl	*165*			ng/L	*250*	*NA*	*66.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*277*			ng/L	*250*	*NA*	*111*	*30-120*			
Surrogate: Terphenyl-d14	*295*			ng/L	*250*	*NA*	*118*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Matrix Spike (B7C0481-MS1) **Source: 0701628-07** Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1400	55	39	ng/L	549	1000	72.9	70-130	NA	NA	
1-Methylphenanthrene	589	55	20	ng/L	549	36	101	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	485	55	36	ng/L	549	ND	88.3	70-130	NA	NA	
2,6-Dimethylnaphthalene	688	55	38	ng/L	549	230	83.4	70-130	NA	NA	
2-Methylnaphthalene	1620	55	3.1	ng/L	549	1200	76.5	70-130	NA	NA	
Acenaphthene	730	11	2.1	ng/L	549	310	76.5	43-120	NA	NA	
Acenaphthylene	431	11	2.3	ng/L	549	13	76.1	70-130	NA	NA	
Anthracene	486	11	5.5	ng/L	549	14	86.0	70-130	NA	NA	
Benz(a)anthracene	540	11	5.5	ng/L	549	10	96.5	70-130	NA	NA	
Benzo(a)pyrene	528	11	2.3	ng/L	549	9.8	94.4	75-148	NA	NA	
Benzo(b)fluoranthene	505	11	5.5	ng/L	549	7.6	90.6	70-130	NA	NA	
Benzo(e)pyrene	531	11	5.5	ng/L	549	7.2	95.4	70-130	NA	NA	
Benzo(g,h,i)perylene	630	11	6.2	ng/L	549	8.3	113	70-130	NA	NA	
Benzo(k)fluoranthene	551	11	5.5	ng/L	549	11	98.4	70-130	NA	NA	
Biphenyl	624	55	40	ng/L	549	180	80.9	70-130	NA	NA	
Chrysene	516	11	5.5	ng/L	549	19	90.5	70-130	NA	NA	
Dibenz(a,h)anthracene	566	11	3.8	ng/L	549	ND	103	70-130	NA	NA	
Fluoranthene	621	11	5.5	ng/L	549	72	100	67-130	NA	NA	
Fluorene	735	11	2.3	ng/L	549	300	79.2	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	654	11	2.7	ng/L	549	6.9	118	70-130	NA	NA	
Naphthalene	2880	55	2.1	ng/L	549	2400	87.4	70-130	NA	NA	
Perylene	512	22	13	ng/L	549	ND	93.3	70-130	NA	NA	
Phenanthrene	848	11	5.5	ng/L	549	430	76.1	70-130	NA	NA	
Pyrene	599	11	5.5	ng/L	549	50	100	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*223*			ng/L	*275*	*NA*	*81.1*	*30-120*			
Surrogate: Nitrobenzene-d5	*302*			ng/L	*275*	*NA*	*110*	*30-120*			
Surrogate: Terphenyl-d14	*323*			ng/L	*275*	*NA*	*117*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7C0481 - EPA 3510C

Matrix Spike Duplicate (B7C0481-MSD1) **Source: 0701628-07** Prepared: 03/29/07 Analyzed: 04/03/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1360	50	36	ng/L	505	1000	71.3	70-130	2.90	20	
1-Methylphenanthrene	556	50	18	ng/L	505	36	103	70-130	5.76	20	
2,3,5-Trimethylnaphthalene	459	50	32	ng/L	505	ND	90.9	70-130	5.51	20	
2,6-Dimethylnaphthalene	664	50	35	ng/L	505	230	85.9	70-130	3.55	20	
2-Methylnaphthalene	1560	50	2.8	ng/L	505	1200	71.3	70-130	3.77	20	
Acenaphthene	683	10	1.9	ng/L	505	310	73.9	43-120	6.65	20	
Acenaphthylene	402	10	2.1	ng/L	505	13	77.0	70-130	6.96	20	
Anthracene	465	10	5.0	ng/L	505	14	89.3	70-130	4.42	20	
Benz(a)anthracene	488	10	5.0	ng/L	505	10	94.7	70-130	10.1	20	
Benzo(a)pyrene	489	10	2.1	ng/L	505	9.8	94.9	75-148	7.67	20	
Benzo(b)fluoranthene	454	10	5.0	ng/L	505	7.6	88.4	70-130	10.6	20	
Benzo(e)pyrene	485	10	5.0	ng/L	505	7.2	94.6	70-130	9.06	20	
Benzo(g,h,i)perylene	572	10	5.6	ng/L	505	8.3	112	70-130	9.65	20	
Benzo(k)fluoranthene	508	10	5.0	ng/L	505	11	98.4	70-130	8.12	20	
Biphenyl	592	50	36	ng/L	505	180	81.6	70-130	5.26	20	
Chrysene	473	10	5.0	ng/L	505	19	89.9	70-130	8.70	20	
Dibenz(a,h)anthracene	516	10	3.5	ng/L	505	ND	102	70-130	9.24	20	
Fluoranthene	581	10	5.0	ng/L	505	72	101	67-130	6.66	20	
Fluorene	701	10	2.1	ng/L	505	300	79.4	70-130	4.74	20	
Indeno(1,2,3-cd)pyrene	597	10	2.5	ng/L	505	6.9	117	70-130	9.11	20	
Naphthalene	4810	50	1.9	ng/L	505	2400	477	70-130	50.2	20	
Perylene	481	20	11	ng/L	505	ND	95.2	70-130	6.24	20	
Phenanthrene	814	10	5.0	ng/L	505	430	76.0	70-130	4.09	20	
Pyrene	559	10	5.0	ng/L	505	50	101	70-130	6.91	20	
Surrogate: 2-Fluorobiphenyl	*223*			ng/L	*253*	*NA*	*88.1*	*30-120*			
Surrogate: Nitrobenzene-d5	*324*			ng/L	*253*	*NA*	*128*	*30-120*			
Surrogate: Terphenyl-d14	*297*			ng/L	*253*	*NA*	*117*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Method Blank (B7D0063-BLK1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
1-Methylphenanthrene	ND	50	18	ng/L	NA	NA	NA	NA	NA	NA	
2,3,5-Trimethylnaphthalene	ND	50	32	ng/L	NA	NA	NA	NA	NA	NA	
2,6-Dimethylnaphthalene	ND	50	35	ng/L	NA	NA	NA	NA	NA	NA	
2-Methylnaphthalene	ND	50	2.8	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthene	13.4	10	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Acenaphthylene	16.1	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Anthracene	5.59	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benz(a)anthracene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	ND	100	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	ND	100	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(e)pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(g,h,i)perylene	23.9	10	5.6	ng/L	NA	NA	NA	NA	NA	NA	
Benzo(k)fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Biphenyl	ND	50	36	ng/L	NA	NA	NA	NA	NA	NA	
Chrysene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Dibenz(a,h)anthracene	ND	100	3.5	ng/L	NA	NA	NA	NA	NA	NA	
Fluoranthene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Fluorene	ND	10	2.1	ng/L	NA	NA	NA	NA	NA	NA	
Indeno(1,2,3-cd)pyrene	12.0	10	2.5	ng/L	NA	NA	NA	NA	NA	NA	
Naphthalene	16.8	50	1.9	ng/L	NA	NA	NA	NA	NA	NA	
Perylene	ND	20	11	ng/L	NA	NA	NA	NA	NA	NA	
Phenanthrene	12.3	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Pyrene	ND	10	5.0	ng/L	NA	NA	NA	NA	NA	NA	
Surrogate: 2-Fluorobiphenyl	*180*			ng/L	*250*	*NA*	*72.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*194*			ng/L	*250*	*NA*	*77.6*	*30-120*			
Surrogate: Terphenyl-d14	*234*			ng/L	*250*	*NA*	*93.6*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Laboratory Control Sample (B7D0063-BS1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	439	50	36	ng/L	500	NA	87.8	70-130	NA	NA	
1-Methylphenanthrene	449	50	18	ng/L	500	NA	89.8	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	448	50	32	ng/L	500	NA	89.6	70-130	NA	NA	
2,6-Dimethylnaphthalene	450	50	35	ng/L	500	NA	90.0	70-130	NA	NA	
2-Methylnaphthalene	428	50	2.8	ng/L	500	NA	85.6	70-130	NA	NA	
Acenaphthene	457	10	1.9	ng/L	500	NA	91.4	43-120	NA	NA	
Acenaphthylene	500	10	2.1	ng/L	500	NA	100	70-130	NA	NA	
Anthracene	495	10	5.0	ng/L	500	NA	99.0	70-130	NA	NA	
Benz(a)anthracene	464	10	5.0	ng/L	500	NA	92.8	70-130	NA	NA	
Benzo(a)pyrene	394	10	2.1	ng/L	500	NA	78.8	75-148	NA	NA	
Benzo(b)fluoranthene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Benzo(e)pyrene	434	10	5.0	ng/L	500	NA	86.8	70-130	NA	NA	
Benzo(g,h,i)perylene	514	10	5.6	ng/L	500	NA	103	70-130	NA	NA	
Benzo(k)fluoranthene	412	10	5.0	ng/L	500	NA	82.4	70-130	NA	NA	
Biphenyl	466	50	36	ng/L	500	NA	93.2	70-130	NA	NA	
Chrysene	438	10	5.0	ng/L	500	NA	87.6	70-130	NA	NA	
Dibenz(a,h)anthracene	405	10	3.5	ng/L	500	NA	81.0	70-130	NA	NA	
Fluoranthene	465	10	5.0	ng/L	500	NA	93.0	67-130	NA	NA	
Fluorene	473	10	2.1	ng/L	500	NA	94.6	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	493	10	2.5	ng/L	500	NA	98.6	70-130	NA	NA	
Naphthalene	441	50	1.9	ng/L	500	NA	88.2	70-130	NA	NA	
Perylene	411	20	11	ng/L	500	NA	82.2	70-130	NA	NA	
Phenanthrene	441	10	5.0	ng/L	500	NA	88.2	70-130	NA	NA	
Pyrene	458	10	5.0	ng/L	500	NA	91.6	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*197*			ng/L	*250*	*NA*	*78.8*	*30-120*			
Surrogate: Nitrobenzene-d5	*209*			ng/L	*250*	*NA*	*83.6*	*30-120*			
Surrogate: Terphenyl-d14	*221*			ng/L	*250*	*NA*	*88.4*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Laboratory Control Sample Duplicate (B7D0063-BSD1) Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	368	50	36	ng/L	500	NA	73.6	70-130	17.6	20	
1-Methylphenanthrene	410	50	18	ng/L	500	NA	82.0	70-130	9.08	20	
2,3,5-Trimethylnaphthalene	387	50	32	ng/L	500	NA	77.4	70-130	14.6	20	
2,6-Dimethylnaphthalene	366	50	35	ng/L	500	NA	73.2	70-130	20.6	20	
2-Methylnaphthalene	357	50	2.8	ng/L	500	NA	71.4	70-130	18.1	20	
Acenaphthene	404	10	1.9	ng/L	500	NA	80.8	43-120	12.3	20	
Acenaphthylene	400	10	2.1	ng/L	500	NA	80.0	70-130	22.2	20	
Anthracene	436	10	5.0	ng/L	500	NA	87.2	70-130	12.7	20	
Benz(a)anthracene	433	10	5.0	ng/L	500	NA	86.6	70-130	6.91	20	
Benzo(a)pyrene	366	10	2.1	ng/L	500	NA	73.2	75-148	7.37	20	
Benzo(b)fluoranthene	396	10	5.0	ng/L	500	NA	79.2	70-130	10.1	20	
Benzo(e)pyrene	416	10	5.0	ng/L	500	NA	83.2	70-130	4.24	20	
Benzo(g,h,i)perylene	399	10	5.6	ng/L	500	NA	79.8	70-130	25.2	20	
Benzo(k)fluoranthene	408	10	5.0	ng/L	500	NA	81.6	70-130	0.976	20	
Biphenyl	394	50	36	ng/L	500	NA	78.8	70-130	16.7	20	
Chrysene	425	10	5.0	ng/L	500	NA	85.0	70-130	3.01	20	
Dibenz(a,h)anthracene	335	10	3.5	ng/L	500	NA	67.0	70-130	18.9	20	
Fluoranthene	430	10	5.0	ng/L	500	NA	86.0	67-130	7.82	20	
Fluorene	423	10	2.1	ng/L	500	NA	84.6	70-130	11.2	20	
Indeno(1,2,3-cd)pyrene	404	10	2.5	ng/L	500	NA	80.8	70-130	19.8	20	
Naphthalene	355	50	1.9	ng/L	500	NA	71.0	70-130	21.6	20	
Perylene	400	20	11	ng/L	500	NA	80.0	70-130	2.71	20	
Phenanthrene	399	10	5.0	ng/L	500	NA	79.8	70-130	10.0	20	
Pyrene	423	10	5.0	ng/L	500	NA	84.6	70-130	7.95	20	
Surrogate: 2-Fluorobiphenyl	*155*			ng/L	*250*	*NA*	*62.0*	*30-120*			
Surrogate: Nitrobenzene-d5	*183*			ng/L	*250*	*NA*	*73.2*	*30-120*			
Surrogate: Terphenyl-d14	*204*			ng/L	*250*	*NA*	*81.6*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Matrix Spike (B7D0063-MS1) **Source: 0701706-01** Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1630	94	67	ng/L	943	870	80.6	70-130	NA	NA	
1-Methylphenanthrene	888	94	34	ng/L	943	ND	94.2	70-130	NA	NA	
2,3,5-Trimethylnaphthalene	931	94	61	ng/L	943	57	92.7	70-130	NA	NA	
2,6-Dimethylnaphthalene	1190	94	66	ng/L	943	370	87.0	70-130	NA	NA	
2-Methylnaphthalene	1880	94	5.3	ng/L	943	1200	72.1	70-130	NA	NA	
Acenaphthene	1030	19	3.6	ng/L	943	220	85.9	43-120	NA	NA	
Acenaphthylene	845	19	4.0	ng/L	943	ND	89.6	70-130	NA	NA	
Anthracene	919	19	9.4	ng/L	943	ND	97.5	70-130	NA	NA	
Benz(a)anthracene	933	19	9.4	ng/L	943	ND	98.9	70-130	NA	NA	
Benzo(a)pyrene	769	19	4.0	ng/L	943	ND	81.5	75-148	NA	NA	
Benzo(b)fluoranthene	885	19	9.4	ng/L	943	ND	93.8	70-130	NA	NA	
Benzo(e)pyrene	821	19	9.4	ng/L	943	ND	87.1	70-130	NA	NA	
Benzo(g,h,i)perylene	787	19	11	ng/L	943	ND	83.5	70-130	NA	NA	
Benzo(k)fluoranthene	765	19	9.4	ng/L	943	ND	81.1	70-130	NA	NA	
Biphenyl	1020	94	68	ng/L	943	150	92.3	70-130	NA	NA	
Chrysene	848	19	9.4	ng/L	943	ND	89.9	70-130	NA	NA	
Dibenz(a,h)anthracene	794	19	6.6	ng/L	943	ND	84.2	70-130	NA	NA	
Fluoranthene	916	19	9.4	ng/L	943	27	94.3	67-130	NA	NA	
Fluorene	1050	19	4.0	ng/L	943	120	98.6	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	896	19	4.7	ng/L	943	ND	95.0	70-130	NA	NA	
Naphthalene	2710	94	3.6	ng/L	943	220	264	70-130	NA	NA	
Perylene	787	38	22	ng/L	943	ND	83.5	70-130	NA	NA	
Phenanthrene	966	19	9.4	ng/L	943	190	82.3	70-130	NA	NA	
Pyrene	880	19	9.4	ng/L	943	16	91.6	70-130	NA	NA	
Surrogate: 2-Fluorobiphenyl	*438*			ng/L	*472*	*NA*	*92.8*	*30-120*			
Surrogate: Nitrobenzene-d5	*468*			ng/L	*472*	*NA*	*99.2*	*30-120*			
Surrogate: Terphenyl-d14	*499*			ng/L	*472*	*NA*	*106*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Polyaromatic Hydrocarbons by Selected Ion Monitoring - Quality Control

Batch B7D0063 - EPA 3510C

Matrix Spike Duplicate (B7D0063-MSD1) **Source: 0701706-01** Prepared: 04/04/07 Analyzed: 04/13/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene	1700	110	76	ng/L	1060	870	78.3	70-130	4.20	20	
1-Methylphenanthrene	939	110	38	ng/L	1060	ND	88.6	70-130	5.58	20	
2,3,5-Trimethylnaphthalene	997	110	69	ng/L	1060	57	88.7	70-130	6.85	20	
2,6-Dimethylnaphthalene	1230	110	74	ng/L	1060	370	81.1	70-130	3.31	20	
2-Methylnaphthalene	1950	110	6.0	ng/L	1060	1200	70.8	70-130	3.66	20	
Acenaphthene	1110	21	4.0	ng/L	1060	220	84.0	43-120	7.48	20	
Acenaphthylene	911	21	4.5	ng/L	1060	ND	85.9	70-130	7.52	20	
Anthracene	970	21	11	ng/L	1060	ND	91.5	70-130	5.40	20	
Benz(a)anthracene	1060	21	11	ng/L	1060	ND	100	70-130	12.7	20	
Benzo(a)pyrene	892	21	4.5	ng/L	1060	ND	84.2	75-148	14.8	20	
Benzo(b)fluoranthene	1000	21	11	ng/L	1060	ND	94.3	70-130	12.2	20	
Benzo(e)pyrene	953	21	11	ng/L	1060	ND	89.9	70-130	14.9	20	
Benzo(g,h,i)perylene	948	21	12	ng/L	1060	ND	89.4	70-130	18.6	20	
Benzo(k)fluoranthene	901	21	11	ng/L	1060	ND	85.0	70-130	16.3	20	
Biphenyl	1080	110	77	ng/L	1060	150	87.7	70-130	5.71	20	
Chrysene	946	21	11	ng/L	1060	ND	89.2	70-130	10.9	20	
Dibenz(a,h)anthracene	924	21	7.4	ng/L	1060	ND	87.2	70-130	15.1	20	
Fluoranthene	968	21	11	ng/L	1060	27	88.8	67-130	5.52	20	
Fluorene	1080	21	4.5	ng/L	1060	120	90.6	70-130	2.82	20	
Indeno(1,2,3-cd)pyrene	1060	21	5.3	ng/L	1060	ND	100	70-130	16.8	20	
Naphthalene	2800	110	4.0	ng/L	1060	220	243	70-130	3.27	20	
Perylene	911	43	24	ng/L	1060	ND	85.9	70-130	14.6	20	
Phenanthrene	1040	21	11	ng/L	1060	190	80.2	70-130	7.38	20	
Pyrene	930	21	11	ng/L	1060	16	86.2	70-130	5.52	20	
Surrogate: 2-Fluorobiphenyl	*465*			ng/L	*532*	*NA*	*87.4*	*30-120*			
Surrogate: Nitrobenzene-d5	*508*			ng/L	*532*	*NA*	*95.5*	*30-120*			
Surrogate: Terphenyl-d14	*512*			ng/L	*532*	*NA*	*96.2*	*30-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7C0496 - EPA 5030B

Method Blank (B7C0496-BLK1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	1.0	0.069	ug/L	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	1.0	0.030	ug/L	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	1.0	0.039	ug/L	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	1.0	0.051	ug/L	NA	NA	NA	NA	NA	NA	
Benzene	ND	1.0	0.042	ug/L	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	2.5	0.050	ug/L	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	1.0	0.036	ug/L	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	1.0	0.059	ug/L	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	1.0	0.072	ug/L	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	1.0	0.027	ug/L	NA	NA	NA	NA	NA	NA	
Styrene	ND	1.0	0.049	ug/L	NA	NA	NA	NA	NA	NA	
Toluene	ND	1.0	0.048	ug/L	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	1.0	0.067	ug/L	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.4*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*24.8*			ug/L	*25.0*	*NA*	*99.2*	*80-120*			
Surrogate: Dibromofluoromethane	*27.2*			ug/L	*25.0*	*NA*	*109*	*80-120*			
Surrogate: Toluene-d8	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			

Laboratory Control Sample (B7C0496-BS1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	22.3	1.0	0.030	ug/L	25.0	NA	89.2	75-125	NA	NA	
1,3,5-Trimethylbenzene	22.4	1.0	0.039	ug/L	25.0	NA	89.6	75-125	NA	NA	
1,4-Dichlorobenzene	24.3	1.0	0.051	ug/L	25.0	NA	97.2	75-125	NA	NA	
Benzene	26.3	1.0	0.042	ug/L	25.0	NA	105	75-125	NA	NA	
Carbon Tetrachloride	21.4	2.5	0.050	ug/L	25.0	NA	85.6	75-125	NA	NA	
Ethylbenzene	24.2	1.0	0.036	ug/L	25.0	NA	96.8	75-125	NA	NA	
m,p-Xylenes	47.7	1.0	0.059	ug/L	50.0	NA	95.4	75-125	NA	NA	
o-Xylene	23.6	1.0	0.072	ug/L	25.0	NA	94.4	75-125	NA	NA	
sec-Butylbenzene	23.1	1.0	0.027	ug/L	25.0	NA	92.4	75-125	NA	NA	
Styrene	23.8	1.0	0.049	ug/L	25.0	NA	95.2	75-125	NA	NA	
Toluene	24.3	1.0	0.048	ug/L	25.0	NA	97.2	75-125	NA	NA	
Trichloroethene	26.3	1.0	0.067	ug/L	25.0	NA	105	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.4*			ug/L	*25.0*	*NA*	*97.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Dibromofluoromethane	*27.7*			ug/L	*25.0*	*NA*	*111*	*80-120*			
Surrogate: Toluene-d8	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7C0496 - EPA 5030B

Laboratory Control Sample Duplicate (B7C0496-BSD1)

Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	21.4	1.0	0.030	ug/L	25.0	NA	85.6	75-125	4.12	20	
1,3,5-Trimethylbenzene	21.4	1.0	0.039	ug/L	25.0	NA	85.6	75-125	4.57	20	
1,4-Dichlorobenzene	23.3	1.0	0.051	ug/L	25.0	NA	93.2	75-125	4.20	20	
Benzene	25.8	1.0	0.042	ug/L	25.0	NA	103	75-125	1.92	20	
Carbon Tetrachloride	21.0	2.5	0.050	ug/L	25.0	NA	84.0	75-125	1.89	20	
Ethylbenzene	23.5	1.0	0.036	ug/L	25.0	NA	94.0	75-125	2.94	20	
m,p-Xylenes	46.2	1.0	0.059	ug/L	50.0	NA	92.4	75-125	3.19	20	
o-Xylene	22.9	1.0	0.072	ug/L	25.0	NA	91.6	75-125	3.01	20	
sec-Butylbenzene	21.8	1.0	0.027	ug/L	25.0	NA	87.2	75-125	5.79	20	
Styrene	23.2	1.0	0.049	ug/L	25.0	NA	92.8	75-125	2.55	20	
Toluene	23.7	1.0	0.048	ug/L	25.0	NA	94.8	75-125	2.50	20	
Trichloroethene	25.8	1.0	0.067	ug/L	25.0	NA	103	75-125	1.92	20	
Surrogate: 1,2-Dichloroethane-d4	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Dibromofluoromethane	*28.2*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Matrix Spike (B7C0496-MS1)

Source: 0701632-04 Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	23.1	1.0	0.030	ug/L	25.0	ND	92.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	23.0	1.0	0.039	ug/L	25.0	ND	92.0	75-125	NA	NA	
1,4-Dichlorobenzene	25.3	1.0	0.051	ug/L	25.0	ND	101	75-125	NA	NA	
Benzene	27.6	1.0	0.042	ug/L	25.0	ND	110	75-125	NA	NA	
Carbon Tetrachloride	22.4	1.0	0.050	ug/L	25.0	ND	89.6	75-125	NA	NA	
Ethylbenzene	25.3	1.0	0.036	ug/L	25.0	ND	101	75-125	NA	NA	
m,p-Xylenes	49.5	1.0	0.059	ug/L	50.0	ND	99.0	75-125	NA	NA	
o-Xylene	24.7	1.0	0.072	ug/L	25.0	ND	98.8	75-125	NA	NA	
sec-Butylbenzene	23.3	1.0	0.027	ug/L	25.0	ND	93.2	75-125	NA	NA	
Styrene	24.8	1.0	0.049	ug/L	25.0	ND	99.2	75-125	NA	NA	
Toluene	25.4	1.0	0.048	ug/L	25.0	ND	102	75-125	NA	NA	
Trichloroethene	27.5	1.0	0.067	ug/L	25.0	ND	110	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.6*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Dibromofluoromethane	*27.8*			ug/L	*25.0*	*NA*	*111*	*80-120*			
Surrogate: Toluene-d8	*25.1*			ug/L	*25.0*	*NA*	*100*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7C0496 - EPA 5030B

Matrix Spike Duplicate (B7C0496-MSD1) **Source: 0701632-04** Prepared & Analyzed: 03/29/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	23.7	1.0	0.030	ug/L	25.0	ND	94.8	75-125	2.56	20	
1,3,5-Trimethylbenzene	23.7	1.0	0.039	ug/L	25.0	ND	94.8	75-125	3.00	20	
1,4-Dichlorobenzene	26.1	1.0	0.051	ug/L	25.0	ND	104	75-125	3.11	20	
Benzene	28.4	1.0	0.042	ug/L	25.0	ND	114	75-125	2.86	20	
Carbon Tetrachloride	22.9	1.0	0.050	ug/L	25.0	ND	91.6	75-125	2.21	20	
Ethylbenzene	26.2	1.0	0.036	ug/L	25.0	ND	105	75-125	3.50	20	
m,p-Xylenes	51.4	1.0	0.059	ug/L	50.0	ND	103	75-125	3.77	20	
o-Xylene	25.4	1.0	0.072	ug/L	25.0	ND	102	75-125	2.79	20	
sec-Butylbenzene	24.1	1.0	0.027	ug/L	25.0	ND	96.4	75-125	3.38	20	
Styrene	25.6	1.0	0.049	ug/L	25.0	ND	102	75-125	3.17	20	
Toluene	26.3	1.0	0.048	ug/L	25.0	ND	105	75-125	3.48	20	
Trichloroethene	28.6	1.0	0.067	ug/L	25.0	ND	114	75-125	3.92	20	
Surrogate: 1,2-Dichloroethane-d4	*24.9*			ug/L	*25.0*	*NA*	*99.6*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Dibromofluoromethane	*28.2*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

Batch B7D0021 - EPA 5035

Method Blank (B7D0021-BLK1) Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	ND	0.050	0.0016	mg/kg	NA	NA	NA	NA	NA	NA	
1,2,4-Trimethylbenzene	ND	0.050	0.0035	mg/kg	NA	NA	NA	NA	NA	NA	
1,3,5-Trimethylbenzene	ND	0.050	0.0049	mg/kg	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene	ND	0.050	0.0060	mg/kg	NA	NA	NA	NA	NA	NA	
Benzene	ND	0.050	0.0022	mg/kg	NA	NA	NA	NA	NA	NA	
Carbon Tetrachloride	ND	0.12	0.0028	mg/kg	NA	NA	NA	NA	NA	NA	
Ethylbenzene	ND	0.050	0.0053	mg/kg	NA	NA	NA	NA	NA	NA	
m,p-Xylenes	ND	0.050	0.0063	mg/kg	NA	NA	NA	NA	NA	NA	
o-Xylene	ND	0.050	0.0070	mg/kg	NA	NA	NA	NA	NA	NA	
sec-Butylbenzene	ND	0.050	0.0021	mg/kg	NA	NA	NA	NA	NA	NA	
Styrene	ND	0.050	0.0023	mg/kg	NA	NA	NA	NA	NA	NA	
Toluene	ND	0.050	0.0086	mg/kg	NA	NA	NA	NA	NA	NA	
Trichloroethene	ND	0.050	0.0037	mg/kg	NA	NA	NA	NA	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.3*			ug/L	*25.0*	*NA*	*101*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*24.6*			ug/L	*25.0*	*NA*	*98.4*	*80-120*			
Surrogate: Dibromofluoromethane	*27.5*			ug/L	*25.0*	*NA*	*110*	*80-120*			
Surrogate: Toluene-d8	*25.7*			ug/L	*25.0*	*NA*	*103*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0021 - EPA 5035

Laboratory Control Sample (B7D0021-BS1)

Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.08	0.050	0.0035	mg/kg	1.25	NA	86.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.08	0.050	0.0049	mg/kg	1.25	NA	86.4	75-125	NA	NA	
1,4-Dichlorobenzene	1.18	0.050	0.0060	mg/kg	1.25	NA	94.4	75-125	NA	NA	
Benzene	1.30	0.050	0.0022	mg/kg	1.25	NA	104	75-125	NA	NA	
Carbon Tetrachloride	1.10	0.12	0.0028	mg/kg	1.25	NA	88.0	75-125	NA	NA	
Ethylbenzene	1.20	0.050	0.0053	mg/kg	1.25	NA	96.0	75-125	NA	NA	
m,p-Xylenes	2.39	0.050	0.0063	mg/kg	2.50	NA	95.6	75-125	NA	NA	
o-Xylene	1.18	0.050	0.0070	mg/kg	1.25	NA	94.4	75-125	NA	NA	
sec-Butylbenzene	1.11	0.050	0.0021	mg/kg	1.25	NA	88.8	75-125	NA	NA	
Styrene	1.19	0.050	0.0023	mg/kg	1.25	NA	95.2	75-125	NA	NA	
Toluene	1.20	0.050	0.0086	mg/kg	1.25	NA	96.0	75-125	NA	NA	
Trichloroethene	1.33	0.050	0.0037	mg/kg	1.25	NA	106	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*26.1*			ug/L	*25.0*	*NA*	*104*	*80-120*			
Surrogate: Dibromofluoromethane	*27.9*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			

Laboratory Control Sample Duplicate (B7D0021-BSD1)

Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	0.980	0.050	0.0035	mg/kg	1.25	NA	78.4	75-125	9.71	20	
1,3,5-Trimethylbenzene	0.976	0.050	0.0049	mg/kg	1.25	NA	78.1	75-125	10.1	20	
1,4-Dichlorobenzene	1.08	0.050	0.0060	mg/kg	1.25	NA	86.4	75-125	8.85	20	
Benzene	1.18	0.050	0.0022	mg/kg	1.25	NA	94.4	75-125	9.68	20	
Carbon Tetrachloride	0.982	0.12	0.0028	mg/kg	1.25	NA	78.6	75-125	11.3	20	
Ethylbenzene	1.09	0.050	0.0053	mg/kg	1.25	NA	87.2	75-125	9.61	20	
m,p-Xylenes	2.15	0.050	0.0063	mg/kg	2.50	NA	86.0	75-125	10.6	20	
o-Xylene	1.07	0.050	0.0070	mg/kg	1.25	NA	85.6	75-125	9.78	20	
sec-Butylbenzene	0.997	0.050	0.0021	mg/kg	1.25	NA	79.8	75-125	10.7	20	
Styrene	1.08	0.050	0.0023	mg/kg	1.25	NA	86.4	75-125	9.69	20	
Toluene	1.10	0.050	0.0086	mg/kg	1.25	NA	88.0	75-125	8.70	20	
Trichloroethene	1.20	0.050	0.0037	mg/kg	1.25	NA	96.0	75-125	10.3	20	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.9*			ug/L	*25.0*	*NA*	*104*	*80-120*			
Surrogate: Dibromofluoromethane	*28.4*			ug/L	*25.0*	*NA*	*114*	*80-120*			
Surrogate: Toluene-d8	*25.2*			ug/L	*25.0*	*NA*	*101*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Volatile Organic Compounds - Quality Control

Batch B7D0021 - EPA 5035

Matrix Spike (B7D0021-MS1) **Source: 0701669-03** Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.13	0.052	0.0037	mg/kg dry	1.31	ND	86.3	75-125	NA	NA	
1,3,5-Trimethylbenzene	1.13	0.052	0.0051	mg/kg dry	1.31	ND	86.3	75-125	NA	NA	
1,4-Dichlorobenzene	1.24	0.052	0.0063	mg/kg dry	1.31	ND	94.7	75-125	NA	NA	
Benzene	1.38	0.052	0.0023	mg/kg dry	1.31	ND	105	75-125	NA	NA	
Carbon Tetrachloride	1.15	0.13	0.0029	mg/kg dry	1.31	ND	87.8	75-125	NA	NA	
Ethylbenzene	1.25	0.052	0.0055	mg/kg dry	1.31	ND	95.4	75-125	NA	NA	
m,p-Xylenes	2.47	0.052	0.0066	mg/kg dry	2.62	ND	94.3	75-125	NA	NA	
o-Xylene	1.23	0.052	0.0073	mg/kg dry	1.31	ND	93.9	75-125	NA	NA	
sec-Butylbenzene	1.16	0.052	0.0022	mg/kg dry	1.31	ND	88.5	75-125	NA	NA	
Styrene	1.23	0.052	0.0024	mg/kg dry	1.31	ND	93.9	75-125	NA	NA	
Toluene	1.26	0.052	0.0090	mg/kg dry	1.31	ND	96.2	75-125	NA	NA	
Trichloroethene	1.40	0.052	0.0039	mg/kg dry	1.31	ND	107	75-125	NA	NA	
Surrogate: 1,2-Dichloroethane-d4	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.8*			ug/L	*25.0*	*NA*	*103*	*80-120*			
Surrogate: Dibromofluoromethane	*28.2*			ug/L	*25.0*	*NA*	*113*	*80-120*			
Surrogate: Toluene-d8	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			

Matrix Spike Duplicate (B7D0021-MSD1) **Source: 0701669-03** Prepared & Analyzed: 03/30/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	1.13	0.052	0.0037	mg/kg dry	1.31	ND	86.3	75-125	0.00	20	
1,3,5-Trimethylbenzene	1.11	0.052	0.0051	mg/kg dry	1.31	ND	84.7	75-125	1.79	20	
1,4-Dichlorobenzene	1.22	0.052	0.0063	mg/kg dry	1.31	ND	93.1	75-125	1.63	20	
Benzene	1.33	0.052	0.0023	mg/kg dry	1.31	ND	102	75-125	3.69	20	
Carbon Tetrachloride	1.09	0.13	0.0029	mg/kg dry	1.31	ND	83.2	75-125	5.36	20	
Ethylbenzene	1.21	0.052	0.0055	mg/kg dry	1.31	ND	92.4	75-125	3.25	20	
m,p-Xylenes	2.38	0.052	0.0066	mg/kg dry	2.62	ND	90.8	75-125	3.71	20	
o-Xylene	1.19	0.052	0.0073	mg/kg dry	1.31	ND	90.8	75-125	3.31	20	
sec-Butylbenzene	1.15	0.052	0.0022	mg/kg dry	1.31	ND	87.8	75-125	0.866	20	
Styrene	1.19	0.052	0.0024	mg/kg dry	1.31	ND	90.8	75-125	3.31	20	
Toluene	1.22	0.052	0.0090	mg/kg dry	1.31	ND	93.1	75-125	3.23	20	
Trichloroethene	1.34	0.052	0.0039	mg/kg dry	1.31	ND	102	75-125	4.38	20	
Surrogate: 1,2-Dichloroethane-d4	*24.7*			ug/L	*25.0*	*NA*	*98.8*	*80-120*			
Surrogate: 4-Bromofluorobenzene	*25.5*			ug/L	*25.0*	*NA*	*102*	*80-120*			
Surrogate: Dibromofluoromethane	*28.1*			ug/L	*25.0*	*NA*	*112*	*80-120*			
Surrogate: Toluene-d8	*25.0*			ug/L	*25.0*	*NA*	*100*	*80-120*			

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0093 - AIRTUBES Prep

Laboratory Control Sample (B7D0093-BS1) Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29100	0.00		ug/m³	28200	NA	103	70-130	NA	NA	
2-Methylnaphthalene filter	29200	0.00		ug/m³	28200	NA	104	70-130	NA	NA	
Acenaphthene filter	26500	0.00		ug/m³	26000	NA	102	70-130	NA	NA	
Acenaphthylene filter	26000	0.00		ug/m³	25700	NA	101	70-130	NA	NA	
Anthracene filter	26500	0.00		ug/m³	25100	NA	106	70-130	NA	NA	
Benz(a)anthracene filter	26500	0.00		ug/m³	25600	NA	104	70-130	NA	NA	
Benzo(a)pyrene filter	26100	0.00		ug/m³	25300	NA	103	70-130	NA	NA	
Benzo(b)fluoranthene filter	26100	0.00		ug/m³	25300	NA	103	70-130	NA	NA	
Benzo(g,h,i)perylene filter	32000	0.00		ug/m³	25800	NA	124	70-130	NA	NA	
Benzo(k)fluoranthene filter	26400	0.00		ug/m³	25400	NA	104	70-130	NA	NA	
Chrysene filter	25600	0.00		ug/m³	25400	NA	101	70-130	NA	NA	
Dibenz(a,h)anthracene filter	35400	0.00		ug/m³	25100	NA	141	70-130	NA	NA	
Fluoranthene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene filter	27700	0.00		ug/m³	26800	NA	103	70-130	NA	NA	
Naphthalene filter	28100	0.00		ug/m³	28100	NA	100	70-130	NA	NA	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	NA	NA	
Pyrene filter	26400	0.00		ug/m³	25600	NA	103	70-130	NA	NA	
1-Methylnaphthalene	25200	1590		ug/m³	26600	NA	94.7	70-130	NA	NA	
2-Methylnaphthalene	25200	1590		ug/m³	26400	NA	95.5	70-130	NA	NA	
Acenaphthene	25300	3310		ug/m³	27600	NA	91.7	70-130	NA	NA	
Acenaphthylene	23400	3050		ug/m³	25500	NA	91.8	70-130	NA	NA	
Anthracene	25200	3300		ug/m³	27500	NA	91.6	70-130	NA	NA	
Benz(a)anthracene	24800	1790		ug/m³	29800	NA	83.2	70-130	NA	NA	
Benzo(a)pyrene	23100	1890		ug/m³	31500	NA	73.3	70-130	NA	NA	
Benzo(b)fluoranthene	24300	1870		ug/m³	31200	NA	77.9	70-130	NA	NA	
Benzo(g,h,i)perylene	28100	4620		ug/m³	38500	NA	73.0	70-130	NA	NA	
Benzo(k)fluoranthene	24700	1890		ug/m³	31600	NA	78.2	70-130	NA	NA	
Chrysene	23900	1800		ug/m³	29900	NA	79.9	70-130	NA	NA	
Dibenz(a,h)anthracene	31100	19300		ug/m³	32100	NA	96.9	70-130	NA	NA	
Fluoranthene	25000	3420		ug/m³	28500	NA	87.7	70-130	NA	NA	
Fluorene	25200	3250		ug/m³	27100	NA	93.0	70-130	NA	NA	
Indeno(1,2,3-cd)pyrene	23600	2030		ug/m³	33900	NA	69.6	70-130	NA	NA	
Naphthalene	25700	1660		ug/m³	27700	NA	92.8	70-130	NA	NA	
Phenanthrene	25100	3320		ug/m³	27700	NA	90.6	70-130	NA	NA	
Pyrene	24800	3480		ug/m³	29000	NA	85.5	70-130	NA	NA	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0093 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0093-BSD1) Prepared & Analyzed: 04/05/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1-Methylnaphthalene filter	29200	0.00		ug/m³	28200	NA	104	70-130	0.343	20	
2-Methylnaphthalene filter	29300	0.00		ug/m³	28200	NA	104	70-130	0.342	20	
Acenaphthene filter	26600	0.00		ug/m³	26000	NA	102	70-130	0.377	20	
Acenaphthylene filter	25800	0.00		ug/m³	25700	NA	100	70-130	0.772	20	
Anthracene filter	26400	0.00		ug/m³	25100	NA	105	70-130	0.378	20	
Benz(a)anthracene filter	26500	0.00		ug/m³	25600	NA	104	70-130	0.00	20	
Benzo(a)pyrene filter	26100	0.00		ug/m³	25300	NA	103	70-130	0.00	20	
Benzo(b)fluoranthene filter	26100	0.00		ug/m³	25300	NA	103	70-130	0.00	20	
Benzo(g,h,i)perylene filter	31800	0.00		ug/m³	25800	NA	123	70-130	0.627	20	
Benzo(k)fluoranthene filter	26300	0.00		ug/m³	25400	NA	104	70-130	0.380	20	
Chrysene filter	25600	0.00		ug/m³	25400	NA	101	70-130	0.00	20	
Dibenz(a,h)anthracene filter	35900	0.00		ug/m³	25100	NA	143	70-130	1.40	20	
Fluoranthene filter	26200	0.00		ug/m³	25500	NA	103	70-130	0.381	20	
Fluorene filter	26300	0.00		ug/m³	25600	NA	103	70-130	0.00	20	
Indeno(1,2,3-cd)pyrene filter	27900	0.00		ug/m³	26800	NA	104	70-130	0.719	20	
Naphthalene filter	28300	0.00		ug/m³	28100	NA	101	70-130	0.709	20	
Phenanthrene filter	26300	0.00		ug/m³	25500	NA	103	70-130	0.00	20	
Pyrene filter	26600	0.00		ug/m³	25600	NA	104	70-130	0.755	20	
1-Methylnaphthalene	26900	1590		ug/m³	26600	NA	101	70-130	6.53	20	
2-Methylnaphthalene	26900	1590		ug/m³	26400	NA	102	70-130	6.53	20	
Acenaphthene	27200	3310		ug/m³	27600	NA	98.6	70-130	7.24	20	
Acenaphthylene	25200	3050		ug/m³	25500	NA	98.8	70-130	7.41	20	
Anthracene	27600	3300		ug/m³	27500	NA	100	70-130	9.09	20	
Benz(a)anthracene	28300	1790		ug/m³	29800	NA	95.0	70-130	13.2	20	
Benzo(a)pyrene	28000	1890		ug/m³	31500	NA	88.9	70-130	19.2	20	
Benzo(b)fluoranthene	28600	1870		ug/m³	31200	NA	91.7	70-130	16.3	20	
Benzo(g,h,i)perylene	36200	4620		ug/m³	38500	NA	94.0	70-130	25.2	20	
Benzo(k)fluoranthene	29000	1890		ug/m³	31600	NA	91.8	70-130	16.0	20	
Chrysene	27400	1800		ug/m³	29900	NA	91.6	70-130	13.6	20	
Dibenz(a,h)anthracene	38400	19300		ug/m³	32100	NA	120	70-130	21.0	20	
Fluoranthene	27700	3420		ug/m³	28500	NA	97.2	70-130	10.2	20	
Fluorene	27100	3250		ug/m³	27100	NA	100	70-130	7.27	20	
Indeno(1,2,3-cd)pyrene	29200	2030		ug/m³	33900	NA	86.1	70-130	21.2	20	
Naphthalene	27300	1660		ug/m³	27700	NA	98.6	70-130	6.04	20	
Phenanthrene	27400	3320		ug/m³	27700	NA	98.9	70-130	8.76	20	
Pyrene	27700	3480		ug/m³	29000	NA	95.5	70-130	11.0	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample (B7D0206-BS1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	99000	5880	5880	ug/m³	110000	NA	90.0	75-125	NA	NA	
Xylenes, Total	289000	5990	2990	ug/m³	337000	NA	85.8	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	103000	2970	2970	ug/m³	99100	NA	104	75-125	NA	NA	
Styrene	122000	3920	3920	ug/m³	131000	NA	93.1	75-125	NA	NA	
Toluene	107000	3020	3020	ug/m³	101000	NA	106	75-125	NA	NA	
Trichloroethene	104000	2990	2990	ug/m³	99800	NA	104	75-125	NA	NA	

Laboratory Control Sample (B7D0206-BS3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	82400	3030	3030	ug/m³	90200	NA	91.4	75-125	NA	NA	
1,2,4-Trimethylbenzene	85700	2970	2970	ug/m³	91600	NA	93.6	75-125	NA	NA	
1,3,5-Trimethylbenzene	92500	2880	2880	ug/m³	94100	NA	98.3	75-125	NA	NA	
1,4-Dichlorobenzene	62800	3470	3470	ug/m³	65400	NA	96.0	75-125	NA	NA	
Carbon Tetrachloride	97000	6120	6120	ug/m³	102000	NA	95.1	75-125	NA	NA	
sec-Butylbenzene	100000	2940	2940	ug/m³	97000	NA	103	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0206-BSD1) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	109000	5880	5880	ug/m³	110000	NA	99.1	75-125	9.62	20	
Xylenes, Total	329000	5990	2990	ug/m³	337000	NA	97.6	75-125	12.9	20	

Laboratory Control Sample Duplicate (B7D0206-BSD2) Prepared: 04/11/07 Analyzed: 04/12/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	98100	2970	2970	ug/m³	99100	NA	99.0	75-125	4.87	20	
Styrene	120000	3920	3920	ug/m³	131000	NA	91.6	75-125	1.65	20	
Toluene	100000	3020	3020	ug/m³	101000	NA	99.0	75-125	6.76	20	
Trichloroethene	98700	2990	2990	ug/m³	99800	NA	98.9	75-125	5.23	20	

Laboratory Control Sample Duplicate (B7D0206-BSD3) Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	93300	3030	3030	ug/m³	90200	NA	103	75-125	12.4	20	

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0206 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0206-BSD3)

Prepared & Analyzed: 04/11/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,4-Trimethylbenzene	96000	2970	2970	ug/m³	91600	NA	105	75-125	11.3	20	
1,3,5-Trimethylbenzene	102000	2880	2880	ug/m³	94100	NA	108	75-125	9.77	20	
1,4-Dichlorobenzene	71400	3470	3470	ug/m³	65400	NA	109	75-125	12.8	20	
Carbon Tetrachloride	107000	6120	6120	ug/m³	102000	NA	105	75-125	9.80	20	
sec-Butylbenzene	110000	2940	2940	ug/m³	97000	NA	113	75-125	9.52	20	

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample (B7D0415-BS1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	88100	2940	2940	ug/m³	98000	NA	89.9	75-125	NA	NA	
Xylenes, Total	261000	2990	2990	ug/m³	299000	NA	87.3	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS2)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	NA	NA	
Styrene	97300	3920	3920	ug/m³	131000	NA	74.3	75-125	NA	NA	
Toluene	99700	3020	3020	ug/m³	101000	NA	98.7	75-125	NA	NA	
Trichloroethene	99400	2990	2990	ug/m³	99800	NA	99.6	75-125	NA	NA	

Laboratory Control Sample (B7D0415-BS3)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86300	3030	3030	ug/m³	90200	NA	95.7	75-125	NA	NA	
1,2,4-Trimethylbenzene	90100	2970	2970	ug/m³	91600	NA	98.4	75-125	NA	NA	
1,3,5-Trimethylbenzene	95800	2880	2880	ug/m³	94100	NA	102	75-125	NA	NA	
1,4-Dichlorobenzene	64000	3470	3470	ug/m³	65400	NA	97.9	75-125	NA	NA	
Carbon Tetrachloride	103000	30600	3060	ug/m³	102000	NA	101	75-125	NA	NA	
sec-Butylbenzene	102000	2940	2940	ug/m³	97000	NA	105	75-125	NA	NA	

Laboratory Control Sample Duplicate (B7D0415-BSD1)

Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Ethyl Benzene	85700	2940	2940	ug/m³	98000	NA	87.4	75-125	2.76	20	
Xylenes, Total	258000	2990	2990	ug/m³	299000	NA	86.3	75-125	1.16	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

Organic Compounds - Quality Control

Batch B7D0415 - AIRTUBES Prep

Laboratory Control Sample Duplicate (B7D0415-BSD2) Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Benzene	100000	2970	2970	ug/m³	99100	NA	101	75-125	0.00	20	
Styrene	108000	3920	3920	ug/m³	131000	NA	82.4	75-125	10.4	20	
Toluene	98400	3020	3020	ug/m³	101000	NA	97.4	75-125	1.31	20	
Trichloroethene	98100	2990	2990	ug/m³	99800	NA	98.3	75-125	1.32	20	

Laboratory Control Sample Duplicate (B7D0415-BSD3) Prepared & Analyzed: 04/23/07

Analyte	Result	MRL	MDL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
1,2,3-Trimethylbenzene	86800	3030	3030	ug/m³	90200	NA	96.2	75-125	0.578	20	
1,2,4-Trimethylbenzene	89000	2970	2970	ug/m³	91600	NA	97.2	75-125	1.23	20	
1,3,5-Trimethylbenzene	93700	2880	2880	ug/m³	94100	NA	99.6	75-125	2.22	20	
1,4-Dichlorobenzene	64600	3470	3470	ug/m³	65400	NA	98.8	75-125	0.933	20	
Carbon Tetrachloride	100000	30600	3060	ug/m³	102000	NA	98.0	75-125	2.96	20	
sec-Butylbenzene	99300	2940	2940	ug/m³	97000	NA	102	75-125	2.68	20	

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701628

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ___ Yes ___ No
Rush / Quote # _____

Page 1 of 2

REPORT RESULTS TO
Contact Name Hubert Huls
Company URS Corp
Mailing Address 700 3rd St. S. Suite 600
City, State, Zip Minneapolis, MN 55415
Telephone # 612-370-0700 Fax # 612-373-6800
E-mail hubert_huls@urscorp.com

Project ID/Name Ashland NSP
P.O. #/Project # 25688375.75000

SEND INVOICE TO
Contact Name
Company
Address
City, State, Zip
Telephone #
Fax #
SAME

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	VOC	PAH	TSS	Percent Solids	TOC					FOR LAB USE ONLY
1	NSP-1-10Q-VOC-3-032307	03/23/07	09:10	Soil		2	N	X									0701628-1
2	NSP-1-10Q-PAH-3-032307		09:10	Soil		2	N		X								-2
3	NSP-1-1M-PAH-1-032307		09:20	Soil		2	N		X								-3
4	NSP-1-1M-TSS-7-032307		09:40	Slurry		1	N			X	X						-4
5	NSP-1-1M-TOC-7-032307		09:40	Slurry		1	N					X					-5
6	NSP-1-1M-VOC-1-032307		0955	Soil		2	N	X									-6
7	NSP-1-10Q-PAH-4-032307		11:20	Water		3	N		X								-7
8	NSP-1-10Q-VOC-4-032307		11:20	Water		3	N	X									-8
9	NSP-1-1M-PAH-2-032307		11:40	Air	301.2L	3	N		X								-9,10
10	NSP-1-1M-VOC-2-032307		11:40		301.2L	2	N	X									-11,12
11	NSP-1-1M-PAH-5-032307		15:49		602.4L	3	N		X								-13,14
12	NSP-1-1M-VOC-5-032307	03/23/07	15:49		602.4L	2	N	X									-15,16
13	NSP-1-1M-PAH-6-032407	03/24/07	07:48		2409.6L	3	N		X								-17,18
14	NSP-1-1M-VOC-6-032407	"	"	Air	2409.6L	2	N	X									-19,20
15	NSP-1-1M-VOC-8-032407	"	08:10	Slurry		6	N	X									-21

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr.
Collector's Signature: Will A. Flynn
Relinquished by: Will A. Flynn — Date/Time 03/26/07 11:00
Received by: Pat Stitt — Date/Time 03/26/07 1100
Relinquished by: Pat Stitt — Date/Time 03/26/07 1400
Received Contents Not Verified: Pat Finetto — Date/Time 3/26/07 1409
Received Contents Verified: — Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 1.5 °C

Form # CS02.02 F:/Groups/QA-QC/Forms/ClientServices/COC-CS02 Effective Date: 11/17/06

BRAUN INTERTEC

11001 Hampshire Ave. S.
Minneapolis, MN 55438
952.995.2000 Phone
952.995.2020 Fax

URS Corporation	Client Ref: Ashland/NSP	Work Order #: 0701628
700 South Third Street	Client Contact: Mr. Hubert Huls	Project Mgr: Steven J. Albrecht
Minneapolis, MN 55415	PO Number:	Account ID: B03123

For Braun Intertec Use Only
Laboratory Work Order No.
0701628

BRAUN INTERTEC
Braun Intertec Corporation
11001 Hampshire Ave. S
Minneapolis, MN 55438

REQUEST FOR LABORATORY ANALYTICAL SERVICES

Bottle orders and sampling inquires:
labservices@braunintertec.com
Phone: 952-995-2600 Fax: 952-995-2601

IMPORTANT
Date Results Requested: _____
Time _____
Rush Charges Authorized? ____ Yes ____ No
Rush / Quote # _____

Page 2 of 2

REPORT RESULTS TO
Contact Name: Hubert Huls
Project ID/Name: Ashland NSP
P.O. #/Project #: 25688375.75000
Company: URS Corp
Mailing Address: 700 3rd St S., Suite 600
City, State, Zip: Minneapolis, MN 55415
Telephone #: 612-370-0700 Fax #: 612-373-6800
E-mail: hubert_huls@urs.com

SEND INVOICE TO
Contact Name: Same
Company:
Address:
City, State, Zip:
Telephone #: Fax #:

Special Instructions and/or Specific Regulatory Requirements:
(method, limit of detection, petrofund, reporting units)
Agitate line item #1 prior to analysis.
Filter Line Item #2 prior to analysis.

ANALYSIS REQUESTED
(Enter an 'X' in the box below to indicate request)

	CLIENT SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	MATRIX/ MEDIA	AIR VOLUME (specify units)	Number of Containers	Metals Field Filtered Y/N	PAH	TSS	Percent Solids	TOC	DOC	VOC					FOR LAB USE ONLY
1	NSP-1-1M-PAH-8-032407	03/24/07	08:00	Slurry		3	N	X										0701628-22
2	NSP-1-1M-PAH-8-032407		"			3	N	X										-23
3	NSP-1-1M-TSS-8-032407		08:10			1	N		X	X								-24
4	NSP-1-1M-TOC-8-032407		"			1	N				X							-25
5	NSP-1-1M-DOC-8-032407		"	Slurry		1	N					X						-26
6	NSP-1-1M-VOC-3-032407		08:50	Soil		2	~~N~~						X					-27
7	NSP-1-1M-PAH-3-032407		08:50	Soil		2	N	X										-28
8	NSP-1-1M-VOC-4-032407		09:45	Water		3	N						X					-29
9	NSP-1-1M-PAH-4-032407	03/24/07	09:45	Water		3	N	X										-30
10	Trip Blank (DI)					2												-31
11	Trip Blank (MeOH)					1												-32
12	Temp. Blank	3/24/07				1												N/A
13	NSP-2A-10Q-PAH-1-032607	3/26/07	9:30	Soil		2		X										-33
14	NSP-2A-10Q-VOC-1-032607		9:35	Soil		2						~~X~~	X					-34
15	NSP-2A-10Q-TOC-7-032607	3/26/07	10:00	Slurry		1					X							-35

CHAIN OF CUSTODY
Collected by: (Print) William A. Flynn Jr
Collector's Signature: [signature]
Relinquished by: [signature] Date/Time 03/26/07 11:00
Received by: [signature] Date/Time 03/26/07 1100
Relinquished by: [signature] Date/Time 3/26/07 1408
Received Contents Not Verified: [signature] Date/Time 3/26/07 1409
Received Contents Verified: Date/Time
Comments:

Custody Seal Intact ☐ Yes ☐ No ☑ N/A
On Ice ☑ Yes ☐ No
Temp Blank ☑ Yes ☐ No
Temp: 1.5 °C

Form # CS02.02 F:\Groups\QA-QC\Forms\labservices\COC-CS02 Effective Date: 11/17/06

APPENDIX G

QA/QC Summary – Data Assessment Report

ASHLAND/NSP LAKEFRONT SITE
RI PHASE I TREATABILITY REPORT – APPENDIX H
WDNR BRRTS #02-02-00013
CERCLA DOCKET NO. V-W-04-C-764
USEPA ID# WISFN057952

DATA ASSESSMENT REPORT

F.0 DATA QUALITY REVIEW

This Data Assessment Report (DAR) summarizes the usability of the analytical data generated for the treatability studies for the Remedial Investigation (RI) at the Ashland/NSP Lakefront Superfund Site ("Site"). The Data Quality Indicators (DQIs) and Quality Assurance/Quality Control (QA/QC) objectives for field sampling and analysis relevant to the RI are documented in the following approved plans:

- Remedial Investigation/Feasibility Study (RI/FS) Work Plan Revision 02 Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. (February 2005) ("RI/FS Work Plan");
- Quality Assurance Project Plan RI/FS Tasks, Revision 03, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. Remedial Investigation/Feasibility Study (February 2005) ("project QAPP");
- Field Sampling Plan, RI/FS Tasks, Revision 02, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. Remedial Investigation/Feasibility Study (February 2005) ("FSP"); and
- Phase I Treatability Studies Work Plan, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. Remedial Investigation/Feasibility Study (February 2005) ("Phase I Work Plan")

In addition, the project QAPP was amended in September 2006 to include detailed information on laboratories (e.g., statement of qualifications), analytical testing practices (e.g., Standard Operating Procedures [SOPs]), and quality assurance/quality control (QA/QC) practices for the various tasks described in the new Phase I Work Plan. This addendum was approved by USEPA on September X, 2006. Sections of the aforementioned Phase I Work Plan and project QAPP addendum are referenced throughout this DAR to highlight the specific field sampling and analysis practices for the Phase I Treatability Report.

The RI Phase I Work Plan describes the field and laboratory activities for the following types of work associated with the Site:

- Bench-scale testing of consolidation conditions (i.e., flux cap testing).
- Analytical chemistry testing of sediment, water and soils for bench-scale consolidation testing and to support air emission studies.
- Measurement of air emissions or evaluation of volatilization of VOCs from Site sediments (i.e., wind tunnel source emissions experiment)

Vibracore sampling was used to obtain sediments for bench-scale testing and air emission experiments. The SOP for Vibracore sampling was presented in the project QAPP (URS, 2005b). Additional work, including odor testing and air emission modeling will be performed for the Phase I Treatability Work. A separate DAR will be provided describing QA results for associated testing laboratories. **Table F-1**

provides a summary of the matrices and parameter group for all the samples collected for the Phase I Treatability work.

The data quality and usability of the results are summarized in this DAR. The major components of the QA/QC program include the collection and analysis of QC samples, the use of standardized SOPs for laboratory activities, and data validation of analytical results. Sections F.1, F.2, and F.3 describe these components of the QA/QC program in greater detail. Section F.4 summarizes the data validation results for each laboratory. The data usability/assessment for the entire data set is found in Section F.5.

Data were evaluated from the following analytical laboratories for the Phase I Treatability work:

- Braun Intertec Corporation[1], ("Braun") Minneapolis, Minnesota
- Minnesota Valley Testing Laboratories, Inc., ("MVTL"), Bismarck, North Dakota
- ERA Laboratories, Inc., ("ERA") Duluth, Minnesota

Braun performed all sample analyses for this work with the exception of total organic carbon (TOC), which was subcontracted to MVTL and ERA. The primary focus of this DAR is related to the analytical testing program and results from Braun.

F.1 QUALITY CONTROL SAMPLE COLLECTION

Field and laboratory QC samples were collected and analyzed at different frequencies depending upon the sampling program and matrix collected. Field QC samples were collected for the various matrices based on specifications in the project QAPP and its addenda. Similarly, laboratory QC samples were analyzed based on the requirements of the reference analytical test method that was performed and the laboratory-specific standard operating procedures (SOPs). Field QC samples included trip blanks, methanol blanks, field duplicates and matrix spike/matrix spike duplicate (MS/MSD) samples. Laboratory QC samples included method blanks, laboratory control sample (LCS), and MS/MSD samples. The collection frequency for field and laboratory QC samples generally followed criteria specified in Section 4.2 (Measurement Performance Criteria - PARCC) and Section 5.13 (Collection of Quality Control Samples) of the project QAPP (URS, 2005b). MS/MSD samples were not applicable to samples requiring air analyses. **Table F-2** shows the field QC samples collected or performed per matrix. The laboratory QC samples required to be analyzed during normal operations are summarized in the laboratory SOPs (URS, 2006). Summaries of the findings associated with the field and laboratory QC analyses are found in Section F.4**.** This section describes the individual laboratory performance for the Phase I Treatability work that occurred in March 2007.

F.2 STANDARD OPERATING PROCEDURES

Laboratory and field SOPs for the Phase I Treatability work are found in the RI/FS Work Plan (URS, 2005c), FSP (URS, 2005a), Phase I Treatability Work Plan (URS, 2006a) and QAPP and its addendums (URS, 2005b; URS, 2006b). Laboratory SOPs were followed for analytical testing. It was assumed that field SOPs were followed for all field activities. A review of compliance to sampling procedures to assess proper sample collection, handling and decontamination were not reviewed as part of this DAR (e.g., no field audit was conducted). The analytical laboratories (i.e., those performing chemical testing) were required to meet analytical sensitivity requirements for the generation of data for most samples. These requirements were listed in the laboratory-specific SOPs. All SOPs for the analytical testing were

[1] 11001 Hampshire Ave. S., Minneapolis, MN 55438; Tel: 952.995.2000; Fax: 952.9952020. Certification/Accreditation Numbers - MN Department of Health: 027-053-117, WI DNR: 999462640, NVLAP: 101234-0, and AIHA: 101103.

included in the reference documents listed in Section F.1. No geotechnical or toxicity testing laboratories were subcontracted for the Phase I Treatability work.

F.3 LABORATORY DATA VALIDATION AND USABILITY ASSESSMENT

Data validation consists of evaluating the completeness, correctness, and conformance of a data set against the method, SOP, or contract requirements documented in the project QAPP. Data assessment is the process of evaluating validated data to determine if it can be used for the purpose of the project (i.e., to answer the environmental questions or to make the environmental decision that must be made).

Validation of analytical data was based on principles found in the USEPA guidance documents, USEPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (1999) and USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (2004). Data validation is a comprehensive review and examination of the raw data and subsequent re-calculation of results to verify the completeness of documentation and the accuracy of reported results. The validation also includes an assessment of sample handling, field QC sample analyses, and laboratory QC performance. Specifically, the items reviewed during the data validation process were:

- Analytical methods performed and test method references
- Sample Condition - review of log-in records for cooler temperature, presence of headspace, chemical preservation, etc.
- Holding times (comparison of collection, preparation, and analysis dates)
- Analytical results (units, values, significant figures, reporting limits, including any matrix interference problems, analyst, percent moisture)
- Sample traceability (Chain of Custody documentation)
- Method blank results and laboratory contamination
- Laboratory control sample (LCS) results and comparison to laboratory control limits
- Matrix spike/matrix spike duplicate (MS/MSD) results and comparison to laboratory control limits
- Field replicate/duplicate results and comparison to data review criteria
- Surrogate recoveries (where applicable) and comparison to laboratory control limits
- Internal standard values (where applicable) and comparison to laboratory control limits
- Instrument calibrations (initial and continuing)
- Chromatograms (form, structure, baseline)
- Quantitation reports (calculations)
- Mass spectra (GC/MS only)
- Internal standards
- Retention times
- Run logs/sequence logs
- Preparation/extraction logs

For this project, a comprehensive validation of the analytical results was not performed since the laboratory did not provide complete supporting documentation to assess all validation criteria. Missing documentation included calibration information, chromatograms/mass spectra/internal standards (where required), and bench sheets for extraction and/or preparations. The validation was completed without the information and summarized in a Data Validation Reports (DVR).

Data validations were completed by URS Corporation (URS), Chicago, Illinois. Each DVR contains a comprehensive listing of samples reviewed (field sample identifications and laboratory sample numbers),

validation review elements, a summary of the individual method's performance, and the sample data sheets showing data validation qualifiers (and reasons for qualification) that were applied to the sample results. Edits were not made to the laboratory's sample data sheets if the performance and QC sample results were within laboratory or project criteria. When QC results indicated inadequate performance, the validation group applied data qualifiers to the results to inform the data user of the possible performance problem. These qualifiers are in addition to, or a revision of, the qualifiers provided by the laboratory. Data qualifying protocols were based on guidance from the CLP guidelines (USEPA, 1999 and USEPA, 2004a), the laboratory-specific SOPs, and SW846 guidance (USEPA, 2005). The data qualifiers are presented on the laboratory analysis forms attached to the individual DVR included in Appendix G and are also shown on the final tables for the RI. The laboratories' original analysis reports are included in Appendix E of the Phase I Treatability Report.

On the basis of the validations, data were 1) accepted without qualification, or 2) qualified as estimated ("J" for positive results, or "NDJ" for non-detect results). None of the analytical results were rejected ("R"). A "J" qualifier was appended to those detected and undetected values that were usable, but should be considered estimated due to laboratory and/or field performance problems.

Data qualifiers were added to the results in the electronic database by Newfields, Inc. (Newfields), Madison, Wisconsin, after completion of data validation. A printout of the final electronic data deliverable (EDD) for the Phase I Treatability Report, showing post-validation qualifiers and data revisions, is found in Tables ?? through ??**.** Consistent with the approach stated in the project QAPP (URS, 2005b), 100 percent of the analytical data was required to be validated for the treatability work. DELETE THIS PARAGRAPH IF THIS WASN'T DONE.

Data assessment of the validated project data involves the evaluation of the data quality in terms of precision, accuracy (bias), [sample] representativeness, completeness, and comparability (PARCC). It also includes an evaluation of the method sensitivity and quantitation limits for each matrix. The data quality indicators were evaluated by assessing the following:

- Conformance to sample collection procedures
- Conformance to analytical methodologies
- Sample handling and chain-of-custody (COC) issues
- Adherence to sample holding times
- Results of field and laboratory QC samples
- Instrument calibration and tuning (where required)
- Analytical performance checks
- Analytical sensitivity of results (method detection limit [MDL], method reporting limit [MRL])
- Completeness, comparability, and representativeness of results
- Laboratory flags and codes

The following section describes the findings of the validation for the laboratories performing testing for the Phase I Treatability work.

F.4 BRAUN INTERTEC CORPORATION (BRAUN)

Braun performed analysis of soils/sediment samples, slurry samples, aqueous samples, and air tube samples for the Phase I Treatability work. Data validation was performed on all Braun analytical reports in accordance with the evaluation program described in Section F.3. This included a review of the laboratory analysis reports for completeness, QC results, sample handling, hold time compliance,

accuracy, precision, and reported detection limits. A comprehensive review of the laboratory's preparation processes (e.g., extraction) and calibration procedures, however, were not performed due to the type of analytical report supplied (e.g., Level II). A summary of the results of the data validation for the Braun analytical reports is provided in Sections F.4.1 through F.4.10. There were 10 analytical reports (i.e., work orders) associated with the Phase I Treatability work. These were as follows: 0701706, 0701696, 0701628, 0701617, 0701595, 0701575, 0701544, 0701731, 0701477, and 0701451.

F.4.1 Conformance to the Sample Collection Procedures

Sample custody for the laboratory was generally in accordance with the FSP (URS, 2005a) and the project QAPP (URS, 2005b; URS, 2006b). Laboratory personnel completed the COC correctly recording the signature and date/time of custody transfer. The sample temperature at the time of receipt was greater than the recommended temperature of 6°C for three sets of samples (associated with work orders 0701706, 0701544, and 0701696). The results for all project samples in these work orders were qualified as estimated (J or NDJ). Also, laboratory personnel did not list several trip blank samples on one COC for work order 0701595. The trip blanks were added to the COC by the lab. Additionally, project personnel did not place custody seals on coolers. No qualification of data was made based on this deviation but corrective action included reminding project personnel that custody seals are required on shipping containers regardless of the mode of transportation. Also, shipping papers were not provided for the subcontracted laboratory's receipt of samples. The COCs that were completed for each sampling event were included in the laboratory analysis reports provided in Appendix E.

Table 9 of the project QAPP specifies the container and preservation requirements for aqueous, soil and sediment samples. Sample collection procedures for aqueous and solid matrices were in accordance with SOPs provided in the project FSP (URS, 2005a) with some slight modification for container size. For aqueous sample collection, 40-milliliter (mL) glass vials were used for VOCs, 1-Liter (L) amber glass jars were used for SVOCs/PAHs, and 125 to 500-mL plastic bottles were used for miscellaneous parameter groups. Chemical preservation was in accordance with requirements. For solid sample collection, 4-ounce or larger, glass jars were used for both organics and inorganics. For all other parameter groups (air tube samples), the sample collection was in accordance with project requirements provided in the project QAPP Addendum No. 4 (URS, 2006b). All sample containers were pre-cleaned per project QAPP requirements (URS, 2005b).

F.4.2 Conformance to Analytical Methodologies

Analyses were performed according to current versions of the laboratory SOPs provided in the project QAPP Addendum No. 4 (URS, 2006b) and included the following parameter groups and test methods:

- Volatile Organic Compounds (VOCs) by SW846[2] Method 5035 (extraction), Method 5030B (purge-and-trap), and Method 8260B (analysis) by Gas Chromatography/Mass Spectrometry (GC/MS)
- Semi-Volatile Organic Compounds (SVOCs) by SW846 Method 3545 (solids extraction), Method 3510C (liquid-liquid extraction), and Method 8270C (analysis) by GC/MS
- Total Organic Carbon (TOC) by SW846 Method 9060
- Total Solids by USEPA MCAWW[3] Method 160.3
- Dissolved Organic Carbon (DOC) by MCAWW Method 415.1

---

[2] *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* (SW846) USEPA, Final Update IIIB, November 2004.
[3] Manual of Methods for Chemical Analysis of Water and Wastes (MCAWW) USEPA Revised 1983.

- Polycyclic Aromatic Hydrocarbons (PAHs) by NIOSH[4] Method 5506 (air), OSHA[5] Method 58 (air), and SW846 Method 8270C by GC/MS Single Ion Monitoring (SIM) (aqueous)
- VOCs by NIOSH and AIHI[6]
- Percent Solids by Standard Methods[7] Method 2540G

No deviations in the specified procedures were described in the laboratory analysis reports or in the DVRs for the aforementioned methods.

F.4.3 Sample Handling and Chain-of-Custody

Sample handling and COC procedures followed the procedures outlined in the project QAPP (URS, 2005b; URS, 2006b). All sample containers were cleaned, checked for adequate labeling, wrapped to prevent breakage, and then packed on ice in a cooler for transport to the laboratory. A COC form was completed for each cooler. Shipment was conducted using private or commercial couriers. Copies of the completed forms (after receipt at Braun) are provided in Appendix E of the Phase I Treatability Report. Once received, Braun assigned a work order and unique laboratory identification number to each sample. The work order groups the samples (on a single day of receipt) for reporting purposes. Copies of the COCs associated with the subcontractor laboratory analyses were not provided.

F.4.4 Adherence to Sample Holding Times

Holding times for the individual methods of analysis are listed in the project QAPP (URS, 2005b; URS, 2006b). Sample analyses occurred within holding time limits with the exception of the following:

- For WO 0701595, the SVOCs in sample NSP-1-10M-PAH-8-032207 were extracted 1 day past the method specified holding time.
- For WO 0701575, the SVOCs in sample NSP-2-10M-PAH-8-032107 dissolved were extracted 2 days past the method specified holding time.

Affected results were qualified as estimated ("J" flag for positive results and "NDJ" for non-detect results) on the basis of the holding time exceedances. Results associated with analyses performed past recommended hold times may be negatively biased since the chemical of concern may be lost during extended storage. No results were rejected based on holding time issues.

F.4.5 Results of Field and Laboratory QC Samples

Braun analyzed field and laboratory QC samples in accordance with QAPP requirements. The following paragraphs explain the general findings of the QC sample analyses performed.

Laboratory Control Samples and Matrix Spike/Matrix Spike Duplicates

The laboratory performed LCS analyses for all methods in accordance with laboratory-specific SOPs. Percent recoveries and statistical control limits were reported for most LCS spiked compounds. Percent

---

[4] NIOSH *Manual of Analytical Methods* 3rd (1984) and 4th (1995) Editions.
[5] OSHA Organic Methods Evaluation Branch Analytical Laboratory 2nd Edition (1990).
[6] Per the laboratory SOP (IHVOCS1, 9/12/04, Rev. 1), "This method is based on NIOSH, OSHA, and 3M 3500 Organic Vapor Monitoring (OVM) Guide methodologies and AIHA accreditation guidelines."
[7] Standard Methods for the Examination of Water and Wastewater (SM). 20th ed. American Public Health Association. 1998. Washington, D.C.

recovery results outside of statistical control limits were noted by Braun and further qualified in the DVR as estimated ("J" flag for positive results and "NDJ" for non-detect results). In general, the accuracy of the analyses was acceptable for most analytical groups.

Braun also performed MS/MSD analyses on multiple project samples for soil and water matrices. (MS/MSD analyses were not applicable to air analyses.) A summary of the spiked compounds and matrices are listed in **Table F-2**. The project samples for VOC and PAHs were spiked with the target chemical list. Similar to the LCS analyses, percent recoveries and statistical control limits were reported for each MS/MSD compound. Percent recoveries outside of statistical control limits were noted by the laboratory and further qualified in the DVR to show the impact on the analytical results. The DVRs identified acceptable spike recoveries for most parameter groups and matrices. No results were rejected based on MS/MSD results. In general, the accuracy of all analytical methods performed by Braun was acceptable for all analytical groups.

Method Blanks and Trip Blanks

For the treatability work, the field QC samples included water and methanol trip blanks samples. These were collected (submitted) and analyzed at a frequency of one set per sample shipment. The water and methanol trip blank were analyzed for VOCs. Laboratory blanks included method blanks and instrument blanks where required. These were analyzed at least once per batch in accordance with the laboratory SOPs.

None of the water trip blanks contained VOC contamination. One VOC (toluene) was detected at 0.11 mg/kg in a methanol trip blank associated with work order 0701706. None of the other 17 (out of a total of 18) trip blanks (water or methanol) contained any contamination. The concentration did not impact any of the sample results; therefore, no revision of results was required.

Laboratory blanks included method blanks, preparation blanks, and calibration blanks (as appropriate for the method) and that were analyzed at the frequency specified in the laboratory's SOPs. The results of the laboratory blank analyses revealed trace laboratory contamination especially for the PAH method of analyses for both solids and aqueous samples. Some common contaminants detected included 1-methylnaphthalene, 2,6-dimethylnaphthalene, 2-methylnaphthalene, acenaphthene, naphthalene, phenanthrene, pyrene, acenaphthylene, anthracene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene. The presence of these chemicals in the blanks indicates the possibility of false positives in the associated project samples. When a target chemical was detected in the method blank, the associated project sample results were compared to a blank action level (i.e., 10 times the method blank concentration for common laboratory contaminants or five times for non-common contaminants). If the project sample result was less than the action level, the concentration in the sample was considered a non-detect value (revised to "ND"). The project sample results were revised using the following CLP qualification rules: if the sample result was greater than the reporting limit, but less than the action limit (five times the method blank value for most compounds), then the sample result was revised to a non-detect (ND) result; if the sample result was less than the reporting limit and less than the action limit, the result was revised to the reporting limit and qualified as non-detect (ND); and if the sample result was greater than the action limit or the chemical was not detected in the sample, then no qualification of data was required. Table 1 found in each of the DVRs, summarized the list of the sample results that were revised to non-detect (ND), i.e., impacted by method blank contamination.

Field and Laboratory Duplicate Samples

Field duplicates were not collected at the frequency specified in the QAPP (URS, 2006b), which was listed as a frequency of one sample for every ten project samples for both solid and liquid matrices. Field

duplicates were only collected for TOC analyses. The results of the field duplicates demonstrated good agreement (RPD less than 50 percent) for this parameter group. An evaluation of precision related to the impact of sampling and/or laboratory analysis on the matrix could not be performed.

Laboratory duplicate samples were not required to be analyzed for this project with the exception of the laboratory-prepared MS/MSD duplicates. Laboratory duplicate analyses using MS samples were performed at a frequency of at least one per 20 samples for the applicable parameter groups. Agreement between the two sample results, expressed as RPD, met the criteria of the analytical methods in most cases. Where the RPDs were greater than the laboratory's corresponding upper control limits (e.g., work order 0701145) the results were qualified as estimated ("J" flag for positive results and "NDJ" for non-detect results).

F.4.6 Instrument Calibration and Tuning

Initial and continuing calibrations and tuning data were not reviewed since documentation was not provided by Braun. A few chemicals did not meet initial or continuing calibration criteria were noted by laboratory flags, "A1a", "A1b", and "A1." These flags were used to indicate that the closing calibration check solution was above the upper laboratory control limit and which could create a slight high bias in the associated data. Where these laboratory flags were used, the associated chemicals were qualified as estimated ("J" for positive results and "NDJ" for non-detect results). Instrument tunes for the VOC and PAH analyses were not provided; therefore, no evaluation of tuning data was performed.

F.4.7 Analytical Performance Checks

Performance checks such as surrogate recovery and internal standard responses were required to be reviewed during data validation of the GC/MS methods of analyses. Generally, surrogate recoveries were within acceptable limits for most analyses. Surrogate recoveries were outside acceptance criteria occurred only in a limited number of samples (e.g., PAHs in work order 0701706). The results for these samples were qualified as estimated ("J" for positive results and "NDJ" for non-detect results). The qualification practice was based on USEPA CLP guidance (USEPA, 1999). Internal standard performance (applicable to MS analyses only), which is used to assess the condition of the analytical instrumentation for the VOCs and PAH analyses, was not evaluated since the internal standard values were not reported by Braun. It was assumed that internal standard performance was acceptable since the laboratory flagged results affected by poor performance.

F.4.8 Analytical Sensitivity of Results

The MRLs conformed to the target quantitation limits specified in the project QAPP (URS, 2006b). However, dilutions were required on the basis of sample matrix interference. Where dilutions were performed to quantify elevated levels of target compounds (concentrations above the upper calibration standard), the original results were not reported by the laboratory (only the final results were reported). This practice ensured that only quantitative results were available for use in project data evaluations. MRLs for diluted samples were raised by a factor equivalent to the dilution factor (i.e., results were reported with elevated MRLs). These results are still usable for quantitative purposes; however, the elevated reporting limits may prevent conclusive confirmation that the target chemicals of concern are not present at a specific location if the reporting limit is above the associated action level.

An "A5a" flag was used to indicate that the MDL value for the analyte is an estimated value (i.e., statistically-derived value has been determined). This occurred for the compound, benzo(e)pyrene for PAH analysis of slurry and solid samples. The results for this compound in the affected project samples

were qualified as estimated ("J" for positive results and "NDJ" for non-detect results). The non-detect results should be used with caution since the precision of the chemical in these matrices cannot be verified without a statistically-derived MDL study.

An "ia" flag was used to indicate the back section of the sample air tube contained greater than 10% of the amount (of PAHs) collected on the front section, which indicates possible analyte breakthrough (loss) during field sampling. This occurred with work orders 0701628, 0701595 and 0701731.

The analytical results are reported in various units of measure depending upon the matrix. The soil/sediment samples were corrected for percent moisture (%M) content. Slurry samples were not corrected for moisture. Moisture correction is not applicable to air tube samples. The following units of measure were used by the laboratory for each parameter group: VOC-soils (mg/kg, corrected for %M), PAH-soils (mg/kg, corrected for %M), VOC-water (ug/L), PAH-water (ng/L), VOC-slurry (ug/L), PAH-slurry (ug/L), TSS-slurry (mg/L), DOC-slurry (mg/L), TOC-slurry (mg/L), VOC-air tube (ug/m^3), and PAH-air tube (ug/m^3).

F.4.9 Representativeness, Completeness, and Comparability of Results

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and/or proper laboratory protocols. This sampling network was designed to provide data representative of experimental conditions. Representativeness was satisfied by mandating that the QAPP be followed, proper sampling techniques be used, proper analytical procedures be followed, and holding times of the samples not be exceeded in the laboratory. The majority of these factors were addressed during the data validation process. (discussions in previous sections). Evidence of proper sampling techniques and representativeness is described in Sections 2.0 and 4.0 of the Phase I Treatability Report.

Data completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected to be obtained under normal conditions. (See calculation in Section 4.2.4 of the project QAPP.) Valid data is defined as data that are considered usable (i.e., non-rejected results) after the validation process. The amount of expected data refers to the number of measurements planned. The completeness goal (specified in the project QAPP) required that each chemical have a completeness value greater than 95 percent. This goal was obtained for the Braun data sets for all chemicals measured in the aqueous, slurry, soil, sediment, and air tube matrices. The data generated by Braun for all chemicals of concern for the RI, therefore, meet the completeness criteria.

Data comparability expresses the confidence with which one data set can be compared to another; in this case, historical data compared to data collected during the 2005 investigation. Comparability is dependent upon the proper design of the sampling program and the use of proper sampling techniques. Multiple matrices were collected for the treatability work including air tube samples, slurries, sediments and aqueous samples. Since there are no historic data for air tube and slurry samples, comparability is not required to be assessed at this time. For sediments and aqueous samples, the results for this work would be comparable to historical sample results since similar USEPA reference test methods (SW846) were used. Although laboratory QC requirements may have differed slightly between the historical laboratory (e.g., Northern Services) and Braun, the reference method procedures are considered standard for all CLP work and most likely would ensure comparable data for the organic analyses. For future treatability work, however, comparability could be assessed by a comprehensive validation of the Braun methods of analysis.

F.4.10 Laboratory Flags and Codes

For each parameter tested, the laboratory provided the analytical method, analytical result, MDL, MRL, units of measure, analytical batch number (in most cases), and date of the analysis. A "ND" qualifier was used for non-detect results. A "J" qualifier was used to indicate estimated data below the RL but above the MRL. Positive detections of each chemical were "bolded." A "B" flag was used to indicate that the analyte was detected in the method blank. A "vfa" flag was used to indicate that the MRL was raised for one of more analytes; therefore, a dilution of the sample was necessary due to high analyte level and/or matrix interference. An "A5a" flag was used to indicate that the MDL value for the analyte is an estimated value; therefore, no statistical value has been determined. An "ib" flag was used to indicate that an unidentified compound was found in the sample. A "qn" flag was used to indicate that the MS/MSD percent recovery exceeds the laboratory control limits. A "gp" flag was used to indicate that the LCS relative percent difference (RPD) was outside of the laboratory control limit. A "go" flag was used to indicate that the LCS %R was outside of the laboratory control limit. An "A5", "A1c", "A1d", "A1e", "A2", "A3", "A4a", and "A4" flag was used to indicate that the LCS %R is below the laboratory control limit. An "A1a", "A1b", and "A1" flag was used to indicate that the closing calibration check solution was above the upper laboratory control limit, possibly due to a slight high bias in the data. Results where QC criteria were not met were qualified as estimated (J) for detected results, (NDJ) for non-detect results or revised to non-detect (ND) when method blank contamination impacted sample results. Additionally, slurry and soil results were reported as dry weight corrected. Moisture correction is not applicable to air tube samples.

F.5 SUMMARY OF DATA USABILITY

All analytical results generated by Braun and its subcontractors were considered valid and could be used with confidence for decision-making. The data are considered usable based on the QC information provided by the laboratories and the results of the data validation. Although a comprehensive validation was not performed, the review found that the laboratories followed industry-accepted test methods and performed standard QC analyses as required by the laboratory-specific SOPs provided in the approved QAPP (URS, 2005b; URS, 2006b). Some sample results were reported with elevated reporting limits due to the presence of high concentrations of target compounds or matrix interference. These results are still usable for quantitative purposes; however, the elevated reporting limits may prevent conclusive confirmation that the target chemicals of concern are not present at a specific location if the reporting limit is above the associate risk screening level. Some results should be used with caution (for quantitative purposes) due to the lack of an appropriate MDL. Although these results were not rejected, these results still may have some value to the data user to guide further evaluations of the Site and its treatability goals. Additionally, for future treatability work using this laboratory, a comprehensive validation of the methods of analysis should be performed to aid in verification of the procedures associated with each method of analysis, and to assess comparability of data to on-going treatability\or investigation results.

F.6 REFERENCES

URS, 2005a. Field Sampling Plan, RI/FS Tasks, Revision 02, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. Remedial Investigation/Feasibility Study (February 2005).

URS, 2005b. Quality Assurance Project Plan RI/FS Tasks, Revision 03, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. Remedial Investigation/Feasibility Study (February 2005) plus Addendums 1, 2, and 3.

URS 2005c. Remedial Investigation/Feasibility Study (RI/FS) Work Plan Revision 02 Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. (February 2005).

URS 2006a. Phase I Treatability Studies Work Plan, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. Remedial Investigation/Feasibility Study (September 2006)

URS, 2006b. Quality Assurance Project Plan RI/FS Tasks, Revision 03, Ashland/NSP Lakefront Superfund Site, Ashland, Wisconsin. Remedial Investigation/Feasibility Study Addendum 4. (September 2006)

USEPA. 1983. Methods for Chemical Analysis of Water and Wastes. USEPA/600/4/79/020. U.S. Environmental Protection Agency. March 1983.

USEPA. 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. U.S. Environmental Protection Agency. October 1999.

USEPA. 2000. Routine Validation of Gamma Spectroscopy Data. ER-SOP15.06, July 20, 2000.

USEPA. 2004. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. U.S. Environmental Protection Agency. March 2004.

USEPA. 2005. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (Final Update IIIB). SW-846. U.S. Environmental Protection Agency. November 1986, April 1998, November 2004, and July 2005.

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
701451	NSP-4-ES-1-VOC-031407 (0701451-01)	VOCs	Soil
	NSP-4-ES-PAH-1-031407 (0701451-02)	PAHs	Soil
	NSP-4-ES-TOC-1-031407 (0701451-03)	TOCs	Soil
	NSP-4-ES-PAH-2-031407 Front (0701451-04)	PAHs	Air Tube
	NSP-4-ES-VOC-2-031407 Front (0701451-05)	VOCs	Air Tube
	NSP-4-ES-PAH-5-031407 Front (0701451-06)	PAHs	Air Tube
	NSP-4-ES-VOC-5-031407 Front (0701451-07)	VOCs	Air Tube
	NSP-4-ES-PAH-6-031507 Front (0701451-08)	PAHs	Air Tube
	NSP-4-ES-VOC-6-031507 Front (0701451-09)	VOCs	Air Tube
	NSP-4-ES-PAH-3-031507 (0701451-10)	PAHs	Soil
	NSP-4-ES-VOC-3-031507 (0701451-11)	VOCs	Soil
	NSP-4-ES-TOC-3-031507 (0701451-12)	TOCs	Soil
	NSP-4-ES-PAH-4-031507 (0701451-13)	PAHs	Water
	NSP-4-ES-VOC-4-031507 (0701451-14)	VOCs	Water
	NSP-1-ES-PAH-1-031507 (0701451-15)	PAHs	Soil
	NSP-4-ES-TOC-1-031407-Dup (0701451-16) *Field Duplicate*	TOCs	Soil
	NSP-1-ES-VOC-1-031507 (0701451-17)	VOCs	Soil
	NSP-1-ES-TOC-1-031507 (0701451-18)	TOCs	Soil
	NSP-1-ES-TOC-1-031507-Dup (0701451-19) *Field Duplicate*	TOCs	Soil
	Trip Blanks (0701451-20)	VOCs	Water

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
701477	NSP-1-ES-PAH-2-031507 Sample A (0701477-01)	PAH	Air Tube
	NSP-1-ES-VOC-2-031507 Front (0701477-02)	VOC	Air Tube
	NSP-1-ES-PAH-5-031507 Front (0701477-03)	PAH	Air Tube
	NSP-1-ES-VOC-5-031507 Front (0701477-04)	VOC	Air Tube
	NSP-1-ES-PAH-6-031607 Sample A (0701477-05)	PAH	Air Tube
	NSP-1-ES-VOC-6-031607 Sample A (0701477-06)	VOC	Air Tube
	NSP-1-ES-PAH-3-031607 (0701477-07)	PAHs	Soil
	NSP-1-ES-TOC-3-031607 (0701477-08)	TOC	Soil
	NSP-1-ES-VOC-3-031607 (0701477-09)	VOC	Soil
	NSP-1-ES-PAH-4-031607 (0701477-10)	PAHs-SIM	Water
	NSP-1-ES-VOC-4-031607 (0701477-11)	VOC	Water
	Trip Blank (MeOH) (0701477-12)	VOCs	Soil
	Trip Blank (HCL) (0701477-13)	VOCs	Water
	NSP-1-ES-PAH-2-031607 Sample B (0701477-14)	PAH	Air Tube
	NSP-1-ES-PAH-6-031607 Sample B (0701477-18)	PAH	Air Tube
	NSP-1-ES-VOC-6-031607 Sample B (0701477-19)	VOC	Air Tube
701544	NSP-2-ES-PAH-1-031907 (0701544-01)	PAH	Soil
	NSP-2-ES-TOC-1-031907 (0701544-02)	TOC	Soil
	NSP-2-ES-TOC-1-031907-Dup (0701544-03) *Field Duplicate*	TOC	Soil
	NSP-2-ES-VOC-1-031907 (0701544-04)	VOC	Soil
	NSP-2-ES-PAH-2-031907 Front (0701544-05)	PAH	Air Tube

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	NSP-2-ES-VOC-2-031907 Front (0701544-07)	VOC	Air Tube
	NSP-2-ES-PAH-5-031907 Front (0701544-09)	PAH	Air Tube
	NSP-2-ES-VOC-5-031907 Front (0701544-11)	VOC	Air Tube
	NSP-2-ES-PAH-6-032007 Front (0701544-13)	PAH	Air Tube
	NSP-2-ES-VOC-6-032007 Front (0701544-15)	VOC	Air Tube
	NSP-2-ES-TOC-3-032007 (0701544-17)	TOC	Soil
	NSP-2-ES-PAH-3-032007 (0701544-18)	PAH	Soil
	NSP-2-ES-VOC-3-032007 (0701544-19)	VOC	Soil
	NSP-2-10M-PAH-1-032007 (0701544-20)	PAH	Soil
	NSP-2-10M-VOC-1-032007 (0701544-21)	VOC	Soil
	NSP-2-10M-TSS-032007 (0701544-22)	TSS	Slurry
	NSP-2-10M-TOC-7-032007 (0701544-23)	TOC	Slurry
	Trip Blanks (0701544-24)	VOC	Soil
701575	NSP-2-10M-PAH-2-032007 Front (0701575-01)	PAH	Air Tube
	NSP-2-10M-VOC-2-032007 Front (0701575-03)	VOC	Air Tube
	NSP-2-10M-PAH-5-032007 Front (0701575-05)	PAH	Air Tube
	NSP-2-10M-VOC-5-032007 Front (0701575-07)	VOC	Air Tube
	NSP-2-10M-PAH-6-032107 Front (0701575-09)	PAH	Air Tube
	NSP-2-10M-VOC-6-032107 Front (0701575-11)	VOC	Air Tube
	NSP-2-10M-VOC-8-032107 (0701575-13)	VOC	Slurry
	NSP-2-10M-PAH-8-032107 total (0701575-14)	PAH	Water
	NSP-2-10M-DOC-8-032107 (0701575-15)	DOC	Slurry

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	NSP-2-10M-TOC-8-032107 (0701575-16)	TOC	Slurry
	NSP-2-10M-TSS-8-032107 (0701575-17)	TSS	Slurry
	NSP-1-10M-PAH-1-032107 (0701575-18)	PAH	Soil
	NSP-1-10M-VOC-1-032107 (0701575-19)	VOC	Soil
	NSP-1-10M-TOC-7-032107 (0701575-20)	TOC	Slurry
	NSP-1-10M-TSS-7-032107 (0701575-21)	TSS	Slurry
	Trip Blank (MeOH) (0701575-22)	VOC	Soil
	Trip Blanks (HCL) (0701575-23)	VOC	Water
	NSP-2-10M-PAH-8-032107 dissolved (0701575-24)	PAH	Water
701595	NSP-2-10M-VOC-3-032107 (0701595-01)	VOC	Soil
	NSP-2-10M-PAH-3-032107 (0701595-02)	SVOC	Soil
	NSP-2-10M-PAH-4-032107 (0701595-03)	SVOC	Water
	NSP-2-10M-VOC-4-032107 (0701595-04)	VOC	Water
	NSP-1-10M-PAH-2-032107 Front (0701595-05)	SVOC	Air Tube
	NSP-1-10M-VOC-2-032107 Front (0701595-07)	VOC	Air Tube
	NSP-1-10M-PAH-5-032107 Front (0701595-09)	SVOC	Air Tube
	NSP-1-10M-VOC-5-032107 Front (0701595-11)	VOC	Air Tube
	NSP-1-10M-PAH-6-032207 Front (0701595-13)	SVOC	Air Tube
	NSP-1-10M-VOC-6-032207 Front (0701595-15)	VOC	Air Tube
	NSP-1-10M-VOC-6-032207 Back (0701595-16)	VOC	Air Tube
	NSP-1-10M-VOC-8-032207 (0701595-17)	VOC	Slurry
	NSP-1-10M-PAH-8-032207 total (0701595-18)	SVOC	Water

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	NSP-1-10M-TOC-8-032207 (0701595-19)	TOC	Slurry
	NSP-1-10M-DOC-8-032207 (0701595-20)	DOC	Slurry
	NSP-1-10M-TSS-8-032207 (0701595-21)	TSS	Slurry
	Trip Blank (MeOH) (0701595-22)	VOC	Soil
	Trip Blanks (HCL) (0701595-23)	VOC	Water
	NSP-1-10M-PAH-8-032207 (0701595-24)	SVOC	Water
701617	NSP-1-10Q-TSS-7-032207 (0701617-01)	TSS	Slurry
	NSP-1-10Q-TOC-7-032207 (0701617-02)	TOC	Slurry
	NWP-1-10Q-PAH-3-032207 (0701617-03)	VOCs	Soil
	NSP-1-10Q-VOC-3-032207 (0701617-04)	VOCs	Soil
	NSP-1-10M-PAH-4-032207 (0701617-05)	SVOCs	Water
	NSP-1-10M-VOC-4-032207 (0701617-06)	VOCs	Slurry
	NSP-1-10Q-PAH-2-032207 Front (0701617-07)	SVOCs	Air Tube
	NSP-1-10Q-VOC-2-032207 Front (0701617-09)	VOCs	Air Tube
	NSP-1-10Q-PAH-5-032207 Front (0701617-11)	SVOCs	Air Tube
	NSP-1-10Q-VOC-5-032207 Front (0701617-13)	VOCs	Air Tube
	NSP-1-10Q-PAH-6-032307 Front (0701617-15)	SVOCs	Air Tube
	NSP-1-10Q-VOC-6-032307 Front (0701617-17)	VOCs	Air Tube
	NSP-1-10Q-PAH-8-032307 total (0701617-19)	SVOCs	Water
	NSP-1-10Q-PAH-8-032307 dissolved (0701617-20)	SVOCs	Water

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	NSP-1-10Q-VOC-8-032307 (0701617-21)	VOCs	Slurry
	NSP-1-10Q-TSS-8-032307 (0701617-22)	TSS/TS	Slurry
	NSP-1-10Q-DOC-8-032307 (0701617-23)	DOC	Slurry
	NSP-1-10Q-TOC-8-032307 (0701617-24)	TOC	Slurry
	Trip Blank (D1) (0701617-25)	VOCs	Water
	Trip Blank (MeOH) (0701617-26)	VOCs	Soil
701628	NSP-1-10Q-VOC-3-032307 (0701628-01)	VOC	Soil
	NSP-1-10Q-PAH-3-032307 (0701628-02)	SVOC	Soil
	NSP-1-1M-PAH-1-032307 (0701628-03)	SVOC	Soil
	NSP-1-1M-TSS-7-032307 (0701628-04)	TSS	Slurry
	NSP-1-1M-TOC-7-032307 (0701628-05)	TOC	Slurry
	NSP-1-1M-VOC-1-032307 (0701628-06)	VOC	Soil
	NSP-1-10Q-PAH-4-032307 (0701628-07)	SVOC	Water
	NSP-1-10Q-VOC-4-032307 (0701628-08)	VOC	Slurry
	NSP-1-1M-PAH-2-032307 Front (0701628-09)	SVOC	Air Tube
	NSP-1-1M-VOC-2-032307 Front (0701628-11)	VOC	Air Tube
	NSP-1-1M-PAH-5-032307 Front (0701628-13)	SVOC	Air Tube
	NSP-1-1M-VOC-5-032307 Front (0701628-15)	VOC	Air Tube
	NSP-1-1M-PAH-6-032407 Front (0701628-17	SVOC	Air Tube

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	NSP-1-1M-VOC-6-032407 Front (0701628-19)	VOC	Air Tube
	NSP-1-1M-VOC-6-032407 Back (0701628-20)	VOC	Air Tube
	NSP-1-1M-VOC-8-032407 (0701628-21)	VOC	Slurry
	NSP-1-1M-PAH-8-032407 Total (0701628-22)	SVOC	Water
	NSP-1-1M-PAH-8-032407 dissolved (0701628-23)	SVOC	Water
	NSP-1-1M-TSS-8-032407 (0701628-24)	TSS	Slurry
	NSP-1-1M-TOC-8-032407 (0701628-25)	TOC	Slurry
	NSP-1-1M-DOC-8-032407 (0701628-26)	DOC	Slurry
	NSP-1-1M-VOC-3-032407 (0701628-27)	VOC	Soil
	NSP-1-1M-PAH-3-032407 (0701628-28)	SVOC	Soil
	NSP-1-1M-VOC-4-032407 (0701628-29)	VOC	Slurry
	NSP-1-1M-PAH-4-032407 (0701628-30)	SVOC	Water
	Trip Blanks (D1) (0701628-31)	VOC	Water
	Trip Blank (MeOH) (0701628-32)	VOC	Soil
	NSP-2A-10Q-PAH-1-032607 (0701628-33)	SVOC	Soil
	NSP-2A-10Q-VOC-1-032607 (0701628-34)	VOC	Soil
	NSP-2A-10Q-TOC-7-032607 (0701628-35)	TOC	Slurry
701696	NSP-2A-1M-PAH-2-032707 Front (0701696-01)	PAH	Air Tube
	NSP-2A-1M-VOC-2-032707 Front (0701696-03)	VOC	Air Tube

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	NSP-2A-1M-PAH-5-032707 Front (0701696-05)	PAH	Air Tube
	NSP-2A-1M-VOC-5-032707 Front (0701696-07)	VOC	Air Tube
	NSP-2A-1M-PAH-6-032807 Front (0701696-09)	PAH	Air Tube
	NSP-2A-1M-PAH-6-032807 Back (0701696-10)	PAH	Air Tube
	NSP-2A-1M-VOC-6-032807 Front (0701696-11)	VOC	Air Tube
	NSP-2A-1M-VOC-6-032807 Back (0701696-12)	VOC	Air Tube
	NSP-2A-1M-PAH-8-032807 Total (0701696-13)	PAH	Slurry
	NSP-2A-1M-PAH-8-032807 Dissolved (0701696-14)	PAH	Slurry
	NSP-2A-1M-VOC-8-032807 (0701696-15)	VOC	Slurry
	NSP-2A-1M-TSS-8-032807 (0701696-16)	TSS	Slurry
	NSP-2A-1M-TOC-8-032807 (0701696-17)	TOC	Slurry
	NSP-2A-1M-DOC-8-032807 (0701696-18)	DOC	Slurry
	NSP-2A-10M-TOC-1-032807 (0701696-19)	TOC	Soil
	NSP-2A-10M-PAH-1-032807 (0701696-20)	PAH	Soil
	NSP-2A-10M-VOC-1-032807 (0701696-21)	VOC	Soil
	NSP-2A-1M-PAH-3-032807 (0701696-22)	PAH	Soil
	NSP-2A-1M-VOC-3-032807 (0701696-23)	VOC	Soil
	Trip Blanks (D1) (0701696-24)	VOC	Water

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	Trip Blank (MeOH) (0701696-25)	VOC	Soil
701706	NSP-2A-1M-PAH-4-032807 (0701706-01)	PAH	Water
	NSP-2A-1M-VOC-4-032807 (0701706-02)	VOC	Slurry
	NSP-2A-10M-PAH-2-032807 Front (0701706-03)	PAH	Air Tube
	NSP-2A-10M-VOC-2-032807 Front (0701706-05)	VOC	Air Tube
	NSP-2A-10M-PAH-5-032807 Front (0701706-07)	PAH	Air Tube
	NSP-2A-10M-PAH-5-032807 Back (0701706-08)	PAH	Air Tube
	NSP-2A-10M-VOC-5-032807 Front (0701706-09)	VOC	Air Tube
	NSP-2A-10M-PAH-6-032907 Front (0701706-11)	PAH	Air Tube
	NSP-2A-10M-PAH-6-032907 Back (0701706-12)	PAH	Air Tube
	NSP-2A-10M-VOC-6-032907 Front (0701706-13)	VOC	Air Tube
	NSP-2A-10M-VOC-6-032907 Back (0701706-14)	VOC	Air Tube
	NSP-2A-10M-PAH-8-032907 Total (0701706-15)	PAH	Slurry
	NSP-2A-10M-PAH-8-032907 Dissolved (0701706-16)	PAH	Slurry
	NSP-2A-10M-VOC-8-032907 (0701706-17)	VOC	Slurry
	NSP-2A-10M-TSS-8-032907 (0701706-18)	TSS	Slurry
	NSP-2A-10M-DOC-8-032907 (0701706-19)	DOC	Slurry
	NSP-2A-10M-TOC-8-032907 (0701706-20)	TOC	Slurry

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	NSP-2A-10M-PAH-3-032907 (0701706-21)	PAH	Soil
	NSP-2A-10M-VOC-3-032907 (0701706-22)	VOC	Soil
	Trip Blanks (D1) (0701706-23)	VOC	Water
	Trip Blank (MeOH) (0701706-24)	VOC	Soil
701731	NSP-2A-1Q-TSS-7-032907 (0701731-01)	TSS	Slurry
	NSP-2A-1Q-TOC-7-032907 (0701731-02)	TOC	Slurry
	NSP-2A-1Q-PAH-2-032907 Front (0701731-03)	PAH	Air Tube
	NSP-2A-1Q-VOC-2-032907 Front (0701731-05)	VOC	Air Tube
	NSP-2A-1Q-PAH-5-032907 Front (0701731-07)	PAH	Air Tube
	NSP-2A-1Q-VOC-5-032907 Front (0701731-09)	VOC	Air Tube
	NSP-2A-1Q-PAH-6-033007 Front (0701731-11)	PAH	Air Tube
	NSP-2A-1Q-PAH-6-033007 Back (0701731-12)	PAH	Air Tube
	NSP-2A-1Q-VOC-6-033007 Front (0701731-13)	VOC	Air Tube
	NSP-2A-1Q-PAH-8-033007 Total (0701731-15)	PAH	Slurry
	NSP-2A-1Q-PAH-8-033007 Dissolved (0701731-16)	PAH	Slurry
	NSP-2A-1Q-TSS-8-033007 (0701731-17)	TSS	Slurry
	NSP-2A-1Q-DOC-8-033007 (0701731-18)	DOC	Slurry
	NSP-2A-1Q-TOC-8-033007 (0701731-19)	TOC	Slurry
	NSP-2A-1Q-VOC-8-033007	VOC	Slurry

Table F-1
Sample Identifications, Matrix, and Analysis Performed

Work Order	Sample Identifications	Sample Analyses	Sample Matrix
	(0701731-20)		
	NSP-2A-1Q-VOC-3-033007 (0701731-21)	VOC	Soil
	NSP-2A-1Q-PAH-3-033007 (0701731-22)	PAH	Soil
	Trip Blanks (D1) (0701731-23)	VOC	Water
	Trip Blank (MeOH) (0701731-24)	VOC	Soil

Table F-2
MS/MSD Quality Control Samples

Sample Identification	Analyses Performed	Sample Matrix	Field Required or Lab Selected?
NSP-4-ES-1-VOC-031407 (0701451-01)	VOCs	Soil	FR
NSP-4-ES-PAH-1-031407 (0701451-02)	PAHs	Soil	FR
NSP-1-ES-PAH-1-031507 (0701451-15)	PAHs	Soil	FR
NSP-1-ES-VOC-1-031507 (0701451-17)	VOCs	Soil	FR
NSP-2-10M-PAH-4-032107 (0701595-03)	PAHs	Water	LS
NSP-1-1M-PAH-1-032307 (0701628-03)	Acenaphthene and Pyrene	Soil	LS
NSP-1-10Q-PAH-4-032307 (0701628-07)	PAHs	Water	LS
NSP-1-1M-PAH-8-032407 Total (0701628-22)	Acenaphthene and Pyrene	Water	LS
NSP-1-1M-PAH-8-032407 dissolved (0701628-23)	Acenaphthene and Pyrene	Water	LS
NSP-2A-1M-PAH-4-032807 (0701706-01)	PAH	Water	LS

Field Duplicates

Sample Identifications	Sample Analyses	Sample Matrix
NSP-4-ES-TOC-1-031407-Dup (0701451-16)	TOCs	Soil
NSP-1-ES-TOC-1-031507-Dup (0701451-19)	TOCs	Soil
NSP-2-ES-TOC-1-031907-Dup (0701544-03)	TOC	Soil

APPENDIX H

Air Emission Wind Tunnel Results and Summary Tables

Appendix H
Air Emission Wind Tunnel Results Summary (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

	0 - 2 Hour Emission Rate ($ug/m^2/hr$)															
	Sediment		***Exposed Sediment***		***Sediment***		***10% Mixed***		***Sediment*** [1]		***10% Quiescent***		***Sediment***		***1% Mixed***	
Chemical/Parameter	*Concentration (mg/Kg)*	*flags*	*Emission Rate ($ug/m^2/hr$)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate ($ug/m^2/hr$)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate ($ug/m^2/hr$)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate ($ug/m^2/hr$)*	*flags*
VOCs																
1,2,3-Trimethylbenzene	3.40	0	68817	U	4.90	0	43166	U			34765	U	4.00	0	32489	U
1,2,4-Trimethylbenzene	8.60	0	79088	0	9.10	0	64963	0			43714	0	11.0	0	37314	0
1,3,5-Trimethylbenzene	2.40	0	32799	U	0.33	U	40944	U			32975	U	3.10	0	30816	U
1,4-Dichlorobenzene	0.120	U	79088	U	0.40	U	49150	U			39584	U	0.170	U	36992	U
Benzene	0.044	U	205765	0	0.150	U	117959	0			96378	0	0.064	U	71732	0
Carbon Tetrachloride	0.056	U	3423710	0	0.190	U	150440	0			69874	U	0.081	U	65299	U
Ethyl Benzene	12.0	0	78745	0	4.60	0	83340	U			67120	U	3.30	0	62726	U
sec-Butylbenzene	0.042	U	33415	U	0.140	U	41713	U			33594	U	0.061	U	31395	U
Styrene	0.046	U	44508	U	0.150	U	55560	U			44747	U	0.067	U	41817	U
Toluene	3.20	0	410845	0	0.580	U	267544	0			186215	0	0.25	U	173701	0
Trichloroethene	0.074	U	34032	U	0.250	U	42482	U			34214	U	0.110	U	31974	U
Xylenes, Total	13.8	0	314297	0	11.4	0	192752	0			68497	U	11.7	0	64012	U
PAHs																
1-Methylnaphthalene	100	0	36223	U	84.0	0	22609	U			18208	U	56.0	0	17016	U
2-Methylnaphthalene	230	0	36017	U	190	0	22481	U			18105	U	170	0	16920	U
Acenaphthene	87.0	0	37661	U	74.0	0	23506	U			18931	U	45.0	0	17692	U
Acenaphthylene	6.20	0	34716	U	6.10	0	21669	U			17451	U	6.90	0	16309	U
Anthracene	46.0	0	37524	U	48.0	0	23421	U			18862	U	32.0	0	17627	U
Benz(a)anthracene	15.0	0	40674	U	14.0	0	25387	U			20446	U	14.0	0	19107	U
Benzo(a)pyrene	13.0	0	43002	U	13.0	0	26840	U			21616	U	11.0	0	20201	U
Benzo(b)fluoranthene	7.70	0	42522	U	8.10	0	26541	U			21375	U	5.30	0	19976	U
Benzo(g,h,i)perylene	1.70	0	52520	U	0.970	0	32781	U			26401	U	3.30	0	24672	U
Benzo(k)fluoranthene	9.20	0	43070	U	9.80	0	26883	U			21651	U	8.00	0	20233	U
Chrysene	16.0	0	40811	U	16.0	0	25472	U			20515	U	14.0	0	19171	U
Dibenz(a,h)anthracene	0.770	0	43823	U	0.490	0	27353	U			22029	U	1.10	J	20587	U
Fluoranthene	46.0	0	38893	U	47.0	0	24276	U			19551	U	34.0	0	18271	U
Fluorene	51.0	0	36976	U	83.0	0	23079	U			18587	U	51.0	0	17370	U
Indeno(1,2,3-cd)pyrene	2.00	0	46220	U	1.20	0	28849	U			23234	U	3.10	0	21713	U
Naphthalene	270	0	102437	0	180	0	86332	0			49566	0	120	0	25090	0
Phenanthrene	160	0	37798	U	160	0	23592	U			19000	U	130	0	17756	U
Pyrene	23.0	0	39510	U	51.0	0	24660	U			19861	U	30.0	0	18560	U
Average Test Conditions																
Sed Temp (degrees F)			63.5				53.8				64.5				63.0	
Air Temp (degrees F)			64.9				60.5				60.5				60.9	
Humidity (%)			35.3				91.9				86.7				82.7	
Air Velocity (Mi/Hr)			5.25				5.05				5.05				5.10	
Cross Section Area (m^2)			0.152				0.152				0.152				0.152	

Flags:
0=No qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnote:
[1] Pretest sediment samples not collected

Appendix H
Air Emission Wind Tunnel Results Summary (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

	2 - 6 Hour Emission Rate (ug/m^2/hr)															
	Sediment		***Exposed***		***Sediment***		***10% Mixed***		***Sediment*** [1]		***10% Quiescent***		***Sediment***		***1% Mixed***	
Chemical/Parameter	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*
VOCs																
1,2,3-Trimethylbenzene	3.40	0	37832	U	4.90	0	15231	U			15086	U	4.00	0	15414	U
1,2,4-Trimethylbenzene	8.60	0	53565	0	9.10	0	33611	0			26602	0	11.0	0	39531	0
1,3,5-Trimethylbenzene	2.40	0	17942	U	0.33	U	14504	U			14366	U	3.10	0	14679	U
1,4-Dichlorobenzene	0.120	U	43077	U	0.40	U	17441	U			17275	U	0.170	U	17651	U
Benzene	0.044	U	107879	0	0.150	U	51174	0			41388	0	0.064	U	63741	0
Carbon Tetrachloride	0.056	U	1116244	0	0.190	U	30886	U			36290	0	0.081	U	64966	0
Ethyl Benzene	12.0	0	48695	0	4.60	0	29554	U			29272	U	3.30	0	29909	U
sec-Butylbenzene	0.042	U	18279	U	0.140	U	14777	U			14636	U	0.061	U	14955	U
Styrene	0.046	U	24385	U	0.150	U	19712	U			19524	U	0.067	U	19950	U
Toluene	3.20	0	273442	0	0.580	U	145648	0			89374	0	0.25	U	149545	0
Trichloroethene	0.074	U	18617	U	0.250	U	15049	U			17455	0	0.110	U	21696	0
Xylenes, Total	13.8	0	208266	0	11.4	0	94474	0			76178	0	11.7	0	116756	0
PAHs																
1-Methylnaphthalene	100	0	9926	U	84.0	0	8024	U			7948	U	56.0	0	8121	U
2-Methylnaphthalene	230	0	9851	U	190	0	7964	U			7888	U	170	0	8060	U
Acenaphthene	87.0	0	10301	U	74.0	0	8327	U			8248	U	45.0	0	8427	U
Acenaphthylene	6.20	0	9514	U	6.10	0	7691	U			7618	U	6.90	0	7784	U
Anthracene	46.0	0	10263	U	48.0	0	8297	U			8218	U	32.0	0	8397	U
Benz(a)anthracene	15.0	0	11125	U	14.0	0	8993	U			8907	U	14.0	0	9101	U
Benzo(a)pyrene	13.0	0	11762	U	13.0	0	9508	U			9417	U	11.0	0	9622	U
Benzo(b)fluoranthene	7.70	0	11612	U	8.10	0	9387	U			9297	U	5.30	0	9500	U
Benzo(g,h,i)perylene	1.70	0	14384	U	0.970	0	11628	U			11517	U	3.30	0	11768	U
Benzo(k)fluoranthene	9.20	0	11762	U	9.80	0	9508	U			9417	U	8.00	0	9622	U
Chrysene	16.0	0	11162	U	16.0	0	9024	U			8937	U	14.0	0	9132	U
Dibenz(a,h)anthracene	0.770	0	11987	U	0.490	0	9690	U			9597	U	1.10	J	9806	U
Fluoranthene	46.0	0	10638	U	47.0	0	8600	U			8518	U	34.0	0	8703	U
Fluorene	51.0	0	10114	U	83.0	0	8176	U			8098	U	51.0	0	8274	U
Indeno(1,2,3-cd)pyrene	2.00	0	12623	U	1.20	0	10204	U			10107	U	3.10	0	10327	U
Naphthalene	270	0	82033	0	180	0	36336	0			21864	0	120	0	15935	0
Phenanthrene	160	0	10338	U	160	0	8357	U			8278	U	130	0	8458	U
Pyrene	23.0	0	10825	U	51.0	0	8751	U			8667	U	30.0	0	8856	U
Average Test Conditions																
Sed Temp (degrees F)			60.8				61.8				64.5				66.3	
Air Temp (degrees F)			65.1				60.5				60.1				60.55	
Humidity (%)			33.6				87.4				82.3				84.0	
Air Velocity (Mi/Hr)			5.20				5.10				5.20				5.10	
Cross Section Area (m^2)			0.152				0.152				0.152				0.152	

Flags:
0=No qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnote:
[1] Pretest sediment samples not collected

Appendix H
Air Emission Wind Tunnel Results Summary (Area 1)
Ashland/Northern States Power Lakefront Superfund Site

	6 - 22 Hour Emission Rate (ug/m^2/hr)															
	Sediment		***Exposed***		***Sediment***		***10% Mixed***		***Sediment*** [1]		***10% Quiescent***		***Sediment***		***1% Mixed***	
Chemical/Parameter	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/Kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*
VOCs																
1,2,3-Trimethylbenzene	3.40	0	15098	U	4.90	0	10418	0			8374	0	4.00	0	6784	0
1,2,4-Trimethylbenzene	8.60	0	35696	0	9.10	0	41991	0			26797	0	11.0	0	19583	0
1,3,5-Trimethylbenzene	2.40	0	6876	U	0.33	U	14608	0			7537	0	3.10	0	7290	0
1,4-Dichlorobenzene	0.120	U	16501	U	0.40	U	8381	U			4307	U	0.170	U	5397	U
Benzene	0.044	U	43918	0	0.150	U	47899	0			30207	0	0.064	U	24100	0
Carbon Tetrachloride	0.056	U	7277	0	0.190	U	244354	0			49049	0	0.081	U	24306	0
Ethyl Benzene	12.0	0	23950	0	4.60	0	25055	0			13997	0	3.30	0	11638	0
sec-Butylbenzene	0.042	U	6990	U	0.140	U	7100	U			3649	U	0.061	U	4573	U
Styrene	0.046	U	19767	U	0.150	U	16791	0			8913	0	0.067	U	8527	0
Toluene	3.20	0	143098	0	0.580	U	136625	0			92116	0	0.25	U	61936	0
Trichloroethene	0.074	U	9626	U	0.250	U	9661	0			9032	0	0.110	U	7833	0
Xylenes, Total	13.8	0	109551	0	11.4	0	106332	0			73274	0	11.7	0	48050	0
PAHs																
1-Methylnaphthalene	100	0	3793	U	84.0	0	10534	0			6460	0	56.0	0	3823	0
2-Methylnaphthalene	230	0	3770	U	190	0	21068	0			1968	U	170	0	8021	0
Acenaphthene	87.0	0	3942	U	74.0	0	2002	U			2058	U	45.0	0	1289	U
Acenaphthylene	6.20	0	3633	U	6.10	0	1845	U			1896	U	6.90	0	1188	U
Anthracene	46.0	0	3931	U	48.0	0	1996	U			2052	U	32.0	0	1286	U
Benz(a)anthracene	15.0	0	4257	U	14.0	0	2162	U			2222	U	14.0	0	1392	U
Benzo(a)pyrene	13.0	0	4498	U	13.0	0	2284	U			2348	U	11.0	0	1471	U
Benzo(b)fluoranthene	7.70	0	4446	U	8.10	0	2258	U			2321	U	5.30	0	1454	U
Benzo(g,h,i)perylene	1.70	0	5495	U	0.970	0	2791	U			2868	U	3.30	0	1797	U
Benzo(k)fluoranthene	9.20	0	4504	U	9.80	0	2287	U			2351	U	8.00	0	1473	U
Chrysene	16.0	0	4274	U	16.0	0	2171	U			2231	U	14.0	0	1398	U
Dibenz(a,h)anthracene	0.770	0	4584	U	0.490	0	2328	U			2393	U	1.10	J	1499	U
Fluoranthene	46.0	0	4068	U	47.0	0	2066	U			2123	U	34.0	0	1331	U
Fluorene	51.0	0	3868	U	83.0	0	1964	U			2019	U	51.0	0	1265	U
Indeno(1,2,3-cd)pyrene	2.00	0	4836	U	1.20	0	2456	U			2524	U	3.10	0	1582	U
Naphthalene	270	0	23374	0	180	0	22116	0			12202	0	120	0	6072	0
Phenanthrene	160	0	3948	U	160	0	2005	U			2061	U	130	0	1291	U
Pyrene	23.0	0	4131	U	51.0	0	2098	U			2156	U	30.0	0	1351	U
Average Test Conditions																
Sed Temp (degrees F)			59.8				69.3				65.0				68.8	
Air Temp (degrees F)			65.3				62.6				61.6				61.2	
Humidity (%)			32.3				83.6				79.2				85.8	
Air Velocity (Mi/Hr)			5.05				5.00				5.05				5.00	
Cross Section Area (m^2)			0.152				0.152				0.152				0.152	

Flags:
0=No qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnote:
[1] Pretest sediment samples not collected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
Exposed Sediment, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	20.1	U	849	17067	0.124	2	68817
1,2,4-Trimethylbenzene	23.1		849	19614	0.124	2	79088
1,3,5-Trimethylbenzene	9.58	U	849	8134	0.124	2	32799
1,4-Dichlorobenzene	23.1	U	849	19614	0.124	2	79088
Benzene	60.1		849	51030	0.124	2	205765
Carbon Tetrachloride	1000		849	849080	0.124	2	3423710
Ethyl Benzene	23.0		849	19529	0.124	2	78745
sec-Butylbenzene	9.76	U	849	8287	0.124	2	33415
Styrene	13.0	U	849	11038	0.124	2	44508
Toluene	120		849	101890	0.124	2	410845
Trichloroethene	9.94	U	849	8440	0.124	2	34032
Xylenes, Total	91.8		849	77946	0.124	2	314297
PAHs							
1-Methylnaphthalene	10.6	U	849	8983	0.124	2	36223
2-Methylnaphthalene	10.5	U	849	8932	0.124	2	36017
Acenaphthene	11.0	U	849	9340	0.124	2	37661
Acenaphthylene	10.1	U	849	8610	0.124	2	34716
Anthracene	11.0	U	849	9306	0.124	2	37524
Benz(a)anthracene	11.9	U	849	10087	0.124	2	40674
Benzo(a)pyrene	12.6	U	849	10664	0.124	2	43002
Benzo(b)fluoranthene	12.4	U	849	10546	0.124	2	42522
Benzo(g,h,i)perylene	15.3	U	849	13025	0.124	2	52520
Benzo(k)fluoranthene	12.6	U	849	10681	0.124	2	43070
Chrysene	11.9	U	849	10121	0.124	2	40811
Dibenz(a,h)anthracene	12.8	U	849	10868	0.124	2	43823
Fluoranthene	11.4	U	849	9646	0.124	2	38893
Fluorene	10.8	U	849	9170	0.124	2	36976
Indeno(1,2,3-cd)pyrene	13.5	U	849	11463	0.124	2	46220
Naphthalene	29.9		849	25404	0.124	2	102437
Phenanthrene	11.0	U	849	9374	0.124	2	37798
Pyrene	11.5	U	849	9798	0.124	2	39510
Test Conditions							
Sed Temp (degrees F)	Max	65.5		Min	61.5	Avg	63.5
Air Temp (degrees F)	Max	65.6		Min	64.2	Avg	64.9
Humidity (%)	Max	36.1		Min	34.5	Avg	35.3
Air Velocity (Mi/Hr)	Max	466		Min	458	Avg	5.25
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/15/2007

Sample IDs: NSP-1-ES-PAH-2-031507 Sample A, NSP-1-ES-PAH-2-031507 Sample B, NSP-1-ES-VOC-2-031507 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
Exposed Sediment, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	1858	18765	0.124	4	37832
1,2,4-Trimethylbenzene	14.3		1858	26568	0.124	4	53565
1,3,5-Trimethylbenzene	4.79	U	1858	8899	0.124	4	17942
1,4-Dichlorobenzene	11.5	U	1858	21366	0.124	4	43077
Benzene	28.8		1858	53508	0.124	4	107879
Carbon Tetrachloride	298		1858	553657	0.124	4	1116244
Ethyl Benzene	13.0		1858	24153	0.124	4	48695
sec-Butylbenzene	4.88	U	1858	9067	0.124	4	18279
Styrene	6.51	U	1858	12095	0.124	4	24385
Toluene	73.0		1858	135627	0.124	4	273442
Trichloroethene	4.97	U	1858	9234	0.124	4	18617
Xylenes, Total	55.6		1858	103300	0.124	4	208266
PAHs							
1-Methylnaphthalene	2.65	U	1858	4923	0.124	4	9926
2-Methylnaphthalene	2.63	U	1858	4886	0.124	4	9851
Acenaphthene	2.75	U	1858	5109	0.124	4	10301
Acenaphthylene	2.54	U	1858	4719	0.124	4	9514
Anthracene	2.74	U	1858	5091	0.124	4	10263
Benz(a)anthracene	2.97	U	1858	5518	0.124	4	11125
Benzo(a)pyrene	3.14	U	1858	5834	0.124	4	11762
Benzo(b)fluoranthene	3.10	U	1858	5760	0.124	4	11612
Benzo(g,h,i)perylene	3.84	U	1858	7134	0.124	4	14384
Benzo(k)fluoranthene	3.14	U	1858	5834	0.124	4	11762
Chrysene	2.98	U	1858	5537	0.124	4	11162
Dibenz(a,h)anthracene	3.20	U	1858	5945	0.124	4	11987
Fluoranthene	2.84	U	1858	5276	0.124	4	10638
Fluorene	2.70	U	1858	5016	0.124	4	10114
Indeno(1,2,3-cd)pyrene	3.37	U	1858	6261	0.124	4	12623
Naphthalene	21.9		1858	40688	0.124	4	82033
Phenanthrene	2.76	U	1858	5128	0.124	4	10338
Pyrene	2.89	U	1858	5369	0.124	4	10825
Test Conditions							
Sed Temp (degrees F)	Max	62.0		Min	59.5	Avg	60.8
Air Temp (degrees F)	Max	65.8		Min	64.4	Avg	65.1
Humidity (%)	Max	34.9		Min	32.2	Avg	33.6
Air Velocity (Mi/Hr)	Max	466		Min	449	Avg	5.20
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/15/2007

Sample IDs: NSP-1-ES-PAH-5-031507 Front, NSP-1-ES-VOC-5-031507 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
Exposed Sediment, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.27		5684	29954	0.124	16	15098
1,2,4-Trimethylbenzene	12.5		5684	70820	0.124	16	35696
1,3,5-Trimethylbenzene	2.40	U	5684	13641	0.124	16	6876
1,4-Dichlorobenzene	5.76	U	5684	32739	0.124	16	16501
Benzene	15.3		5684	87133	0.124	16	43918
Carbon Tetrachloride	2.54	U	5684	14437	0.124	16	7277
Ethyl Benzene	8.36		5684	47517	0.124	16	23950
sec-Butylbenzene	2.44	U	5684	13868	0.124	16	6990
Styrene	6.90		5684	39218	0.124	16	19767
Toluene	50.0		5684	283906	0.124	16	143098
Trichloroethene	3.36		5684	19098	0.124	16	9626
Xylenes, Total	38.2		5684	217349	0.124	16	109551
PAHs							
1-Methylnaphthalene	1.32	U	5684	7525	0.124	16	3793
2-Methylnaphthalene	1.32	U	5684	7480	0.124	16	3770
Acenaphthene	1.38	U	5684	7821	0.124	16	3942
Acenaphthylene	1.27	U	5684	7207	0.124	16	3633
Anthracene	1.37	U	5684	7798	0.124	16	3931
Benz(a)anthracene	1.49	U	5684	8446	0.124	16	4257
Benzo(a)pyrene	1.57	U	5684	8924	0.124	16	4498
Benzo(b)fluoranthene	1.55	U	5684	8821	0.124	16	4446
Benzo(g,h,i)perylene	1.92	U	5684	10902	0.124	16	5495
Benzo(k)fluoranthene	1.57	U	5684	8935	0.124	16	4504
Chrysene	1.49	U	5684	8480	0.124	16	4274
Dibenz(a,h)anthracene	1.60	U	5684	9094	0.124	16	4584
Fluoranthene	1.42	U	5684	8071	0.124	16	4068
Fluorene	1.35	U	5684	7673	0.124	16	3868
Indeno(1,2,3-cd)pyrene	1.69	U	5684	9594	0.124	16	4836
Naphthalene	8.16		5684	46374	0.124	16	23374
Phenanthrene	1.38	U	5684	7832	0.124	16	3948
Pyrene	1.44	U	5684	8196	0.124	16	4131
Test Conditions							
Sed Temp (degrees F)	Max	60.5		Min	59.0	Avg	59.8
Air Temp (degrees F)	Max	65.6		Min	64.9	Avg	65.3
Humidity (%)	Max	33.1		Min	31.4	Avg	32.3
Air Velocity (Mi/Hr)	Max	449		Min	440	Avg	5.05
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/16/2007

Sample IDs: NSP-1-ES-PAH-6-031607 Sample A, NSP-1-ES-VOC-6-031607 Sample A, NSP-1-ES-VOC-6-031607 Sample B, NSP-1-ES-PAH-6-031607 Sample B

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
10% Mixed, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	1060	10705	0.124	2	43166
1,2,4-Trimethylbenzene	15.2		1060	16111	0.124	2	64963
1,3,5-Trimethylbenzene	9.58	U	1060	10154	0.124	2	40944
1,4-Dichlorobenzene	11.5	U	1060	12189	0.124	2	49150
Benzene	27.6		1060	29254	0.124	2	117959
Carbon Tetrachloride	35.2		1060	37309	0.124	2	150440
Ethyl Benzene	19.5	U	1060	20668	0.124	2	83340
sec-Butylbenzene	9.76	U	1060	10345	0.124	2	41713
Styrene	13.0	U	1060	13779	0.124	2	55560
Toluene	62.6		1060	66351	0.124	2	267544
Trichloroethene	9.94	U	1060	10536	0.124	2	42482
Xylenes, Total	45.1		1060	47802	0.124	2	192752
PAHs							
1-Methylnaphthalene	5.29	U	1060	5607	0.124	2	22609
2-Methylnaphthalene	5.26	U	1060	5575	0.124	2	22481
Acenaphthene	5.50	U	1060	5830	0.124	2	23506
Acenaphthylene	5.07	U	1060	5374	0.124	2	21669
Anthracene	5.48	U	1060	5808	0.124	2	23421
Benz(a)anthracene	5.94	U	1060	6296	0.124	2	25387
Benzo(a)pyrene	6.28	U	1060	6656	0.124	2	26840
Benzo(b)fluoranthene	6.21	U	1060	6582	0.124	2	26541
Benzo(g,h,i)perylene	7.67	U	1060	8130	0.124	2	32781
Benzo(k)fluoranthene	6.29	U	1060	6667	0.124	2	26883
Chrysene	5.96	U	1060	6317	0.124	2	25472
Dibenz(a,h)anthracene	6.40	U	1060	6783	0.124	2	27353
Fluoranthene	5.68	U	1060	6020	0.124	2	24276
Fluorene	5.40	U	1060	5724	0.124	2	23079
Indeno(1,2,3-cd)pyrene	6.75	U	1060	7154	0.124	2	28849
Naphthalene	20.2		1060	21410	0.124	2	86332
Phenanthrene	5.52	U	1060	5851	0.124	2	23592
Pyrene	5.77	U	1060	6116	0.124	2	24660
Test Conditions							
Sed Temp (degrees F)	Max	56.0		Min	51.5	Avg	53.8
Air Temp (degrees F)	Max	61.3		Min	59.7	Avg	60.5
Humidity (%)	Max	94.4		Min	89.3	Avg	91.9
Air Velocity (Mi/Hr)	Max	5.10		Min	5.00	Avg	5.05
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/21/2007

Sample IDs: NSP-1-10M-PAH-2-032107 Front, NSP-1-10M-VOC-2-032107 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
10% Mixed, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.03	U	1502	7555	0.124	4	15231
1,2,4-Trimethylbenzene	11.1		1502	16671	0.124	4	33611
1,3,5-Trimethylbenzene	4.79	U	1502	7194	0.124	4	14504
1,4-Dichlorobenzene	5.76	U	1502	8651	0.124	4	17441
Benzene	16.9		1502	25382	0.124	4	51174
Carbon Tetrachloride	10.2	U	1502	15319	0.124	4	30886
Ethyl Benzene	9.76	U	1502	14659	0.124	4	29554
sec-Butylbenzene	4.88	U	1502	7329	0.124	4	14777
Styrene	6.51	U	1502	9777	0.124	4	19712
Toluene	48.1		1502	72241	0.124	4	145648
Trichloroethene	4.97	U	1502	7464	0.124	4	15049
Xylenes, Total	31.2		1502	46859	0.124	4	94474
PAHs							
1-Methylnaphthalene	2.65	U	1502	3980	0.124	4	8024
2-Methylnaphthalene	2.63	U	1502	3950	0.124	4	7964
Acenaphthene	2.75	U	1502	4130	0.124	4	8327
Acenaphthylene	2.54	U	1502	3815	0.124	4	7691
Anthracene	2.74	U	1502	4115	0.124	4	8297
Benz(a)anthracene	2.97	U	1502	4461	0.124	4	8993
Benzo(a)pyrene	3.14	U	1502	4716	0.124	4	9508
Benzo(b)fluoranthene	3.10	U	1502	4656	0.124	4	9387
Benzo(g,h,i)perylene	3.84	U	1502	5767	0.124	4	11628
Benzo(k)fluoranthene	3.14	U	1502	4716	0.124	4	9508
Chrysene	2.98	U	1502	4476	0.124	4	9024
Dibenz(a,h)anthracene	3.20	U	1502	4806	0.124	4	9690
Fluoranthene	2.84	U	1502	4265	0.124	4	8600
Fluorene	2.70	U	1502	4055	0.124	4	8176
Indeno(1,2,3-cd)pyrene	3.37	U	1502	5061	0.124	4	10204
Naphthalene	12.0		1502	18023	0.124	4	36336
Phenanthrene	2.76	U	1502	4145	0.124	4	8357
Pyrene	2.89	U	1502	4340	0.124	4	8751
Test Conditions							
Sed Temp (degrees F)	Max	64.5		Min	59.0	Avg	61.8
Air Temp (degrees F)	Max	61.8		Min	59.1	Avg	60.5
Humidity (%)	Max	89.3		Min	85.5	Avg	87.4
Air Velocity (Mi/Hr)	Max	5.20		Min	5.00	Avg	5.10
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/21/2007

Sample IDs: NSP-1-10M-PAH-5-032107 Front, NSP-1-10M-VOC-5-032107 Front

U=Analtye not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
10% Mixed, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	3.58		5773	20669	0.124	16	10418
1,2,4-Trimethylbenzene	14.4		5773	83311	0.124	16	41991
1,3,5-Trimethylbenzene	5.02		5773	28983	0.124	16	14608
1,4-Dichlorobenzene	2.88	U	5773	16628	0.124	16	8381
Benzene	16.5		5773	95031	0.124	16	47899
Carbon Tetrachloride	84.0		5773	484797	0.124	16	244354
Ethyl Benzene	8.61		5773	49709	0.124	16	25055
sec-Butylbenzene	2.44	U	5773	14087	0.124	16	7100
Styrene	5.77		5773	33313	0.124	16	16791
Toluene	47.0		5773	271064	0.124	16	136625
Trichloroethene	3.32		5773	19168	0.124	16	9661
Xylenes, Total	36.5		5773	210962	0.124	16	106332
PAHs							
1-Methylnaphthalene	3.62		5773	20900	0.124	16	10534
2-Methylnaphthalene	7.24		5773	41800	0.124	16	21068
Acenaphthene	0.688	U	5773	3972	0.124	16	2002
Acenaphthylene	0.634	U	5773	3660	0.124	16	1845
Anthracene	0.686	U	5773	3961	0.124	16	1996
Benz(a)anthracene	0.743	U	5773	4290	0.124	16	2162
Benzo(a)pyrene	0.785	U	5773	4532	0.124	16	2284
Benzo(b)fluoranthene	0.776	U	5773	4480	0.124	16	2258
Benzo(g,h,i)perylene	0.959	U	5773	5537	0.124	16	2791
Benzo(k)fluoranthene	0.786	U	5773	4538	0.124	16	2287
Chrysene	0.746	U	5773	4307	0.124	16	2171
Dibenz(a,h)anthracene	0.800	U	5773	4619	0.124	16	2328
Fluoranthene	0.710	U	5773	4099	0.124	16	2066
Fluorene	0.675	U	5773	3897	0.124	16	1964
Indeno(1,2,3-cd)pyrene	0.844	U	5773	4873	0.124	16	2456
Naphthalene	7.60		5773	43878	0.124	16	22116
Phenanthrene	0.689	U	5773	3978	0.124	16	2005
Pyrene	0.721	U	5773	4163	0.124	16	2098
Test Conditions							
Sed Temp (degrees F)	Max	72.5		Min	66.0	Avg	69.3
Air Temp (degrees F)	Max	63.3		Min	61.8	Avg	62.6
Humidity (%)	Max	88.9		Min	78.3	Avg	83.6
Air Velocity (Mi/Hr)	Max	5.10		Min	4.90	Avg	5.00
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/22/2007

Sample IDs: NSP-1-10M-PAH-6-032207 Front, NSP-1-10M-VOC-6-032207 Back, NSP-1-10M-VOC-6-032207 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
10% Quiescent, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	854	8622	0.124	2	34765
1,2,4-Trimethylbenzene	12.7		854	10841	0.124	2	43714
1,3,5-Trimethylbenzene	9.58	U	854	8178	0.124	2	32975
1,4-Dichlorobenzene	11.5	U	854	9817	0.124	2	39584
Benzene	28.0		854	23902	0.124	2	96378
Carbon Tetrachloride	20.3	U	854	17329	0.124	2	69874
Ethyl Benzene	19.5	U	854	16646	0.124	2	67120
sec-Butylbenzene	9.76	U	854	8331	0.124	2	33594
Styrene	13.0	U	854	11097	0.124	2	44747
Toluene	54.1		854	46181	0.124	2	186215
Trichloroethene	9.94	U	854	8485	0.124	2	34214
Xylenes, Total	19.9	U	854	16987	0.124	2	68497
PAHs							
1-Methylnaphthalene	5.29	U	854	4516	0.124	2	18208
2-Methylnaphthalene	5.26	U	854	4490	0.124	2	18105
Acenaphthene	5.50	U	854	4695	0.124	2	18931
Acenaphthylene	5.07	U	854	4328	0.124	2	17451
Anthracene	5.48	U	854	4678	0.124	2	18862
Benz(a)anthracene	5.94	U	854	5071	0.124	2	20446
Benzo(a)pyrene	6.28	U	854	5361	0.124	2	21616
Benzo(b)fluoranthene	6.21	U	854	5301	0.124	2	21375
Benzo(g,h,i)perylene	7.67	U	854	6547	0.124	2	26401
Benzo(k)fluoranthene	6.29	U	854	5369	0.124	2	21651
Chrysene	5.96	U	854	5088	0.124	2	20515
Dibenz(a,h)anthracene	6.40	U	854	5463	0.124	2	22029
Fluoranthene	5.68	U	854	4849	0.124	2	19551
Fluorene	5.40	U	854	4610	0.124	2	18587
Indeno(1,2,3-cd)pyrene	6.75	U	854	5762	0.124	2	23234
Naphthalene	14.4		854	12292	0.124	2	49566
Phenanthrene	5.52	U	854	4712	0.124	2	19000
Pyrene	5.77	U	854	4925	0.124	2	19861
Test Conditions							
Sed Temp (degrees F)	Max	65.0		Min	64.0	Avg	64.5
Air Temp (degrees F)	Max	61.3		Min	59.7	Avg	60.5
Humidity (%)	Max	88.7		Min	84.6	Avg	86.7
Air Velocity (Mi/Hr)	Max	458		Min	431.00	Avg	5.05
Cross Section Area (m2)						Avg	0.152

Run Date: 3/22/2007

Sample IDs: NSP-1-10Q-PAH-2-032207 Front, NSP-1-10Q-VOC-2-032207 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
10% Quiescent, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.03	U	1488	7482	0.124	4	15086
1,2,4-Trimethylbenzene	8.87		1488	13195	0.124	4	26602
1,3,5-Trimethylbenzene	4.79	U	1488	7125	0.124	4	14366
1,4-Dichlorobenzene	5.76	U	1488	8568	0.124	4	17275
Benzene	13.8		1488	20528	0.124	4	41388
Carbon Tetrachloride	12.1		1488	18000	0.124	4	36290
Ethyl Benzene	9.76	U	1488	14519	0.124	4	29272
sec-Butylbenzene	4.88	U	1488	7259	0.124	4	14636
Styrene	6.51	U	1488	9684	0.124	4	19524
Toluene	29.8		1488	44330	0.124	4	89374
Trichloroethene	5.82		1488	8658	0.124	4	17455
Xylenes, Total	25.4		1488	37784	0.124	4	76178
PAHs							
1-Methylnaphthalene	2.65	U	1488	3942	0.124	4	7948
2-Methylnaphthalene	2.63	U	1488	3912	0.124	4	7888
Acenaphthene	2.75	U	1488	4091	0.124	4	8248
Acenaphthylene	2.54	U	1488	3778	0.124	4	7618
Anthracene	2.74	U	1488	4076	0.124	4	8218
Benz(a)anthracene	2.97	U	1488	4418	0.124	4	8907
Benzo(a)pyrene	3.14	U	1488	4671	0.124	4	9417
Benzo(b)fluoranthene	3.10	U	1488	4611	0.124	4	9297
Benzo(g,h,i)perylene	3.84	U	1488	5712	0.124	4	11517
Benzo(k)fluoranthene	3.14	U	1488	4671	0.124	4	9417
Chrysene	2.98	U	1488	4433	0.124	4	8937
Dibenz(a,h)anthracene	3.20	U	1488	4760	0.124	4	9597
Fluoranthene	2.84	U	1488	4225	0.124	4	8518
Fluorene	2.70	U	1488	4016	0.124	4	8098
Indeno(1,2,3-cd)pyrene	3.37	U	1488	5013	0.124	4	10107
Naphthalene	7.29		1488	10844	0.124	4	21864
Phenanthrene	2.76	U	1488	4106	0.124	4	8278
Pyrene	2.89	U	1488	4299	0.124	4	8667
Test Conditions							
Sed Temp (degrees F)	Max	65.0		Min	64.0	Avg	64.5
Air Temp (degrees F)	Max	60.9		Min	59.3	Avg	60.1
Humidity (%)	Max	84.5		Min	80.0	Avg	82.3
Air Velocity (Mi/Hr)	Max	466		Min	449	Avg	5.20
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/22/2007

Sample IDs: NSP-1-10Q-PAH-5-032207 Front, NSP-1-10Q-VOC-5-032207 Front
U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
10% Quiescent, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	2.80		5934	16614	0.124	16	8374
1,2,4-Trimethylbenzene	8.96		5934	53166	0.124	16	26797
1,3,5-Trimethylbenzene	2.52		5934	14953	0.124	16	7537
1,4-Dichlorobenzene	1.44	U	5934	8545	0.124	16	4307
Benzene	10.1		5934	59930	0.124	16	30207
Carbon Tetrachloride	16.4		5934	97313	0.124	16	49049
Ethyl Benzene	4.68		5934	27770	0.124	16	13997
sec-Butylbenzene	1.22	U	5934	7239	0.124	16	3649
Styrene	2.98		5934	17682	0.124	16	8913
Toluene	30.8		5934	182758	0.124	16	92116
Trichloroethene	3.02		5934	17920	0.124	16	9032
Xylenes, Total	24.5		5934	145376	0.124	16	73274
PAHs							
1-Methylnaphthalene	2.16		5934	12817	0.124	16	6460
2-Methylnaphthalene	0.658	U	5934	3904	0.124	16	1968
Acenaphthene	0.688	U	5934	4082	0.124	16	2058
Acenaphthylene	0.634	U	5934	3762	0.124	16	1896
Anthracene	0.686	U	5934	4071	0.124	16	2052
Benz(a)anthracene	0.743	U	5934	4409	0.124	16	2222
Benzo(a)pyrene	0.785	U	5934	4658	0.124	16	2348
Benzo(b)fluoranthene	0.776	U	5934	4605	0.124	16	2321
Benzo(g,h,i)perylene	0.959	U	5934	5690	0.124	16	2868
Benzo(k)fluoranthene	0.786	U	5934	4664	0.124	16	2351
Chrysene	0.746	U	5934	4427	0.124	16	2231
Dibenz(a,h)anthracene	0.800	U	5934	4747	0.124	16	2393
Fluoranthene	0.710	U	5934	4213	0.124	16	2123
Fluorene	0.675	U	5934	4005	0.124	16	2019
Indeno(1,2,3-cd)pyrene	0.844	U	5934	5008	0.124	16	2524
Naphthalene	4.08		5934	24210	0.124	16	12202
Phenanthrene	0.689	U	5934	4088	0.124	16	2061
Pyrene	0.721	U	5934	4278	0.124	16	2156
Test Conditions							
Sed Temp (degrees F)	Max	65.5		Min	64.5	Avg	65.0
Air Temp (degrees F)	Max	62.9		Min	60.2	Avg	61.6
Humidity (%)	Max	85.4		Min	73.0	Avg	79.2
Air Velocity (Mi/Hr)	Max	458		Min	431	Avg	5.05
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/23/2007

Sample IDs: NSP-1-10Q-PAH-6-032307 Front, NSP-1-10Q-VOC-6-032307 Front

Appendix H
Air Emission Wind Tunnel Results (Area 1)
1% Mixed, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	798	8057	0.124	2	32489
1,2,4-Trimethylbenzene	11.6		798	9254	0.124	2	37314
1,3,5-Trimethylbenzene	9.58	U	798	7642	0.124	2	30816
1,4-Dichlorobenzene	11.5	U	798	9174	0.124	2	36992
Benzene	22.3		798	17790	0.124	2	71732
Carbon Tetrachloride	20.3	U	798	16194	0.124	2	65299
Ethyl Benzene	19.5	U	798	15556	0.124	2	62726
sec-Butylbenzene	9.76	U	798	7786	0.124	2	31395
Styrene	13.0	U	798	10371	0.124	2	41817
Toluene	54.0		798	43078	0.124	2	173701
Trichloroethene	9.94	U	798	7930	0.124	2	31974
Xylenes, Total	19.9	U	798	15875	0.124	2	64012
PAHs							
1-Methylnaphthalene	5.29	U	798	4220	0.124	2	17016
2-Methylnaphthalene	5.26	U	798	4196	0.124	2	16920
Acenaphthene	5.50	U	798	4388	0.124	2	17692
Acenaphthylene	5.07	U	798	4045	0.124	2	16309
Anthracene	5.48	U	798	4372	0.124	2	17627
Benz(a)anthracene	5.94	U	798	4739	0.124	2	19107
Benzo(a)pyrene	6.28	U	798	5010	0.124	2	20201
Benzo(b)fluoranthene	6.21	U	798	4954	0.124	2	19976
Benzo(g,h,i)perylene	7.67	U	798	6119	0.124	2	24672
Benzo(k)fluoranthene	6.29	U	798	5018	0.124	2	20233
Chrysene	5.96	U	798	4755	0.124	2	19171
Dibenz(a,h)anthracene	6.40	U	798	5106	0.124	2	20587
Fluoranthene	5.68	U	798	4531	0.124	2	18271
Fluorene	5.40	U	798	4308	0.124	2	17370
Indeno(1,2,3-cd)pyrene	6.75	U	798	5385	0.124	2	21713
Naphthalene	7.80		798	6222	0.124	2	25090
Phenanthrene	5.52	U	798	4404	0.124	2	17756
Pyrene	5.77	U	798	4603	0.124	2	18560
Test Conditions							
Sed Temp (degrees F)	Max	64.0		Min	62.0	Avg	63.0
Air Temp (degrees F)	Max	61.8		Min	60.0	Avg	60.9
Humidity (%)	Max	84.3		Min	81.1	Avg	82.7
Air Velocity (Mi/Hr)	Max	5.30		Min	4.90	Avg	5.10
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/23/2007

Sample IDs: NSP-1-1M-PAH-2-032307 Front, NSP-1-1M-VOC-2-032307 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
1% Mixed, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.03	U	1520	7645	0.124	4	15414
1,2,4-Trimethylbenzene	12.9		1520	19608	0.124	4	39531
1,3,5-Trimethylbenzene	4.79	U	1520	7281	0.124	4	14679
1,4-Dichlorobenzene	5.76	U	1520	8755	0.124	4	17651
Benzene	20.8		1520	31615	0.124	4	63741
Carbon Tetrachloride	21.2		1520	32223	0.124	4	64966
Ethyl Benzene	9.76	U	1520	14835	0.124	4	29909
sec-Butylbenzene	4.88	U	1520	7417	0.124	4	14955
Styrene	6.51	U	1520	9895	0.124	4	19950
Toluene	48.8		1520	74175	0.124	4	149545
Trichloroethene	7.08		1520	10761	0.124	4	21696
Xylenes, Total	38.1		1520	57911	0.124	4	116756
PAHs							
1-Methylnaphthalene	2.65	U	1520	4028	0.124	4	8121
2-Methylnaphthalene	2.63	U	1520	3998	0.124	4	8060
Acenaphthene	2.75	U	1520	4180	0.124	4	8427
Acenaphthylene	2.54	U	1520	3861	0.124	4	7784
Anthracene	2.74	U	1520	4165	0.124	4	8397
Benz(a)anthracene	2.97	U	1520	4514	0.124	4	9101
Benzo(a)pyrene	3.14	U	1520	4773	0.124	4	9622
Benzo(b)fluoranthene	3.10	U	1520	4712	0.124	4	9500
Benzo(g,h,i)perylene	3.84	U	1520	5837	0.124	4	11768
Benzo(k)fluoranthene	3.14	U	1520	4773	0.124	4	9622
Chrysene	2.98	U	1520	4530	0.124	4	9132
Dibenz(a,h)anthracene	3.20	U	1520	4864	0.124	4	9806
Fluoranthene	2.84	U	1520	4317	0.124	4	8703
Fluorene	2.70	U	1520	4104	0.124	4	8274
Indeno(1,2,3-cd)pyrene	3.37	U	1520	5122	0.124	4	10327
Naphthalene	5.20		1520	7904	0.124	4	15935
Phenanthrene	2.76	U	1520	4195	0.124	4	8458
Pyrene	2.89	U	1520	4393	0.124	4	8856
Test Conditions							
Sed Temp (degrees F)	Max	68.5		Min	64.0	Avg	66.3
Air Temp (degrees F)	Max	60.0		Min	61.1	Avg	60.6
Humidity (%)	Max	84.8		Min	83.2	Avg	84.0
Air Velocity (Mi/Hr)	Max	5.20		Min	5.00	Avg	5.10
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/23/07

Sample IDs: NSP-1-1M-PAH-5-032307 Front, NSP-1-1M-VOC-5-032307 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 1)
1% Mixed, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	3.62		3718	13459	0.124	16	6784
1,2,4-Trimethylbenzene	10.5		3718	38854	0.124	16	19583
1,3,5-Trimethylbenzene	3.89		3718	14463	0.124	16	7290
1,4-Dichlorobenzene	2.88	U	3718	10708	0.124	16	5397
Benzene	12.9		3718	47814	0.124	16	24100
Carbon Tetrachloride	13.0		3718	48223	0.124	16	24306
Ethyl Benzene	6.21		3718	23089	0.124	16	11638
sec-Butylbenzene	2.44	U	3718	9072	0.124	16	4573
Styrene	4.55		3718	16917	0.124	16	8527
Toluene	33.1		3718	122882	0.124	16	61936
Trichloroethene	4.18		3718	15541	0.124	16	7833
Xylenes, Total	25.6		3718	95331	0.124	16	48050
PAHs							
1-Methylnaphthalene	2.04		3718	7585	0.124	16	3823
2-Methylnaphthalene	4.28		3718	15913	0.124	16	8021
Acenaphthene	0.688	U	3718	2558	0.124	16	1289
Acenaphthylene	0.634	U	3718	2357	0.124	16	1188
Anthracene	0.686	U	3718	2551	0.124	16	1286
Benz(a)anthracene	0.743	U	3718	2763	0.124	16	1392
Benzo(a)pyrene	0.785	U	3718	2919	0.124	16	1471
Benzo(b)fluoranthene	0.776	U	3718	2885	0.124	16	1454
Benzo(g,h,i)perylene	0.959	U	3718	3566	0.124	16	1797
Benzo(k)fluoranthene	0.786	U	3718	2922	0.124	16	1473
Chrysene	0.746	U	3718	2774	0.124	16	1398
Dibenz(a,h)anthracene	0.800	U	3718	2974	0.124	16	1499
Fluoranthene	0.710	U	3718	2640	0.124	16	1331
Fluorene	0.675	U	3718	2510	0.124	16	1265
Indeno(1,2,3-cd)pyrene	0.844	U	3718	3138	0.124	16	1582
Naphthalene	3.24		3718	12046	0.124	16	6072
Phenanthrene	0.689	U	3718	2562	0.124	16	1291
Pyrene	0.721	U	3718	2681	0.124	16	1351
Test Conditions							
Sed Temp (degrees F)	Max	70.5		Min	67.0	Avg	68.8
Air Temp (degrees F)	Max	62.2		Min	60.2	Avg	61.2
Humidity (%)	Max	88.5		Min	83.0	Avg	85.8
Air Velocity (Mi/Hr)	Max	5.10		Min	4.90	Avg	5.00
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/24/2007

Sample IDs: NSP-1-1M-PAH-6-032407 Front, NSP-1-1M-VOC-6-032407 Front, NSP-1-1M-VOC-6-032407 Back

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results Summary (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

	0 - 2 Hour Emission Rate (ug/m^2/hr)							
	Sediment		***Exposed***		***Sediment***		***10% Mixed***	
Chemical/Parameter	*Concentration (mg/Kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*	*Concentration (mg/Kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*
VOCs								
1,2,3-Trimethylbenzene	8.20	0	82895	U	8.90	0	76598	U
1,2,4-Trimethylbenzene	19.0	0	81245	U	21.0	0	75836	0
1,3,5-Trimethylbenzene	5.00	0	39509	U	5.70	0	36508	U
1,4-Dichlorobenzene	0.440	U	95267	U	0.420	U	88031	U
Benzene	4.70	0	141457	0	5.30	0	130712	0
Carbon Tetrachloride	0.200	U	42066	U	0.190	U	38871	U
Ethyl Benzene	39.0	0	63511	0	43.0	0	106323	0
sec-Butylbenzene	0.150	U	40251	U	0.150	U	37194	U
Styrene	0.170	U	53613	U	0.160	U	49541	U
Toluene	16.0	0	348900	0	18.0	0	396328	0
Trichloroethene	0.270	U	40994	U	0.260	U	37880	U
Xylenes, Total	39.0	0	266830	0	42.0	0	296865	0
PAHs								
1-Methylnaphthalene	320	0	21817	U	310	0	20159	U
2-Methylnaphthalene	450	0	21693	U	440	0	20045	U
Acenaphthene	280	0	22683	U	270	0	20960	U
Acenaphthylene	25.0	0	20909	U	23.0	0	19321	U
Anthracene	130	0	22600	U	130	0	20883	U
Benz(a)anthracene	47.0	0	24497	U	43.0	0	22636	U
Benzo(a)pyrene	39.0	0	25899	U	35.0	0	23932	U
Benzo(b)fluoranthene	19.0	0	25611	U	18.0	0	23665	U
Benzo(g,h,i)perylene	11.0	0	31632	U	9.60	0	29229	U
Benzo(k)fluoranthene	27.0	0	25941	U	24.0	0	23970	U
Chrysene	50.0	0	24580	U	45.0	0	22713	U
Dibenz(a,h)anthracene	4.10	0	26394	U	3.60	0	24389	U
Fluoranthene	140	0	23425	U	120	0	21646	U
Fluorene	140	0	22270	U	130	0	20579	U
Indeno(1,2,3-cd)pyrene	10.0	0	27838	U	8.80	0	25723	U
Naphthalene	530	0	22765	U	520	0	133761	0
Phenanthrene	370	0	22765	U	360	0	21036	U
Pyrene	110	0	23796	U	97.0	0	21989	U
Average Test Conditions								
Sed Temp (degrees F)			57.8				55.0	
Air Temp (degrees F)			66.0				63.4	
Humidity (%)			31.7				84.1	
Air Velocity (Mi/Hr)			5.25				5.05	
Cross Section Area (m^2)			0.152				0.152	

Flags:
0=no qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration
[1] emission rate in OU/(m^2 x hr)

Appendix H
Air Emission Wind Tunnel Results Summary (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

	2 - 6 Hour Emission Rate (ug/m^2/hr)							
	Sediment		Exposed		Sediment		10% Mixed	
Chemical/Parameter	Concentration (mg/Kg)	Flags	Emission Rate (ug/m^2/hr)	Flags	Concentration (mg/Kg)	Flags	Emission Rate (ug/m^2/hr)	Flags
VOCs								
1,2,3-Trimethylbenzene	8.20	0	31696	U	8.90	0	31620	U
1,2,4-Trimethylbenzene	19.0	0	30911	U	21.0	0	36002	0
1,3,5-Trimethylbenzene	5.00	0	15032	U	5.70	0	14996	U
1,4-Dichlorobenzene	0.440	U	36089	U	0.420	U	36002	U
Benzene	4.70	0	41738	0	5.30	0	57917	0
Carbon Tetrachloride	0.200	U	15942	U	0.190	U	15904	U
Ethyl Benzene	39.0	0	18233	0	43.0	0	40385	0
sec-Butylbenzene	0.150	U	15314	U	0.150	U	15278	U
Styrene	0.170	U	20430	U	0.160	U	20381	U
Toluene	16.0	0	111092	0	18.0	0	159350	0
Trichloroethene	0.270	U	15597	U	0.260	U	15559	U
Xylenes, Total	39.0	0	82848	0	42.0	0	130548	0
PAHs								
1-Methylnaphthalene	320	0	8316	U	310	0	8296	U
2-Methylnaphthalene	450	0	8253	U	440	0	8234	U
Acenaphthene	280	0	8630	U	270	0	8609	U
Acenaphthylene	25.0	0	7971	U	23.0	0	7952	U
Anthracene	130	0	8599	U	130	0	8578	U
Benz(a)anthracene	47.0	0	9320	U	43.0	0	9298	U
Benzo(a)pyrene	39.0	0	9854	U	35.0	0	9830	U
Benzo(b)fluoranthene	19.0	0	9728	U	18.0	0	9705	U
Benzo(g,h,i)perylene	11.0	0	12051	U	9.60	0	12022	U
Benzo(k)fluoranthene	27.0	0	9854	U	24.0	0	9830	U
Chrysene	50.0	0	9352	U	45.0	0	9329	U
Dibenz(a,h)anthracene	4.10	0	10042	U	3.60	0	10018	U
Fluoranthene	140	0	8912	U	120	0	8891	U
Fluorene	140	0	8473	U	130	0	8453	U
Indeno(1,2,3-cd)pyrene	10.0	0	10576	U	8.80	0	10550	U
Naphthalene	530	0	17260	0	520	0	102372	0
Phenanthrene	370	0	8661	U	360	0	8641	U
Pyrene	110	0	9069	U	97.0	0	9048	U
Average Test Conditions								
Sed Temp (degrees F)			59.8				63.0	
Air Temp (degrees F)			66.2				63.2	
Humidity (%)			29.5				79.7	
Air Velocity (Mi/Hr)			5.30				5.10	
Cross Section Area (m^2)			0.152				0.152	

Flags:
0=no qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration
[1] emission rate in OU/(m^2 x hr)

Appendix H
Air Emission Wind Tunnel Results Summary (Area 2)
Ashland/Northern States Power Lakefront Superfund Site

	6 - 22 Hour Emission Rate (ug/m^2/hr)							
	Sediment		Exposed		Sediment		10% Mixed	
Chemical/Parameter	Concentration (mg/Kg)	Flags	Emission Rate (ug/m^2/hr)	Flags	Concentration (mg/Kg)	Flags	Emission Rate (ug/m^2/hr)	Flags
VOCs								
1,2,3-Trimethylbenzene	8.20	0	8703	0	8.90	0	8029	0
1,2,4-Trimethylbenzene	19.0	0	27912	0	21.0	0	22670	0
1,3,5-Trimethylbenzene	5.00	0	9162	0	5.70	0	6081	0
1,4-Dichlorobenzene	0.440	U	8795	U	0.420	U	8501	U
Benzene	4.70	0	38784	0	5.30	0	31289	0
Carbon Tetrachloride	0.200	U	3878	U	0.190	U	3749	U
Ethyl Benzene	39.0	0	19483	0	43.0	0	25002	0
sec-Butylbenzene	0.150	U	3726	U	0.150	U	3601	U
Styrene	0.170	U	11269	0	0.160	U	10597	0
Toluene	16.0	0	112992	0	18.0	0	100067	0
Trichloroethene	0.270	U	3787	U	0.260	U	4752	0
Xylenes, Total	39.0	0	98334	0	42.0	0	86193	0
PAHs								
1-Methylnaphthalene	320	0	2022	U	310	0	19128	0
2-Methylnaphthalene	450	0	2009	U	440	0	32470	0
Acenaphthene	280	0	2101	U	270	0	2031	U
Acenaphthylene	25.0	0	1936	U	23.0	0	1871	U
Anthracene	130	0	2095	U	130	0	2025	U
Benz(a)anthracene	47.0	0	2269	U	43.0	0	2193	U
Benzo(a)pyrene	39.0	0	2397	U	35.0	0	2317	U
Benzo(b)fluoranthene	19.0	0	2370	U	18.0	0	2291	U
Benzo(g,h,i)perylene	11.0	0	2929	U	9.60	0	2831	U
Benzo(k)fluoranthene	27.0	0	2400	U	24.0	0	2320	U
Chrysene	50.0	0	2278	U	45.0	0	2202	U
Dibenz(a,h)anthracene	4.10	0	2443	U	3.60	0	2361	U
Fluoranthene	140	0	2168	U	120	0	2096	U
Fluorene	140	0	2061	U	130	0	1992	U
Indeno(1,2,3-cd)pyrene	10.0	0	2577	U	8.80	0	2491	U
Naphthalene	530	0	18445	0	520	0	64940	0
Phenanthrene	370	0	2104	U	360	0	2034	U
Pyrene	110	0	2202	U	97.0	0	2128	U
Average Test Conditions								
Sed Temp (degrees F)			59.3				65.3	
Air Temp (degrees F)			65.7				63.3	
Humidity (%)			25.9				83.0	
Air Velocity (Mi/Hr)			5.25				5.15	
Cross Section Area (m^2)			0.152				0.152	

Flags:
0=no qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration
[1] emission rate in OU/(m^2 x hr)

Appendix H
Air Emission Wind Tunnel Results (Area 2)
Exposed Sediment, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	20.1	U	1023	20558	0.124	2	82895
1,2,4-Trimethylbenzene	19.7	U	1023	20149	0.124	2	81245
1,3,5-Trimethylbenzene	9.58	U	1023	9798	0.124	2	39509
1,4-Dichlorobenzene	23.1	U	1023	23626	0.124	2	95267
Benzene	34.3		1023	35081	0.124	2	141457
Carbon Tetrachloride	10.2	U	1023	10432	0.124	2	42066
Ethyl Benzene	15.4		1023	15751	0.124	2	63511
sec-Butylbenzene	9.76	U	1023	9982	0.124	2	40251
Styrene	13.0	U	1023	13296	0.124	2	53613
Toluene	84.6		1023	86527	0.124	2	348900
Trichloroethene	9.94	U	1023	10166	0.124	2	40994
Xylenes, Total	64.7		1023	66174	0.124	2	266830
PAHs							
1-Methylnaphthalene	5.29	U	1023	5411	0.124	2	21817
2-Methylnaphthalene	5.26	U	1023	5380	0.124	2	21693
Acenaphthene	5.50	U	1023	5625	0.124	2	22683
Acenaphthylene	5.07	U	1023	5185	0.124	2	20909
Anthracene	5.48	U	1023	5605	0.124	2	22600
Benz(a)anthracene	5.94	U	1023	6075	0.124	2	24497
Benzo(a)pyrene	6.28	U	1023	6423	0.124	2	25899
Benzo(b)fluoranthene	6.21	U	1023	6351	0.124	2	25611
Benzo(g,h,i)perylene	7.67	U	1023	7845	0.124	2	31632
Benzo(k)fluoranthene	6.29	U	1023	6433	0.124	2	25941
Chrysene	5.96	U	1023	6096	0.124	2	24580
Dibenz(a,h)anthracene	6.40	U	1023	6546	0.124	2	26394
Fluoranthene	5.68	U	1023	5809	0.124	2	23425
Fluorene	5.40	U	1023	5523	0.124	2	22270
Indeno(1,2,3-cd)pyrene	6.75	U	1023	6904	0.124	2	27838
Naphthalene	5.52	U	1023	5646	0.124	2	22765
Phenanthrene	5.52	U	1023	5646	0.124	2	22765
Pyrene	5.77	U	1023	5901	0.124	2	23796
Test Conditions							
Sed Temp (degrees F)	Max	56.0		Min	59.5	Avg	57.8
Air Temp (degrees F)	Max	66.5		Min	65.4	Avg	66.0
Humidity (%)	Max	32.5		Min	30.9	Avg	31.7
Air Velocity (Mi/Hr)	Max	5.30		Min	5.20	Avg	5.25
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/19/2007

Sample IDs: NSP-2-ES-VOC-2-031907 Front, NSP-2-ES-PAH-2-031907 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2)
Exposed Sediment, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	1,557	15,721	0.124	4	31696
1,2,4-Trimethylbenzene	9.85	U	1,557	15,332	0.124	4	30911
1,3,5-Trimethylbenzene	4.79	U	1,557	7,456	0.124	4	15032
1,4-Dichlorobenzene	11.5	U	1,557	17,900	0.124	4	36089
Benzene	13.3		1,557	20,702	0.124	4	41738
Carbon Tetrachloride	5.08	U	1,557	7,907	0.124	4	15942
Ethyl Benzene	5.81		1,557	9,043	0.124	4	18233
sec-Butylbenzene	4.88	U	1,557	7,596	0.124	4	15314
Styrene	6.51	U	1,557	10,133	0.124	4	20430
Toluene	35.4		1,557	55,102	0.124	4	111092
Trichloroethene	4.97	U	1,557	7,736	0.124	4	15597
Xylenes, Total	26.4		1,557	41,093	0.124	4	82848
PAHs							
1-Methylnaphthalene	2.65	U	1,557	4,125	0.124	4	8316
2-Methylnaphthalene	2.63	U	1,557	4,094	0.124	4	8253
Acenaphthene	2.75	U	1,557	4,280	0.124	4	8630
Acenaphthylene	2.54	U	1,557	3,954	0.124	4	7971
Anthracene	2.74	U	1,557	4,265	0.124	4	8599
Benz(a)anthracene	2.97	U	1,557	4,623	0.124	4	9320
Benzo(a)pyrene	3.14	U	1,557	4,888	0.124	4	9854
Benzo(b)fluoranthene	3.10	U	1,557	4,825	0.124	4	9728
Benzo(g,h,i)perylene	3.84	U	1,557	5,977	0.124	4	12051
Benzo(k)fluoranthene	3.14	U	1,557	4,888	0.124	4	9854
Chrysene	2.98	U	1,557	4,638	0.124	4	9352
Dibenz(a,h)anthracene	3.20	U	1,557	4,981	0.124	4	10042
Fluoranthene	2.84	U	1,557	4,421	0.124	4	8912
Fluorene	2.70	U	1,557	4,203	0.124	4	8473
Indeno(1,2,3-cd)pyrene	3.37	U	1,557	5,246	0.124	4	10576
Naphthalene	5.50		1,557	8,561	0.124	4	17260
Phenanthrene	2.76	U	1,557	4,296	0.124	4	8661
Pyrene	2.89	U	1,557	4,498	0.124	4	9069
Test Conditions							
Sed Temp (degrees F)	Max	60.0		Min	59.5	Avg	59.8
Air Temp (degrees F)	Max	66.9		Min	65.4	Avg	66.2
Humidity (%)	Max	30.7		Min	28.2	Avg	29.5
Air Velocity (Mi/Hr)	Max	5.40		Min	5.20	Avg	5.30
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/19/2007

Sample IDs: NSP-2-ES-VOC-5-031907 Front, NSP-2-ES-PAH-5-031907 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2)
Exposed Sediment, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	2.85		6059	17268	0.124	16	8703
1,2,4-Trimethylbenzene	9.14		6059	55378	0.124	16	27912
1,3,5-Trimethylbenzene	3.00		6059	18176	0.124	16	9162
1,4-Dichlorobenzene	2.88	U	6059	17449	0.124	16	8795
Benzene	12.7		6059	76947	0.124	16	38784
Carbon Tetrachloride	1.27	U	6059	7695	0.124	16	3878
Ethyl Benzene	6.38		6059	38655	0.124	16	19483
sec-Butylbenzene	1.22	U	6059	7392	0.124	16	3726
Styrene	3.69		6059	22357	0.124	16	11269
Toluene	37.0		6059	224176	0.124	16	112992
Trichloroethene	1.24	U	6059	7513	0.124	16	3787
Xylenes, Total	32.2		6059	195094	0.124	16	98334
PAHs							
1-Methylnaphthalene	0.662	U	6059	4011	0.124	16	2022
2-Methylnaphthalene	0.658	U	6059	3987	0.124	16	2009
Acenaphthene	0.688	U	6059	4168	0.124	16	2101
Acenaphthylene	0.634	U	6059	3841	0.124	16	1936
Anthracene	0.686	U	6059	4156	0.124	16	2095
Benz(a)anthracene	0.743	U	6059	4502	0.124	16	2269
Benzo(a)pyrene	0.785	U	6059	4756	0.124	16	2397
Benzo(b)fluoranthene	0.776	U	6059	4702	0.124	16	2370
Benzo(g,h,i)perylene	0.959	U	6059	5810	0.124	16	2929
Benzo(k)fluoranthene	0.786	U	6059	4762	0.124	16	2400
Chrysene	0.746	U	6059	4520	0.124	16	2278
Dibenz(a,h)anthracene	0.800	U	6059	4847	0.124	16	2443
Fluoranthene	0.710	U	6059	4302	0.124	16	2168
Fluorene	0.675	U	6059	4090	0.124	16	2061
Indeno(1,2,3-cd)pyrene	0.844	U	6059	5114	0.124	16	2577
Naphthalene	6.04		6059	36595	0.124	16	18445
Phenanthrene	0.689	U	6059	4175	0.124	16	2104
Pyrene	0.721	U	6059	4368	0.124	16	2202
Test Conditions							
Sed Temp (degrees F)	Max	59.5		Min	59.0	Avg	59.3
Air Temp (degrees F)	Max	66.9		Min	64.4	Avg	65.7
Humidity (%)	Max	27.4		Min	24.4	Avg	25.9
Air Velocity (Mi/Hr)	Max	5.3		Min	5.20	Avg	5.3
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/20/2007

Sample IDs: NSP-2-ES-VOC-6-032007 Front, NSP-2-ES-PAH-6-032007 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2)
10% Mixed, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	20.1	U	945.09	18996.309	0.124	2	76598
1,2,4-Trimethylbenzene	19.9		945	18807	0.124	2	75836
1,3,5-Trimethylbenzene	9.58	U	945	9054	0.124	2	36508
1,4-Dichlorobenzene	23.1	U	945	21832	0.124	2	88031
Benzene	34.3		945	32417	0.124	2	130712
Carbon Tetrachloride	10.2	U	945	9640	0.124	2	38871
Ethyl Benzene	27.9		945	26368	0.124	2	106323
sec-Butylbenzene	9.76	U	945	9224	0.124	2	37194
Styrene	13.0	U	945	12286	0.124	2	49541
Toluene	104		945	98289	0.124	2	396328
Trichloroethene	9.94	U	945	9394	0.124	2	37880
Xylenes, Total	77.9		945	73623	0.124	2	296865
PAHs							
1-Methylnaphthalene	5.29	U	945	5000	0.124	2	20159
2-Methylnaphthalene	5.26	U	945	4971	0.124	2	20045
Acenaphthene	5.50	U	945	5198	0.124	2	20960
Acenaphthylene	5.07	U	945	4792	0.124	2	19321
Anthracene	5.48	U	945	5179	0.124	2	20883
Benz(a)anthracene	5.94	U	945	5614	0.124	2	22636
Benzo(a)pyrene	6.28	U	945	5935	0.124	2	23932
Benzo(b)fluoranthene	6.21	U	945	5869	0.124	2	23665
Benzo(g,h,i)perylene	7.67	U	945	7249	0.124	2	29229
Benzo(k)fluoranthene	6.29	U	945	5945	0.124	2	23970
Chrysene	5.96	U	945	5633	0.124	2	22713
Dibenz(a,h)anthracene	6.40	U	945	6049	0.124	2	24389
Fluoranthene	5.68	U	945	5368	0.124	2	21646
Fluorene	5.40	U	945	5103	0.124	2	20579
Indeno(1,2,3-cd)pyrene	6.75	U	945	6379	0.124	2	25723
Naphthalene	35.1		945	33173	0.124	2	133761
Phenanthrene	5.52	U	945	5217	0.124	2	21036
Pyrene	5.77	U	945	5453	0.124	2	21989
Test Conditions							
Sed Temp (degrees F)	Max	60.0		Min	50.0	Avg	55.0
Air Temp (degrees F)	Max	64.0		Min	62.7	Avg	63.4
Humidity (%)	Max	85.4		Min	82.7	Avg	84.1
Air Velocity (Mi/Hr)	Max	5.20		Min	4.90	Avg	5.05
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/20/2007

Sample IDs: NSP-2-10M-VOC-2-032007 Front, NSP-2-10M-PAH-2-032007 Front

[1] emission rate in $OU/(m^2 \times hr)$

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2)
10% Mixed, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	1553	15683	0.124	4	31620
1,2,4-Trimethylbenzene	11.5		1553	17857	0.124	4	36002
1,3,5-Trimethylbenzene	4.79	U	1553	7438	0.124	4	14996
1,4-Dichlorobenzene	11.5	U	1553	17857	0.124	4	36002
Benzene	18.5		1553	28727	0.124	4	57917
Carbon Tetrachloride	5.08	U	1553	7888	0.124	4	15904
Ethyl Benzene	12.9		1553	20031	0.124	4	40385
sec-Butylbenzene	4.88	U	1553	7578	0.124	4	15278
Styrene	6.51	U	1553	10109	0.124	4	20381
Toluene	50.9		1553	79038	0.124	4	159350
Trichloroethene	4.97	U	1553	7717	0.124	4	15559
Xylenes, Total	41.7		1553	64752	0.124	4	130548
PAHs							
1-Methylnaphthalene	2.65	U	1553	4115	0.124	4	8296
2-Methylnaphthalene	2.63	U	1553	4084	0.124	4	8234
Acenaphthene	2.75	U	1553	4270	0.124	4	8609
Acenaphthylene	2.54	U	1553	3944	0.124	4	7952
Anthracene	2.74	U	1553	4255	0.124	4	8578
Benz(a)anthracene	2.97	U	1553	4612	0.124	4	9298
Benzo(a)pyrene	3.14	U	1553	4876	0.124	4	9830
Benzo(b)fluoranthene	3.10	U	1553	4814	0.124	4	9705
Benzo(g,h,i)perylene	3.84	U	1553	5963	0.124	4	12022
Benzo(k)fluoranthene	3.14	U	1553	4876	0.124	4	9830
Chrysene	2.98	U	1553	4627	0.124	4	9329
Dibenz(a,h)anthracene	3.20	U	1553	4969	0.124	4	10018
Fluoranthene	2.84	U	1553	4410	0.124	4	8891
Fluorene	2.70	U	1553	4193	0.124	4	8453
Indeno(1,2,3-cd)pyrene	3.37	U	1553	5233	0.124	4	10550
Naphthalene	32.7		1553	50777	0.124	4	102372
Phenanthrene	2.76	U	1553	4286	0.124	4	8641
Pyrene	2.89	U	1553	4488	0.124	4	9048
Test Conditions							
Sed Temp (degrees F)	Max	64.5		Min	61.5	Avg	63.0
Air Temp (degrees F)	Max	65.3		Min	61.1	Avg	63.2
Humidity (%)	Max	87.5		Min	71.8	Avg	79.7
Air Velocity (Mi/Hr)	Max	5.30		Min	4.90	Avg	5.10
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/20/2007

Sample IDs: NSP-2-10M-VOC-5-032007 Front, NSP-2-10M-PAH-5-032007 Front

[1] emission rate in $OU/(m^2 \times hr)$

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2)
10% Mixed, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	2.72		5856	15929	0.124	16	8029
1,2,4-Trimethylbenzene	7.68		5856	44977	0.124	16	22670
1,3,5-Trimethylbenzene	2.06		5856	12064	0.124	16	6081
1,4-Dichlorobenzene	2.88	U	5856	16867	0.124	16	8501
Benzene	10.6		5856	62078	0.124	16	31289
Carbon Tetrachloride	1.27	U	5856	7438	0.124	16	3749
Ethyl Benzene	8.47		5856	49604	0.124	16	25002
sec-Butylbenzene	1.22	U	5856	7145	0.124	16	3601
Styrene	3.59		5856	21025	0.124	16	10597
Toluene	33.9		5856	198533	0.124	16	100067
Trichloroethene	1.61		5856	9429	0.124	16	4752
Xylenes, Total	29.2		5856	171008	0.124	16	86193
PAHs							
1-Methylnaphthalene	6.48		5856	37950	0.124	16	19128
2-Methylnaphthalene	11.0		5856	64421	0.124	16	32470
Acenaphthene	0.688	U	5856	4029	0.124	16	2031
Acenaphthylene	0.634	U	5856	3713	0.124	16	1871
Anthracene	0.686	U	5856	4018	0.124	16	2025
Benz(a)anthracene	0.743	U	5856	4351	0.124	16	2193
Benzo(a)pyrene	0.785	U	5856	4597	0.124	16	2317
Benzo(b)fluoranthene	0.776	U	5856	4545	0.124	16	2291
Benzo(g,h,i)perylene	0.959	U	5856	5616	0.124	16	2831
Benzo(k)fluoranthene	0.786	U	5856	4603	0.124	16	2320
Chrysene	0.746	U	5856	4369	0.124	16	2202
Dibenz(a,h)anthracene	0.800	U	5856	4685	0.124	16	2361
Fluoranthene	0.710	U	5856	4158	0.124	16	2096
Fluorene	0.675	U	5856	3953	0.124	16	1992
Indeno(1,2,3-cd)pyrene	0.844	U	5856	4943	0.124	16	2491
Naphthalene	22.0		5856	128841	0.124	16	64940
Phenanthrene	0.689	U	5856	4035	0.124	16	2034
Pyrene	0.721	U	5856	4222	0.124	16	2128
Test Conditions							
Sed Temp (degrees F)	Max	66.5		Min	64.0	Avg	65.3
Air Temp (degrees F)	Max	65.8		Min	60.8	Avg	63.3
Humidity (%)	Max	88.4		Min	77.6	Avg	83.0
Air Velocity (Mi/Hr)	Max	5.40		Min	4.90	Avg	5.15
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/21/2007

Sample IDs: NSP-2-10M-VOC-6-032107 Front, NSP-2-10M-PAH-6-032107 Front

[1] emission rate in $OU/(m^2 \times hr)$

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results Summary (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

	0 - 2 Hour Emission Rate (ug/m^2/hr)															
	Sediment		***10% Quiescent***		***Sediment***		***10% Mixed***		***Sediment***		***1% Mixed***		***Sediment*** [2]		***1% Quiescent***	
Chemical/Parameter	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*
VOCs																
1,2,3-Trimethylbenzene	13.0	0	30956	U	11.0	0	213237	0	14.0	0	44234	U			44967	U
1,2,4-Trimethylbenzene	30.0	0	47200	0	40.0	0	156544	0	47.0	0	56935	0			104367	0
1,3,5-Trimethylbenzene	7.30	0	29362	U	9.90	0	51206	0	12.0	0	41957	U			42820	U
1,4-Dichlorobenzene	0.600	U	35247	U	0.160	U	42062	U	0.23	U	50366	U			51587	U
Benzene	0.220	U	72640	0	7.00	0	140085	0	3.20	0	83213	0			101385	0
Carbon Tetrachloride	0.280	U	62219	U	0.073	U	2450579	0	0.110	U	88907	U			333975	0
Ethyl Benzene	49.0	0	81221	0	58.0	0	90342	0	62.0	0	85403	U			87072	U
sec-Butylbenzene	0.210	U	29914	U	0.055	U	35698	U	0.081	U	42745	U			43655	U
Styrene	0.230	U	39844	U	0.060	U	103144	0	0.088	U	56935	U			59459	0
Toluene	14.0	0	30466	0	19.0	0	291875	0	14.0	0	211099	0			254656	0
Trichloroethene	0.370	U	0	U	0.096	U	36356	U	0.140	U	43534	U			44490	U
Xylenes, Total	52.0	0	32427	U	67.0	0	387704	0	66.0	0	87155	U			253463	0
PAHs																
1-Methylnaphthalene	330	0	32427	U	250	0	19349	U	4800	0	23168	U			23676	U
2-Methylnaphthalene	660	0	32243	U	380	0	79004	0	2700	0	61753	0			63813	0
Acenaphthene	260	0	33715	U	91.0	0	20117	U	850	0	24088	U			24631	U
Acenaphthylene	24.0	0	31079	U	16.0	0	18544	U	28.0	0	22205	U			22663	U
Anthracene	170	0	33592	U	90.0	0	20044	U	560	0	24000	U			24511	U
Benz(a)anthracene	53.0	0	36412	U	37.0	0	21726	U	78.0	0	26015	U			26599	U
Benzo(a)pyrene	380	0	38496	U	20.0	0	22970	U	60.0	0	27504	U			28090	U
Benzo(b)fluoranthene	24.0	0	38067	U	24.0	0	22714	U	39.0	0	27198	U			27791	U
Benzo(g,h,i)perylene	18.0	0	47016	U	7.60	0	55961	U	6.60	0	33592	U			68584	U
Benzo(k)fluoranthene	32.0	0	38557	U	27.0	0	23006	U	40.0	0	27548	U			28149	U
Chrysene	56.0	0	36534	U	40.0	0	21799	U	66.0	0	26103	U			26658	U
Dibenz(a,h)anthracene	5.00	J	39231	U	2.90	0	46817	U	3.10	J	28030	U			57253	U
Fluoranthene	140	0	34818	U	92.0	0	20775	U	480	0	24876	U			25406	U
Fluorene	210	0	33102	U	110	0	19751	U	860	0	23650	U			24154	U
Indeno(1,2,3-cd)pyrene	15.0	0	41377	U	7.90	0	24689	U	7.80	0	29563	U			30177	U
Naphthalene	650	0	101205	0	410	0	70591	0	3300	0	76206	0			49858	0
Phenanthrene	410	0	33837	U	290	0	20190	U	1900	0	24176	U			24690	U
Pyrene	160	0	35370	U	66.0	0	21104	U	8.40	0	25271	U			25823	U
Average Test Conditions																
Sed Temp (degrees F)			53.8				56.0				55.0				53.0	
Air Temp (degrees F)			63.4				62.0				64.3				60.6	
Humidity (%)			83.6				80.3				85.4				86.1	
Air Velocity (Mi/Hr)			5.2				5.2				5.4				5.4	
Cross Section Area (m^2)			0.2				0.2				0.2				0.2	

Flags:
0=no qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnotes:
[1] emission rate in OU/(m^2 x hr)
[2] Pretest sediment samples not collected

Appendix H
Air Emission Wind Tunnel Results Summary (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

	2 - 6 Hour Emission Rate (ug/m^2/hr)															
	Sediment		***10% Quiescent***		***Sediment***		***10% Mixed***		***Sediment***		***1% Mixed***		***Sediment*** [2]		***1% Quiescent***	
Chemical/Parameter	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*	*Concentration (mg/kg)*	*Flags*	*Emission Rate (ug/m^2/hr)*	*Flags*
VOCs																
1,2,3-Trimethylbenzene	13.0	0	16443	U	11.0	0	19615	0	14.0	0	16337	U			13987	U
1,2,4-Trimethylbenzene	30.0	0	27003	0	40.0	0	68411	0	47.0	0	25463	0			34759	0
1,3,5-Trimethylbenzene	7.30	0	15659	U	9.90	0	21885	0	12.0	0	15557	U			13319	U
1,4-Dichlorobenzene	0.600	U	18830	U	0.160	U	17436	U	0.23	U	18708	U			16017	U
Benzene	0.220	U	43806	0	7.00	0	80519	0	3.20	0	47094	0			39486	0
Carbon Tetrachloride	0.280	U	40210	0	0.073	U	351134	0	0.110	U	42222	0			66736	0
Ethyl Benzene	49.0	0	31906	U	58.0	0	40259	0	62.0	0	31699	U			27139	U
sec-Butylbenzene	0.210	U	15953	U	0.055	U	14772	U	0.081	U	15849	U			13570	U
Styrene	0.230	U	21282	U	0.060	U	36930	0	0.088	U	21143	U			18102	U
Toluene	14.0	0	93822	0	19.0	0	204929	0	14.0	0	108478	0			87870	0
Trichloroethene	0.370	U	16247	U	0.096	U	51157	0	0.140	U	42872	0			13820	U
Xylenes, Total	52.0	0	72573	0	67.0	0	192518	0	66.0	0	78923	0			80918	0
PAHs																
1-Methylnaphthalene	330	0	17326	U	250	0	16043	U	4800	0	8607	U			8509	0
2-Methylnaphthalene	660	0	17195	U	380	0	45496	0	2700	0	26210	0			17324	0
Acenaphthene	260	0	17980	U	91.0	0	16649	U	850	0	8932	U			7647	U
Acenaphthylene	24.0	0	16607	U	16.0	0	15377	U	28.0	0	8250	U			7063	U
Anthracene	170	0	17915	U	90.0	0	16588	U	560	0	8899	U			7619	U
Benz(a)anthracene	53.0	0	19418	U	37.0	0	17980	U	78.0	0	9646	U			8259	U
Benzo(a)pyrene	380	0	20530	U	20.0	0	19010	U	60.0	0	10198	U			8731	U
Benzo(b)fluoranthene	24.0	0	20268	U	24.0	0	18768	U	39.0	0	10068	U			8620	U
Benzo(g,h,i)perylene	18.0	0	25106	U	7.60	0	34841	U	6.60	0	12472	U			21328	U
Benzo(k)fluoranthene	32.0	0	20530	U	27.0	0	19010	U	40.0	0	10198	U			8731	U
Chrysene	56.0	0	19484	U	40.0	0	18041	U	66.0	0	9679	U			8286	U
Dibenz(a,h)anthracene	5.00	J	20922	U	2.90	0	29059	U	3.10	J	10393	U			17796	U
Fluoranthene	140	0	18568	U	92.0	0	17193	U	480	0	9224	U			7897	U
Fluorene	210	0	17653	U	110	0	16346	U	860	0	8769	U			7508	U
Indeno(1,2,3-cd)pyrene	15.0	0	22034	U	7.90	0	20402	U	7.80	0	10945	U			9371	U
Naphthalene	650	0	49853	0	410	0	49280	0	3300	0	31634	0			11762	0
Phenanthrene	410	0	18045	U	290	0	16709	U	1900	0	8964	U			7675	U
Pyrene	160	0	18895	U	66.0	0	17496	U	8.40	0	9386	U			8036	U
Average Test Conditions																
Sed Temp (degrees F)			58.0				64.3				64.5				58.3	
Air Temp (degrees F)			65.2				62.8				62.6				60.8	
Humidity (%)			85.2				87.1				84.6				86.4	
Air Velocity (Mi/Hr)			5.2				5.2				5.3				5.3	
Cross Section Area (m^2)			0.2				0.2				0.2				0.2	

Flags:
0=no qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnotes:
[1] emission rate in OU/(m^2 x hr)
[2] Pretest sediment samples not collected

Appendix H
Air Emission Wind Tunnel Results Summary (Area 2A)
Ashland/Northern States Power Lakefront Superfund Site

	6 - 22 Hour Emission Rate (ug/m^2/hr)															
	Sediment		***10% Quiescent***		***Sediment***		***10% Mixed***		***Sediment***		***1% Mixed***		***Sediment*** [2]		***1% Quiescent***	
Chemical/Parameter	*Concentration (mg/kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*
VOCs																
1,2,3-Trimethylbenzene	13.0	0	12498	0	11.0	0	32409	0	14.0	0	13423	0			17344	0
1,2,4-Trimethylbenzene	30.0	0	40318	0	40.0	0	69385	0	47.0	0	29647	0			30189	0
1,3,5-Trimethylbenzene	7.30	0	14156	0	9.90	0	24063	0	12.0	0	10806	0			3723	U
1,4-Dichlorobenzene	0.600	U	8843	U	0.160	U	9386	0	0.23	U	8866	U			4468	U
Benzene	0.220	U	46582	0	7.00	0	65858	0	3.20	0	38883	0			29103	0
Carbon Tetrachloride	0.280	U	61014	0	0.073	U	172818	0	0.110	U	358347	0			47161	0
Ethyl Benzene	49.0	0	24473	0	58.0	0	39118	0	62.0	0	18687	0			13621	0
sec-Butylbenzene	0.210	U	7492	U	0.055	U	7685	U	0.081	U	7512	U			3785	U
Styrene	0.230	U	17042	0	0.060	U	31244	0	0.088	U	13607	0			13466	0
Toluene	14.0	0	128506	0	19.0	0	194172	0	14.0	0	94359	0			84082	0
Trichloroethene	0.370	U	21218	0	0.096	U	27874	0	0.140	U	143893	0			12193	0
Xylenes, Total	52.0	0	108516	0	67.0	0	186582	0	66.0	0	76472	0			73533	0
PAHs																
1-Methylnaphthalene	330	0	9209	0	250	0	12787	0	4800	0	9454	0			10456	0
2-Methylnaphthalene	660	0	18669	0	380	0	32063	0	2700	0	16403	0			24945	0
Acenaphthene	260	0	4225	U	91.0	0	4334	U	850	0	4236	U			4269	U
Acenaphthylene	24.0	0	3894	U	16.0	0	3994	U	28.0	0	3904	U			3934	U
Anthracene	170	0	4213	U	90.0	0	4321	U	560	0	4224	U			4257	U
Benz(a)anthracene	53.0	0	4563	U	37.0	0	4680	U	78.0	0	4575	U			4611	U
Benzo(a)pyrene	380	0	4821	U	20.0	0	4945	U	60.0	0	4833	U			4871	U
Benzo(b)fluoranthene	24.0	0	4766	U	24.0	0	4888	U	39.0	0	4778	U			4815	U
Benzo(g,h,i)perylene	18.0	0	5889	U	7.60	0	9068	U	6.60	0	5905	U			8933	U
Benzo(k)fluoranthene	32.0	0	4827	U	27.0	0	4951	U	40.0	0	4840	U			4877	U
Chrysene	56.0	0	4581	U	40.0	0	4699	U	66.0	0	4593	U			4629	U
Dibenz(a,h)anthracene	5.00	J	4913	U	2.90	0	7559	U	3.10	J	4926	U			7446	U
Fluoranthene	140	0	4360	U	92.0	0	4472	U	480	0	4372	U			4406	U
Fluorene	210	0	4145	U	110	0	4252	U	860	0	4156	U			4189	U
Indeno(1,2,3-cd)pyrene	15.0	0	5183	U	7.90	0	5317	U	7.80	0	5197	U			5237	U
Naphthalene	650	0	17779	0	410	0	20409	0	3300	0	19457	0			16072	0
Phenanthrene	410	0	4231	U	290	0	4340	U	1900	0	4242	U			4275	U
Pyrene	160	0	4428	U	66.0	0	4542	U	8.40	0	4439	U			4474	U
Average Test Conditions																
Sed Temp (degrees F)			64.0				70.0				71.0				61.5	
Air Temp (degrees F)			65.3				63.4				62.6				60.8	
Humidity (%)			82.9				84.1				82.1				85.8	
Air Velocity (Mi/Hr)			5.2				5.3				5.3				5.4	
Cross Section Area (m^2)			0.2				0.2				0.2				0.2	

Flags:
0=no qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Footnotes:
[1] emission rate in OU/(m^2 x hr)
[2] Pretest sediment samples not collected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
10% Mixed, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	58.3		907	52883	0.124	2	213237
1,2,4-Trimethylbenzene	42.8		907	38823	0.124	2	156544
1,3,5-Trimethylbenzene	14.0		907	12699	0.124	2	51206
1,4-Dichlorobenzene	11.5	U	907	10431	0.124	2	42062
Benzene	38.3		907	34741	0.124	2	140085
Carbon Tetrachloride	670		907	607744	0.124	2	2450579
Ethyl Benzene	24.7		907	22405	0.124	2	90342
sec-Butylbenzene	9.76	U	907	8853	0.124	2	35698
Styrene	28.2		907	25580	0.124	2	103144
Toluene	79.8		907	72385	0.124	2	291875
Trichloroethene	9.94	U	907	9016	0.124	2	36356
Xylenes, Total	106		907	96150	0.124	2	387704
PAHs							
1-Methylnaphthalene	5.29	U	907	4798	0.124	2	19349
2-Methylnaphthalene	21.6		907	19593	0.124	2	79004
Acenaphthene	5.50	U	907	4989	0.124	2	20117
Acenaphthylene	5.07	U	907	4599	0.124	2	18544
Anthracene	5.48	U	907	4971	0.124	2	20044
Benz(a)anthracene	5.94	U	907	5388	0.124	2	21726
Benzo(a)pyrene	6.28	U	907	5696	0.124	2	22970
Benzo(b)fluoranthene	6.21	U	907	5633	0.124	2	22714
Benzo(g,h,i)perylene	15.3	U	907	13878	0.124	2	55961
Benzo(k)fluoranthene	6.29	U	907	5706	0.124	2	23006
Chrysene	5.96	U	907	5406	0.124	2	21799
Dibenz(a,h)anthracene	12.8	U	907	11611	0.124	2	46817
Fluoranthene	5.68	U	907	5152	0.124	2	20775
Fluorene	5.40	U	907	4898	0.124	2	19751
Indeno(1,2,3-cd)pyrene	6.75	U	907	6123	0.124	2	24689
Naphthalene	19.3		907	17507	0.124	2	70591
Phenanthrene	5.52	U	907	5007	0.124	2	20190
Pyrene	5.77	U	907	5234	0.124	2	21104
Test Conditions							
Sed Temp (degrees F)	Max	59.5		Min	52.5	Avg	56.0
Air Temp (degrees F)	Max	62.9		Min	61.1	Avg	62.0
Humidity (%)	Max	86.5		Min	74.1	Avg	80.3
Air Velocity (Mi/Hr)	Max	5.20		Min	5.10	Avg	5.15
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/28/2007

Sample IDs: NSP-2A-10M-PAH-2-032807 Front, NSP-2A-10M-VOC-2-032807 Front

[1] emission rate in $OU/(m^2 \times hr)$

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
10% Mixed, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	6.48		1501	9729	0.124	4	19615
1,2,4-Trimethylbenzene	22.6		1501	33932	0.124	4	68411
1,3,5-Trimethylbenzene	7.23		1501	10855	0.124	4	21885
1,4-Dichlorobenzene	5.76	U	1501	8648	0.124	4	17436
Benzene	26.6		1501	39937	0.124	4	80519
Carbon Tetrachloride	116		1501	174162	0.124	4	351134
Ethyl Benzene	13.3		1501	19969	0.124	4	40259
sec-Butylbenzene	4.88	U	1501	7327	0.124	4	14772
Styrene	12.2		1501	18317	0.124	4	36930
Toluene	67.7		1501	101645	0.124	4	204929
Trichloroethene	16.9		1501	25374	0.124	4	51157
Xylenes, Total	63.6		1501	95489	0.124	4	192518
PAHs							
1-Methylnaphthalene	5.30	U	1501	7957	0.124	4	16043
2-Methylnaphthalene	15.0		1501	22566	0.124	4	45496
Acenaphthene	5.50	U	1501	8258	0.124	4	16649
Acenaphthylene	5.08	U	1501	7627	0.124	4	15377
Anthracene	5.48	U	1501	8228	0.124	4	16588
Benz(a)anthracene	5.94	U	1501	8918	0.124	4	17980
Benzo(a)pyrene	6.28	U	1501	9429	0.124	4	19010
Benzo(b)fluoranthene	6.20	U	1501	9309	0.124	4	18768
Benzo(g,h,i)perylene	11.5	U	1501	17281	0.124	4	34841
Benzo(k)fluoranthene	6.28	U	1501	9429	0.124	4	19010
Chrysene	5.96	U	1501	8948	0.124	4	18041
Dibenz(a,h)anthracene	9.60	U	1501	14413	0.124	4	29059
Fluoranthene	5.68	U	1501	8528	0.124	4	17193
Fluorene	5.40	U	1501	8108	0.124	4	16346
Indeno(1,2,3-cd)pyrene	6.74	U	1501	10119	0.124	4	20402
Naphthalene	16.3		1501	24443	0.124	4	49280
Phenanthrene	5.52	U	1501	8288	0.124	4	16709
Pyrene	5.78	U	1501	8678	0.124	4	17496
Test Conditions							
Sed Temp (degrees F)	Max	68.0		Min	60.5	Avg	64.3
Air Temp (degrees F)	Max	64.0		Min	61.5	Avg	62.8
Humidity (%)	Max	88.7		Min	85.5	Avg	87.1
Air Velocity (Mi/Hr)	Max	5.30		Min	5.00	Avg	5.15
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/28/2007

Sample IDs: NSP-2A-10M-PAH-5-032807 Front, NSP-2A-10M-PAH-5-032807 Back, NSP-2A-10M-VOC-5-032807 Front

[1] emission rate in $OU/(m^2 \times hr)$

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
10% Mixed, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.3		6249	64300	0.124	16	32409
1,2,4-Trimethylbenzene	22.0		6249	137661	0.124	16	69385
1,3,5-Trimethylbenzene	7.64		6249	47741	0.124	16	24063
1,4-Dichlorobenzene	2.98		6249	18621	0.124	16	9386
Benzene	20.9		6249	130662	0.124	16	65858
Carbon Tetrachloride	54.9		6249	342871	0.124	16	172818
Ethyl Benzene	12.4		6249	77610	0.124	16	39118
sec-Butylbenzene	2.44	U	6249	15247	0.124	16	7685
Styrene	9.92		6249	61988	0.124	16	31244
Toluene	61.7		6249	385237	0.124	16	194172
Trichloroethene	8.85		6249	55302	0.124	16	27874
Xylenes, Total	59.2		6249	370178	0.124	16	186582
PAHs							
1-Methylnaphthalene	4.06		6249	25370	0.124	16	12787
2-Methylnaphthalene	10.2		6249	63613	0.124	16	32063
Acenaphthene	1.38	U	6249	8598	0.124	16	4334
Acenaphthylene	1.27	U	6249	7923	0.124	16	3994
Anthracene	1.37	U	6249	8573	0.124	16	4321
Benz(a)anthracene	1.49	U	6249	9286	0.124	16	4680
Benzo(a)pyrene	1.57	U	6249	9811	0.124	16	4945
Benzo(b)fluoranthene	1.55	U	6249	9698	0.124	16	4888
Benzo(g,h,i)perylene	2.88	U	6249	17990	0.124	16	9068
Benzo(k)fluoranthene	1.57	U	6249	9823	0.124	16	4951
Chrysene	1.49	U	6249	9323	0.124	16	4699
Dibenz(a,h)anthracene	2.40	U	6249	14997	0.124	16	7559
Fluoranthene	1.42	U	6249	8873	0.124	16	4472
Fluorene	1.35	U	6249	8436	0.124	16	4252
Indeno(1,2,3-cd)pyrene	1.69	U	6249	10548	0.124	16	5317
Naphthalene	6.48		6249	40492	0.124	16	20409
Phenanthrene	1.38	U	6249	8611	0.124	16	4340
Pyrene	1.44	U	6249	9011	0.124	16	4542
Odor Parameters							
Detection Threshold[1]	160		6249	999840	0.124	16	503952
Recognition Threshold[1]	85		6249	531165	0.124	16	267724
Intensity	15						
Persistence	-0.170						
Hedonic Tone	0.200						
Test Conditions							
Sed Temp (degrees F)	Max	71.5		Min	68.5	Avg	70.0
Air Temp (degrees F)	Max	63.9		Min	62.9	Avg	63.4
Humidity (%)	Max	88.7		Min	79.4	Avg	84.1
Air Velocity (Mi/Hr)	Max	5.40		Min	5.20	Avg	5.30
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/29/07

Sample IDs: NSP-2A-10M-PAH-6-032907 Front, NSP-2A-10M-PAH-6-032907 Back, NSP-2A-10M-VOC-6-032907 Front, NSP-2A-10M-VOC-6-032907 Back

[1] emission rate in $OU/(m^2 \times hr)$

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
10% Quiescent, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	760	7677	0.124	2	30956
1,2,4-Trimethylbenzene	15.4		760	11706	0.124	2	47200
1,3,5-Trimethylbenzene	9.58	U	760	7282	0.124	2	29362
1,4-Dichlorobenzene	11.5	U	760	8741	0.124	2	35247
Benzene	23.7		760	18015	0.124	2	72640
Carbon Tetrachloride	20.3	U	760	15430	0.124	2	62219
Ethyl Benzene	26.5		760	20143	0.124	2	81221
sec-Butylbenzene	9.76	U	760	7419	0.124	2	29914
Styrene	13.0	U	760	9881	0.124	2	39844
Toluene	50.5		760	38386	0.124	2	154780
Trichloroethene	9.94	U	760	7555	0.124	2	30466
Xylenes, Total	9.94	U	760	7555	0.124	2	30466
PAHs							
1-Methylnaphthalene	10.6	U	760	8042	0.124	2	32427
2-Methylnaphthalene	10.5	U	760	7996	0.124	2	32243
Acenaphthene	11.0	U	760	8361	0.124	2	33715
Acenaphthylene	10.1	U	760	7708	0.124	2	31079
Anthracene	11.0	U	760	8331	0.124	2	33592
Benz(a)anthracene	11.9	U	760	9030	0.124	2	36412
Benzo(a)pyrene	12.6	U	760	9547	0.124	2	38496
Benzo(b)fluoranthene	12.4	U	760	9441	0.124	2	38067
Benzo(g,h,i)perylene	15.3	U	760	11660	0.124	2	47016
Benzo(k)fluoranthene	12.6	U	760	9562	0.124	2	38557
Chrysene	11.9	U	760	9061	0.124	2	36534
Dibenz(a,h)anthracene	12.8	U	760	9729	0.124	2	39231
Fluoranthene	11.4	U	760	8635	0.124	2	34818
Fluorene	10.8	U	760	8209	0.124	2	33102
Indeno(1,2,3-cd)pyrene	13.5	U	760	10261	0.124	2	41377
Naphthalene	33.0		760	25099	0.124	2	101205
Phenanthrene	11.0	U	760	8392	0.124	2	33837
Pyrene	11.5	U	760	8772	0.124	2	35370
Test Conditions							
Sed Temp (degrees F)	Max	55.0		Min	52.5	Avg	53.8
Air Temp (degrees F)	Max	64.4		Min	62.4	Avg	63.4
Humidity (%)	Max	87.2		Min	80.0	Avg	83.6
Air Velocity (Mi/Hr)	Max	5.20		Min	5.10	Avg	5.15
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/26/2007

Sample IDs: NSP-2A-10Q-PAH-2-032607 Front, 'NSP-2A-10Q-PAH-2-032607 Back, NSP-2A-10Q-VOC-2-032607

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
10% Quiescent, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.03	U	1621	8156	0.124	4	16443
1,2,4-Trimethylbenzene	8.26		1621	13393	0.124	4	27003
1,3,5-Trimethylbenzene	4.79	U	1621	7767	0.124	4	15659
1,4-Dichlorobenzene	5.76	U	1621	9340	0.124	4	18830
Benzene	13.4		1621	21728	0.124	4	43806
Carbon Tetrachloride	12.3		1621	19944	0.124	4	40210
Ethyl Benzene	9.76	U	1621	15825	0.124	4	31906
sec-Butylbenzene	4.88	U	1621	7913	0.124	4	15953
Styrene	6.51	U	1621	10556	0.124	4	21282
Toluene	28.7		1621	46536	0.124	4	93822
Trichloroethene	4.97	U	1621	8059	0.124	4	16247
Xylenes, Total	22.2		1621	35996	0.124	4	72573
PAHs							
1-Methylnaphthalene	5.30	U	1621	8594	0.124	4	17326
2-Methylnaphthalene	5.26	U	1621	8529	0.124	4	17195
Acenaphthene	5.50	U	1621	8918	0.124	4	17980
Acenaphthylene	5.08	U	1621	8237	0.124	4	16607
Anthracene	5.48	U	1621	8886	0.124	4	17915
Benz(a)anthracene	5.94	U	1621	9631	0.124	4	19418
Benzo(a)pyrene	6.28	U	1621	10183	0.124	4	20530
Benzo(b)fluoranthene	6.20	U	1621	10053	0.124	4	20268
Benzo(g,h,i)perylene	7.68	U	1621	12453	0.124	4	25106
Benzo(k)fluoranthene	6.28	U	1621	10183	0.124	4	20530
Chrysene	5.96	U	1621	9664	0.124	4	19484
Dibenz(a,h)anthracene	6.40	U	1621	10377	0.124	4	20922
Fluoranthene	5.68	U	1621	9210	0.124	4	18568
Fluorene	5.40	U	1621	8756	0.124	4	17653
Indeno(1,2,3-cd)pyrene	6.74	U	1621	10929	0.124	4	22034
Naphthalene	15.3		1621	24727	0.124	4	49853
Phenanthrene	5.52	U	1621	8950	0.124	4	18045
Pyrene	5.78	U	1621	9372	0.124	4	18895
Test Conditions							
Sed Temp (degrees F)	Max	60.5		Min	55.5	Avg	58.0
Air Temp (degrees F)	Max	67.2		Min	63.1	Avg	65.2
Humidity (%)	Max	86.3		Min	84.1	Avg	85.2
Air Velocity (Mi/Hr)	Max	5.20		Min	5.10	Avg	5.15
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/26/2007

Sample IDs: NSP-2A-10Q-PAH-5-032607 Front, NSP-2A-10Q-PAH-5-032607 Back, NSP-2A-10Q-VOC-5-032607 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
10% Quiescent, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	4.07		6092	24795	0.124	16	12498
1,2,4-Trimethylbenzene	13.1		6092	79990	0.124	16	40318
1,3,5-Trimethylbenzene	4.61		6092	28085	0.124	16	14156
1,4-Dichlorobenzene	2.88	U	6092	17545	0.124	16	8843
Benzene	15.2		6092	92418	0.124	16	46582
Carbon Tetrachloride	19.9		6092	121051	0.124	16	61014
Ethyl Benzene	7.97		6092	48554	0.124	16	24473
sec-Butylbenzene	2.44	U	6092	14865	0.124	16	7492
Styrene	5.55		6092	33811	0.124	16	17042
Toluene	41.9		6092	254956	0.124	16	128506
Trichloroethene	6.91		6092	42097	0.124	16	21218
Xylenes, Total	35.3		6092	215297	0.124	16	108516
PAHs							
1-Methylnaphthalene	3.00		6092	18270	0.124	16	9209
2-Methylnaphthalene	6.08		6092	37040	0.124	16	18669
Acenaphthene	1.38	U	6092	8383	0.124	16	4225
Acenaphthylene	1.27	U	6092	7725	0.124	16	3894
Anthracene	1.37	U	6092	8358	0.124	16	4213
Benz(a)anthracene	1.49	U	6092	9053	0.124	16	4563
Benzo(a)pyrene	1.57	U	6092	9565	0.124	16	4821
Benzo(b)fluoranthene	1.55	U	6092	9455	0.124	16	4766
Benzo(g,h,i)perylene	1.92	U	6092	11685	0.124	16	5889
Benzo(k)fluoranthene	1.57	U	6092	9577	0.124	16	4827
Chrysene	1.49	U	6092	9089	0.124	16	4581
Dibenz(a,h)anthracene	1.60	U	6092	9747	0.124	16	4913
Fluoranthene	1.42	U	6092	8651	0.124	16	4360
Fluorene	1.35	U	6092	8224	0.124	16	4145
Indeno(1,2,3-cd)pyrene	1.69	U	6092	10284	0.124	16	5183
Naphthalene	5.79		6092	35274	0.124	16	17779
Phenanthrene	1.38	U	6092	8395	0.124	16	4231
Pyrene	1.44	U	6092	8785	0.124	16	4428
Test Conditions							
Sed Temp (degrees F)	Max	67.5		Min	60.5	Avg	64.0
Air Temp (degrees F)	Max	67.1		Min	63.5	Avg	65.3
Humidity (%)	Max	86.0		Min	79.8	Avg	82.9
Air Velocity (Mi/Hr)	Max	5.30		Min	5.10	Avg	5.20
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/26/07 & 3/17/07

Sample IDs: NSP-2A-10Q-PAH-6-032707 Front, NSP-2A-10Q-PAH-6-032707 Back, NSP-2A-10Q-VOC-6-032707 Front, NSP-2A-10Q-VOC-6-032707 Back

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
1% Mixed, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	1086	10970	0.124	2	44234
1,2,4-Trimethylbenzene	13.0		1086	14120	0.124	2	56935
1,3,5-Trimethylbenzene	9.58	U	1086	10405	0.124	2	41957
1,4-Dichlorobenzene	11.5	U	1086	12491	0.124	2	50366
Benzene	19.0		1086	20637	0.124	2	83213
Carbon Tetrachloride	20.3	U	1086	22049	0.124	2	88907
Ethyl Benzene	19.5	U	1086	21180	0.124	2	85403
sec-Butylbenzene	9.76	U	1086	10601	0.124	2	42745
Styrene	13.0	U	1086	14120	0.124	2	56935
Toluene	48.2		1086	52352	0.124	2	211099
Trichloroethene	9.94	U	1086	10796	0.124	2	43534
Xylenes, Total	19.9	U	1086	21614	0.124	2	87155
PAHs							
1-Methylnaphthalene	5.29	U	1086	5746	0.124	2	23168
2-Methylnaphthalene	14.1		1086	15315	0.124	2	61753
Acenaphthene	5.50	U	1086	5974	0.124	2	24088
Acenaphthylene	5.07	U	1086	5507	0.124	2	22205
Anthracene	5.48	U	1086	5952	0.124	2	24000
Benz(a)anthracene	5.94	U	1086	6452	0.124	2	26015
Benzo(a)pyrene	6.28	U	1086	6821	0.124	2	27504
Benzo(b)fluoranthene	6.21	U	1086	6745	0.124	2	27198
Benzo(g,h,i)perylene	7.67	U	1086	8331	0.124	2	33592
Benzo(k)fluoranthene	6.29	U	1086	6832	0.124	2	27548
Chrysene	5.96	U	1086	6473	0.124	2	26103
Dibenz(a,h)anthracene	6.40	U	1086	6951	0.124	2	28030
Fluoranthene	5.68	U	1086	6169	0.124	2	24876
Fluorene	5.40	U	1086	5865	0.124	2	23650
Indeno(1,2,3-cd)pyrene	6.75	U	1086	7332	0.124	2	29563
Naphthalene	17.4		1086	18899	0.124	2	76206
Phenanthrene	5.52	U	1086	5996	0.124	2	24176
Pyrene	5.77	U	1086	6267	0.124	2	25271
Test Conditions							
Sed Temp (degrees F)	Max	58.5		Min	51.5	Avg	55.0
Air Temp (degrees F)	Max	65.4		Min	63.1	Avg	64.3
Humidity (%)	Max	87.4		Min	83.3	Avg	85.4
Air Velocity (Mi/Hr)	Max	5.50		Min	5.30	Avg	5.40
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/27/2007

Sample IDs: 'NSP-2A-1M-PAH-2-032707 Front, 'NSP-2A-1M-VOC-2-032707 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
1% Mixed, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.03	U	1611	8103	0.124	4	16337
1,2,4-Trimethylbenzene	7.84		1611	12630	0.124	4	25463
1,3,5-Trimethylbenzene	4.79	U	1611	7716	0.124	4	15557
1,4-Dichlorobenzene	5.76	U	1611	9279	0.124	4	18708
Benzene	14.5		1611	23358	0.124	4	47094
Carbon Tetrachloride	13.0		1611	20942	0.124	4	42222
Ethyl Benzene	9.76	U	1611	15723	0.124	4	31699
sec-Butylbenzene	4.88	U	1611	7861	0.124	4	15849
Styrene	6.51	U	1611	10487	0.124	4	21143
Toluene	33.4		1611	53805	0.124	4	108478
Trichloroethene	13.2		1611	21264	0.124	4	42872
Xylenes, Total	24.3		1611	39146	0.124	4	78923
PAHs							
1-Methylnaphthalene	2.65	U	1611	4269	0.124	4	8607
2-Methylnaphthalene	8.07		1611	13000	0.124	4	26210
Acenaphthene	2.75	U	1611	4430	0.124	4	8932
Acenaphthylene	2.54	U	1611	4092	0.124	4	8250
Anthracene	2.74	U	1611	4414	0.124	4	8899
Benz(a)anthracene	2.97	U	1611	4784	0.124	4	9646
Benzo(a)pyrene	3.14	U	1611	5058	0.124	4	10198
Benzo(b)fluoranthene	3.10	U	1611	4994	0.124	4	10068
Benzo(g,h,i)perylene	3.84	U	1611	6186	0.124	4	12472
Benzo(k)fluoranthene	3.14	U	1611	5058	0.124	4	10198
Chrysene	2.98	U	1611	4801	0.124	4	9679
Dibenz(a,h)anthracene	3.20	U	1611	5155	0.124	4	10393
Fluoranthene	2.84	U	1611	4575	0.124	4	9224
Fluorene	2.70	U	1611	4350	0.124	4	8769
Indeno(1,2,3-cd)pyrene	3.37	U	1611	5429	0.124	4	10945
Naphthalene	9.74		1611	15690	0.124	4	31634
Phenanthrene	2.76	U	1611	4446	0.124	4	8964
Pyrene	2.89	U	1611	4656	0.124	4	9386
Test Conditions							
Sed Temp (degrees F)	Max	68.0		Min	61.0	Avg	64.5
Air Temp (degrees F)	Max	63.1		Min	62.0	Avg	62.6
Humidity (%)	Max	85.4		Min	83.7	Avg	84.6
Air Velocity (Mi/Hr)	Max	5.40		Min	5.20	Avg	5.30
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/27/2007
Sample IDs: NSP-2A-1M-PAH-5-032707 Front, NSP-2A-1M-VOC-5-032707 Front
U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
1% Mixed, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	4.36		6107.910	26630.488	0.124	16	13423
1,2,4-Trimethylbenzene	9.63		6108	58819	0.124	16	29647
1,3,5-Trimethylbenzene	3.51		6108	21439	0.124	16	10806
1,4-Dichlorobenzene	2.88	U	6108	17591	0.124	16	8866
Benzene	12.6		6108	77143	0.124	16	38883
Carbon Tetrachloride	116		6108	710961	0.124	16	358347
Ethyl Benzene	6.07		6108	37075	0.124	16	18687
sec-Butylbenzene	2.44	U	6108	14903	0.124	16	7512
Styrene	4.42		6108	26997	0.124	16	13607
Toluene	30.7		6108	187207	0.124	16	94359
Trichloroethene	46.7		6108	285484	0.124	16	143893
Xylenes, Total	24.8		6108	151720	0.124	16	76472
PAHs							
1-Methylnaphthalene	3.07		6108	18757	0.124	16	9454
2-Methylnaphthalene	5.33		6108	32543	0.124	16	16403
Acenaphthene	1.38	U	6108	8404	0.124	16	4236
Acenaphthylene	1.27	U	6108	7745	0.124	16	3904
Anthracene	1.37	U	6108	8380	0.124	16	4224
Benz(a)anthracene	1.49	U	6108	9076	0.124	16	4575
Benzo(a)pyrene	1.57	U	6108	9589	0.124	16	4833
Benzo(b)fluoranthene	1.55	U	6108	9479	0.124	16	4778
Benzo(g,h,i)perylene	1.92	U	6108	11715	0.124	16	5905
Benzo(k)fluoranthene	1.57	U	6108	9602	0.124	16	4840
Chrysene	1.49	U	6108	9113	0.124	16	4593
Dibenz(a,h)anthracene	1.60	U	6108	9773	0.124	16	4926
Fluoranthene	1.42	U	6108	8673	0.124	16	4372
Fluorene	1.35	U	6108	8246	0.124	16	4156
Indeno(1,2,3-cd)pyrene	1.69	U	6108	10310	0.124	16	5197
Naphthalene	6.32		6108	38602	0.124	16	19457
Phenanthrene	1.38	U	6108	8417	0.124	16	4242
Pyrene	1.44	U	6108	8808	0.124	16	4439
Test Conditions							
Sed Temp (degrees F)	Max	73.5		Min	68.5	Avg	71.0
Air Temp (degrees F)	Max	63.8		Min	61.3	Avg	62.6
Humidity (%)	Max	84.5		Min	79.7	Avg	82.1
Air Velocity (Mi/Hr)	Max	5.40		Min	5.20	Avg	5.30
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/28/07

Sample IDs: NSP-2A-1M-PAH-6-032807 Front, NSP-2A-1M-PAH-6-032807 Back, NSP-2A-1M-VOC-6-032807 Front, NSP-2A-1M-VOC-6-032807 Back

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
1% Quiescent, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	7.54	U	1479	11152	0.124	2	44967
1,2,4-Trimethylbenzene	17.5		1479	25883	0.124	2	104367
1,3,5-Trimethylbenzene	7.18	U	1479	10619	0.124	2	42820
1,4-Dichlorobenzene	8.65	U	1479	12794	0.124	2	51587
Benzene	17.0		1479	25144	0.124	2	101385
Carbon Tetrachloride	56.0		1479	82826	0.124	2	333975
Ethyl Benzene	14.6	U	1479	21594	0.124	2	87072
sec-Butylbenzene	7.32	U	1479	10826	0.124	2	43655
Styrene	9.97		1479	14746	0.124	2	59459
Toluene	42.7		1479	63155	0.124	2	254656
Trichloroethene	7.46	U	1479	11034	0.124	2	44490
Xylenes, Total	42.5		1479	62859	0.124	2	253463
PAHs							
1-Methylnaphthalene	3.97	U	1479	5872	0.124	2	23676
2-Methylnaphthalene	10.7		1479	15826	0.124	2	63813
Acenaphthene	4.13	U	1479	6108	0.124	2	24631
Acenaphthylene	3.80	U	1479	5620	0.124	2	22663
Anthracene	4.11	U	1479	6079	0.124	2	24511
Benz(a)anthracene	4.46	U	1479	6596	0.124	2	26599
Benzo(a)pyrene	4.71	U	1479	6966	0.124	2	28090
Benzo(b)fluoranthene	4.66	U	1479	6892	0.124	2	27791
Benzo(g,h,i)perylene	11.5	U	1479	17009	0.124	2	68584
Benzo(k)fluoranthene	4.72	U	1479	6981	0.124	2	28149
Chrysene	4.47	U	1479	6611	0.124	2	26658
Dibenz(a,h)anthracene	9.60	U	1479	14199	0.124	2	57253
Fluoranthene	4.26	U	1479	6301	0.124	2	25406
Fluorene	4.05	U	1479	5990	0.124	2	24154
Indeno(1,2,3-cd)pyrene	5.06	U	1479	7484	0.124	2	30177
Naphthalene	8.36		1479	12365	0.124	2	49858
Phenanthrene	4.14	U	1479	6123	0.124	2	24690
Pyrene	4.33	U	1479	6404	0.124	2	25823
Test Conditions							
Sed Temp (degrees F)	Max	54.5		Min	51.5	Avg	53.0
Air Temp (degrees F)	Max	61.1		Min	60.0	Avg	60.6
Humidity (%)	Max	88.1		Min	84.0	Avg	86.1
Air Velocity (Mi/Hr)	Max	5.50		Min	5.30	Avg	5.40
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/29/2007
Sample IDs: NSP-2A-1Q-PAH-2-032907 Front, NSP-2A-1Q-VOC-6-032907 Front
U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
1% Quiescent, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.03	U	1379	6937	0.124	4	13987
1,2,4-Trimethylbenzene	12.5		1379	17240	0.124	4	34759
1,3,5-Trimethylbenzene	4.79	U	1379	6606	0.124	4	13319
1,4-Dichlorobenzene	5.76	U	1379	7944	0.124	4	16017
Benzene	14.2		1379	19585	0.124	4	39486
Carbon Tetrachloride	24.0		1379	33101	0.124	4	66736
Ethyl Benzene	9.76	U	1379	13461	0.124	4	27139
sec-Butylbenzene	4.88	U	1379	6731	0.124	4	13570
Styrene	6.51	U	1379	8979	0.124	4	18102
Toluene	31.6		1379	43583	0.124	4	87870
Trichloroethene	4.97	U	1379	6855	0.124	4	13820
Xylenes, Total	29.1		1379	40135	0.124	4	80918
PAHs							
1-Methylnaphthalene	3.06		1379	4220	0.124	4	8509
2-Methylnaphthalene	6.23		1379	8593	0.124	4	17324
Acenaphthene	2.75	U	1379	3793	0.124	4	7647
Acenaphthylene	2.54	U	1379	3503	0.124	4	7063
Anthracene	2.74	U	1379	3779	0.124	4	7619
Benz(a)anthracene	2.97	U	1379	4096	0.124	4	8259
Benzo(a)pyrene	3.14	U	1379	4331	0.124	4	8731
Benzo(b)fluoranthene	3.10	U	1379	4276	0.124	4	8620
Benzo(g,h,i)perylene	7.67	U	1379	10579	0.124	4	21328
Benzo(k)fluoranthene	3.14	U	1379	4331	0.124	4	8731
Chrysene	2.98	U	1379	4110	0.124	4	8286
Dibenz(a,h)anthracene	6.40	U	1379	8827	0.124	4	17796
Fluoranthene	2.84	U	1379	3917	0.124	4	7897
Fluorene	2.70	U	1379	3724	0.124	4	7508
Indeno(1,2,3-cd)pyrene	3.37	U	1379	4648	0.124	4	9371
Naphthalene	4.23		1379	5834	0.124	4	11762
Phenanthrene	2.76	U	1379	3807	0.124	4	7675
Pyrene	2.89	U	1379	3986	0.124	4	8036
Test Conditions							
Sed Temp (degrees F)	Max	60.0		Min	56.5	Avg	58.3
Air Temp (degrees F)	Max	60.9		Min	60.6	Avg	60.8
Humidity (%)	Max	87.7		Min	85.0	Avg	86.4
Air Velocity (Mi/Hr)	Max	5.40		Min	5.20	Avg	5.30
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/29/2007
Sample IDs: NSP-2A-1Q-PAH-5-032907 Front, NSP-2A-1Q-VOC-5-032907 Front
U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 2A)
1% Quiescent, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	5.59		6156	34410	0.124	16	17344
1,2,4-Trimethylbenzene	9.73		6156	59895	0.124	16	30189
1,3,5-Trimethylbenzene	1.20	U	6156	7387	0.124	16	3723
1,4-Dichlorobenzene	1.44	U	6156	8864	0.124	16	4468
Benzene	9.38		6156	57740	0.124	16	29103
Carbon Tetrachloride	15.2		6156	93567	0.124	16	47161
Ethyl Benzene	4.39		6156	27024	0.124	16	13621
sec-Butylbenzene	1.22	U	6156	7510	0.124	16	3785
Styrene	4.34		6156	26716	0.124	16	13466
Toluene	27.1		6156	166819	0.124	16	84082
Trichloroethene	3.93		6156	24192	0.124	16	12193
Xylenes, Total	23.7		6156	145890	0.124	16	73533
PAHs							
1-Methylnaphthalene	3.37		6156	20745	0.124	16	10456
2-Methylnaphthalene	8.04		6156	49492	0.124	16	24945
Acenaphthene	1.38	U	6156	8470	0.124	16	4269
Acenaphthylene	1.27	U	6156	7805	0.124	16	3934
Anthracene	1.37	U	6156	8446	0.124	16	4257
Benz(a)anthracene	1.49	U	6156	9147	0.124	16	4611
Benzo(a)pyrene	1.57	U	6156	9664	0.124	16	4871
Benzo(b)fluoranthene	1.55	U	6156	9554	0.124	16	4815
Benzo(g,h,i)perylene	2.88	U	6156	17722	0.124	16	8933
Benzo(k)fluoranthene	1.57	U	6156	9677	0.124	16	4877
Chrysene	1.49	U	6156	9184	0.124	16	4629
Dibenz(a,h)anthracene	2.4	U	6156	14774	0.124	16	7446
Fluoranthene	1.42	U	6156	8741	0.124	16	4406
Fluorene	1.35	U	6156	8310	0.124	16	4189
Indeno(1,2,3-cd)pyrene	1.69	U	6156	10391	0.124	16	5237
Naphthalene	5.18		6156	31887	0.124	16	16072
Phenanthrene	1.38	U	6156	8483	0.124	16	4275
Pyrene	1.44	U	6156	8877	0.124	16	4474
Test Conditions							
Sed Temp (degrees F)	Max	62.5		Min	60.5	Avg	61.5
Air Temp (degrees F)	Max	61.1		Min	60.4	Avg	60.8
Humidity (%)	Max	86.7		Min	84.9	Avg	85.8
Air Velocity (Mi/Hr)	Max	5.50		Min	5.20	Avg	5.35
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/29/07 & 3/30/07

Sample IDs: NSP-2A-1Q-PAH-6-033007 Front, NSP-2A-1Q-PAH-6-033007 Back, NSP-2A-1Q-VOC-6-033007 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results Summary (Area 4)
Ashland/Northern States Power Lakefront Superfund Site

	0 - 2 Hour Emission Rate (ug/m^2/hr)				***2 - 6 Hour Emission Rate (ug/m^2/hr)***				***6 - 22 Hour Emission Rate (ug/m^2/hr)***			
	Sediment		***Exposed Soil***		***Sediment***		***Exposed Soil***		***Sediment***		***Exposed Soil***	
Chemical/Parameter	*Concentration (mg/kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*	*Concentration (mg/kg)*	*flags*	*Emission Rate (ug/m^2/hr)*	*flags*
VOCs												
1,2,3-Trimethylbenzene	11.0	0	84137	U	11.0	0	30006	U	11.0	0	7517	U
1,2,4-Trimethylbenzene	35.0	0	82463	U	35.0	0	29263	U	35.0	0	17999	0
1,3,5-Trimethylbenzene	9.80	0	40101	U	9.80	0	14230	U	9.80	0	6379	0
1,4-Dichlorobenzene	0.120	U	96695	U	0.120	U	34165	U	0.120	U	8625	U
Benzene	82.0	0	41315	U	82.0	0	17290	0	82.0	0	44323	0
Carbon Tetrachloride	0.056	U	42696	U	0.056	U	15092	U	0.056	U	3803	U
Ethyl Benzene	98.0	0	40855	U	98.0	0	14498	U	98.0	0	17070	0
sec-Butylbenzene	0.042	U	40855	U	0.042	U	14498	U	0.042	U	3654	U
Styrene	23.0	0	54417	U	23.0	0	19340	U	23.0	0	7008	0
Toluene	140	0	41859	U	140	0	22608	0	140	0	90443	0
Trichloroethene	0.074	U	41608	U	0.074	U	14765	U	0.074	U	3714	U
Xylenes, Total	133	0	41608	U	133	0	14765	U	133	0	72474	0
PAHs												
1-Methylnaphthalene	62.0	0	22144	U	62.0	0	7873	U	62.0	0	1983	U
2-Methylnaphthalene	100	0	22018	U	100	0	7813	U	100	0	1971	U
Acenaphthene	9.80	0	23023	U	9.80	0	8170	U	9.80	0	2060	U
Acenaphthylene	39.0	0	21223	U	39.0	0	7546	U	39.0	0	1899	U
Anthracene	26.0	0	22939	U	26.0	0	8140	U	26.0	0	2054	U
Benz(a)anthracene	13.0	0	24864	U	13.0	0	8823	U	13.0	0	2225	U
Benzo(a)pyrene	13.0	0	26288	U	13.0	0	9329	U	13.0	0	2351	U
Benzo(b)fluoranthene	5.70	0	25995	U	5.70	0	9210	U	5.70	0	2324	U
Benzo(g,h,i)perylene	4.80	0	32106	U	4.80	0	11408	U	4.80	0	2872	U
Benzo(k)fluoranthene	8.30	0	26329	U	8.30	0	9329	U	8.30	0	2354	U
Chrysene	14.00	0	24948	U	14.00	0	8853	U	14.00	0	2234	U
Dibenz(a,h)anthracene	1.30	0	26790	U	1.30	0	9507	U	1.30	0	2396	U
Fluoranthene	34.0	0	23776	U	34.0	0	8437	U	34.0	0	2126	U
Fluorene	36.0	0	22604	U	36.0	0	8021	U	36.0	0	2021	U
Indeno(1,2,3-cd)pyrene	4.00	0	28255	U	4.00	0	10012	U	4.00	0	2528	U
Naphthalene	230	0	97532	0	230	0	59120	0	230	0	27223	0
Phenanthrene	68.0	0	23106	U	68.0	0	8200	U	68.0	0	2063	U
Pyrene	35.0	0	24153	U	35.0	0	8586	U	35.0	0	2159	U
Average Test Conditions												
Sed Temp (degrees F)			62.3				65.3				65.8	
Air Temp (degrees F)			63.0				63.5				64.6	
Humidity (%)			42.0				39.5				34.2	
Air Velocity (Mi/Hr)			5.30				5.10				5.15	
Cross Section Area (m^2)			0.152				0.152				0.152	

Flags:
0=no qualifier
U=Analyte not detected
J=detected but below Method Reporting Limit; therefore, result is an estimated concentration

Appendix H
Air Emission Wind Tunnel Results (Area 4)
Exposed Sediment, 0-2 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	20.1	U	1038	20866	0.124	2	84137
1,2,4-Trimethylbenzene	19.7	U	1038	20451	0.124	2	82463
1,3,5-Trimethylbenzene	9.58	U	1038	9945	0.124	2	40101
1,4-Dichlorobenzene	23.1	U	1038	23980	0.124	2	96695
Benzene	9.87	U	1038	10246	0.124	2	41315
Carbon Tetrachloride	10.2	U	1038	10589	0.124	2	42696
Ethyl Benzene	9.76	U	1038	10132	0.124	2	40855
sec-Butylbenzene	9.76	U	1038	10132	0.124	2	40855
Styrene	13.0	U	1038	13495	0.124	2	54417
Toluene	10.0	U	1038	10381	0.124	2	41859
Trichloroethene	9.94	U	1038	10319	0.124	2	41608
Xylenes, Total	9.94	U	1038	10319	0.124	2	41608
PAHs							
1-Methylnaphthalene	5.29	U	1038	5492	0.124	2	22144
2-Methylnaphthalene	5.26	U	1038	5460	0.124	2	22018
Acenaphthene	5.50	U	1038	5710	0.124	2	23023
Acenaphthylene	5.07	U	1038	5263	0.124	2	21223
Anthracene	5.48	U	1038	5689	0.124	2	22939
Benz(a)anthracene	5.94	U	1038	6166	0.124	2	24864
Benzo(a)pyrene	6.28	U	1038	6519	0.124	2	26288
Benzo(b)fluoranthene	6.21	U	1038	6447	0.124	2	25995
Benzo(g,h,i)perylene	7.67	U	1038	7962	0.124	2	32106
Benzo(k)fluoranthene	6.29	U	1038	6530	0.124	2	26329
Chrysene	5.96	U	1038	6187	0.124	2	24948
Dibenz(a,h)anthracene	6.40	U	1038	6644	0.124	2	26790
Fluoranthene	5.68	U	1038	5896	0.124	2	23776
Fluorene	5.40	U	1038	5606	0.124	2	22604
Indeno(1,2,3-cd)pyrene	6.75	U	1038	7007	0.124	2	28255
Naphthalene	23.3		1038	24188	0.124	2	97532
Phenanthrene	5.52	U	1038	5730	0.124	2	23106
Pyrene	5.77	U	1038	5990	0.124	2	24153
Test Conditions							
Sed Temp (degrees F)	Max	65.0		Min	59.5	Avg	62.3
Air Temp (degrees F)	Max	63.1		Min	62.9	Avg	63.0
Humidity (%)	Max	42.5		Min	41.5	Avg	42.0
Air Velocity (Mi/Hr)	Max	5.50		Min	5.10	Avg	5.30
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/14/2007

Sample IDs: NSP-4-ES-PAH-2-031407 front, NSP-4-ES-VOC-2-031407 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 4)
Exposed Sediment, 2-6 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	10.1	U	1474	14883	0.124	4	30006
1,2,4-Trimethylbenzene	9.85	U	1474	14514	0.124	4	29263
1,3,5-Trimethylbenzene	4.79	U	1474	7058	0.124	4	14230
1,4-Dichlorobenzene	11.5	U	1474	16946	0.124	4	34165
Benzene	5.82		1474	8576	0.124	4	17290
Carbon Tetrachloride	5.08	U	1474	7486	0.124	4	15092
Ethyl Benzene	4.88	U	1474	7191	0.124	4	14498
sec-Butylbenzene	4.88	U	1474	7191	0.124	4	14498
Styrene	6.51	U	1474	9593	0.124	4	19340
Toluene	7.61		1474	11214	0.124	4	22608
Trichloroethene	4.97	U	1474	7324	0.124	4	14765
Xylenes, Total	4.97	U	1474	7324	0.124	4	14765
PAHs							
1-Methylnaphthalene	2.65	U	1474	3905	0.124	4	7873
2-Methylnaphthalene	2.63	U	1474	3875	0.124	4	7813
Acenaphthene	2.75	U	1474	4052	0.124	4	8170
Acenaphthylene	2.54	U	1474	3743	0.124	4	7546
Anthracene	2.74	U	1474	4038	0.124	4	8140
Benz(a)anthracene	2.97	U	1474	4376	0.124	4	8823
Benzo(a)pyrene	3.14	U	1474	4627	0.124	4	9329
Benzo(b)fluoranthene	3.10	U	1474	4568	0.124	4	9210
Benzo(g,h,i)perylene	3.84	U	1474	5658	0.124	4	11408
Benzo(k)fluoranthene	3.14	U	1474	4627	0.124	4	9329
Chrysene	2.98	U	1474	4391	0.124	4	8853
Dibenz(a,h)anthracene	3.20	U	1474	4715	0.124	4	9507
Fluoranthene	2.84	U	1474	4185	0.124	4	8437
Fluorene	2.70	U	1474	3979	0.124	4	8021
Indeno(1,2,3-cd)pyrene	3.37	U	1474	4966	0.124	4	10012
Naphthalene	19.9		1474	29324	0.124	4	59120
Phenanthrene	2.76	U	1474	4067	0.124	4	8200
Pyrene	2.89	U	1474	4259	0.124	4	8586
Test Conditions							
Sed Temp (degrees F)	Max	65.5		Min	65.0	Avg	65.3
Air Temp (degrees F)	Max	64.2		Min	62.7	Avg	63.5
Humidity (%)	Max	41.9		Min	37.1	Avg	39.5
Air Velocity (Mi/Hr)	Max	5.20		Min	5.00	Avg	5.10
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/14/2007

Sample IDs: NSP-4-ES-PAH-5-031407 Front, NSP-4-ES-VOC-5-031407 Front

U=Analyte not detected

Appendix H
Air Emission Wind Tunnel Results (Area 4)
Exposed Sediment, 6-22 Hour Interval
Ashland/Northern States Power Lakefront Superfund Site

Chemical/Parameter	Concentration (ug/m^3)	Flags	Total Flow (m^3)	Total Mass (ug)	Surface Area (m^2)	Duration (hr)	Emission Rate ($ug/(m^2 \times hr)$)
	(1)		(2)	(1 x 2)=(3)	(4)	(5)	(3/(4 x 5))
VOCs							
1,2,3-Trimethylbenzene	2.51	U	5942	14914	0.124	16	7517
1,2,4-Trimethylbenzene	6.01		5942	35709	0.124	16	17999
1,3,5-Trimethylbenzene	2.13		5942	12656	0.124	16	6379
1,4-Dichlorobenzene	2.88	U	5942	17112	0.124	16	8625
Benzene	14.8		5942	87937	0.124	16	44323
Carbon Tetrachloride	1.27	U	5942	7546	0.124	16	3803
Ethyl Benzene	5.70		5942	33868	0.124	16	17070
sec-Butylbenzene	1.22	U	5942	7249	0.124	16	3654
Styrene	2.34		5942	13904	0.124	16	7008
Toluene	30.2		5942	179439	0.124	16	90443
Trichloroethene	1.24	U	5942	7368	0.124	16	3714
Xylenes, Total	24.2		5942	143789	0.124	16	72474
PAHs							
1-Methylnaphthalene	0.662	U	5942	3933	0.124	16	1983
2-Methylnaphthalene	0.658	U	5942	3910	0.124	16	1971
Acenaphthene	0.688	U	5942	4088	0.124	16	2060
Acenaphthylene	0.634	U	5942	3767	0.124	16	1899
Anthracene	0.686	U	5942	4076	0.124	16	2054
Benz(a)anthracene	0.743	U	5942	4415	0.124	16	2225
Benzo(a)pyrene	0.785	U	5942	4664	0.124	16	2351
Benzo(b)fluoranthene	0.776	U	5942	4611	0.124	16	2324
Benzo(g,h,i)perylene	0.959	U	5942	5698	0.124	16	2872
Benzo(k)fluoranthene	0.786	U	5942	4670	0.124	16	2354
Chrysene	0.746	U	5942	4432	0.124	16	2234
Dibenz(a,h)anthracene	0.800	U	5942	4753	0.124	16	2396
Fluoranthene	0.710	U	5942	4219	0.124	16	2126
Fluorene	0.675	U	5942	4011	0.124	16	2021
Indeno(1,2,3-cd)pyrene	0.844	U	5942	5015	0.124	16	2528
Naphthalene	9.09		5942	54010	0.124	16	27223
Phenanthrene	0.689	U	5942	4094	0.124	16	2063
Pyrene	0.721	U	5942	4284	0.124	16	2159
Test Conditions							
Sed Temp (degrees F)	Max	66.0		Min	65.5	Avg	65.8
Air Temp (degrees F)	Max	65.6		Min	63.6	Avg	64.6
Humidity (%)	Max	36.7		Min	31.6	Avg	34.2
Air Velocity (Mi/Hr)	Max	5.30		Min	5.00	Avg	5.15
Cross Section Area (m^2)						Avg	0.152

Run Date: 3/15/07

Sample IDs: NSP-4-ES-PAH-6-031507 Front, NSP-4-ES-VOC-6-031507 Front

U=Analyte not detected

APPENDIX I

St. Croix Laboratory Reports for Odor Analysis

St. Croix Sensory, Inc.

URS Corporation

Ashland NSP

Odor Evaluation Report

Report No. 708001

03/21/07

Data Release Authorization:

Natasha Kaslow

Natasha Kaslow
Laboratory Associate

Reviewed and Approved:

Michael A. McGinley, P.E.
Laboratory Director

St. Croix Sensory is a laboratory dedicated to practicing state-of-the-art sensory evaluation and to advancing the science of sensory perception.

We are a family owned and operated business providing our clients with personal customer service, flexible scheduling, timely results.

Our focus is to provide the best professional services available to help make your project or product a success.

www.fivesenses.com

3549 Lake Elmo Avenue North
P.O. Box 313
Lake Elmo, Minnesota 55042 U.S.A.

Tel: 800-879-9231
Fax: 651-439-1065

Email: stcroix@fivesenses.com

St. Croix Sensory, Inc. **Odor Evaluation Report**

Client: URS Corporation

Project: Ashland NSP

Report No.: **708001**

Evaluation Date: 03/21/07

			ASTM E679 & EN13725		ASTM E544	PERSISTENCY	CHARACTERIZATION		
#	Field No.	Sample Description	Detection Threshold	Recognition Threshold	Intensity	Dose-Response Slope	Hedonic Tone	Principal Odor Descriptors	**Comments**
1	NSP-2-10M-Odor-2-032007	0-2 hr Odor Sample	40	30	19	-0.30	-1.2	Chemical, Plastic	
2	NSP-2-10M-Odor-5-032007	2-6 hr Odor Sample	65	40	18	-0.21	-0.8	Chemical, Vinyl, Musty	
3	NSP-2-10M-Odor-6-032007	6-22 hr Odor Sample	110	70	19	-0.27	-1.0	Creosote	
4									
5									
6									
7									
8									
9									
10									

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc. **Odor Evaluation Report**

Client: URS Corporation

Project: Ashland NSP

Report No.: **708001**

Evaluation Date: 03/21/07

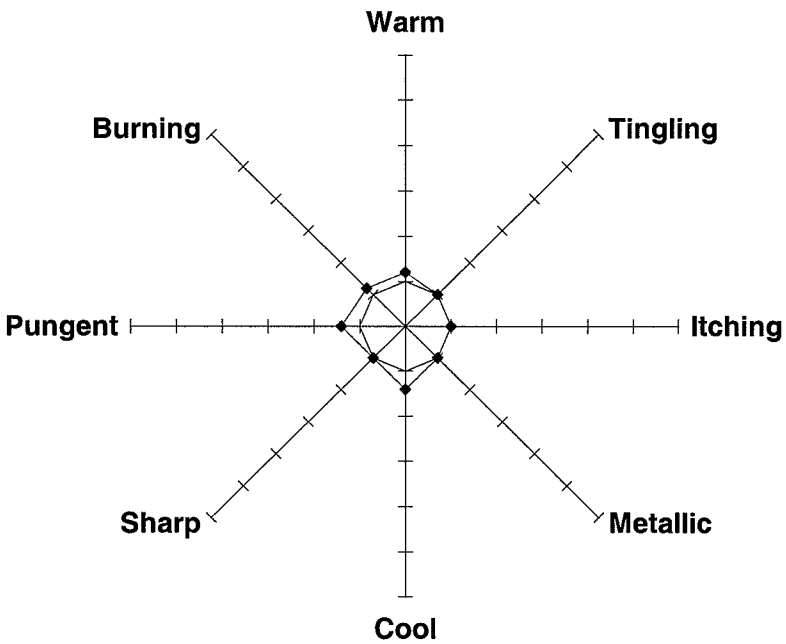
			ASTM E679 & EN13725		ASTM E544	PERSISTENCY	CHARACTERIZATION		
#	Field No.	Sample Description	Detection Threshold	Recognition Threshold	Intensity	Dose-Response Slope	Hedonic Tone	Principal Odor Descriptors	**Comments**
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc. **Odor Evaluation Report**

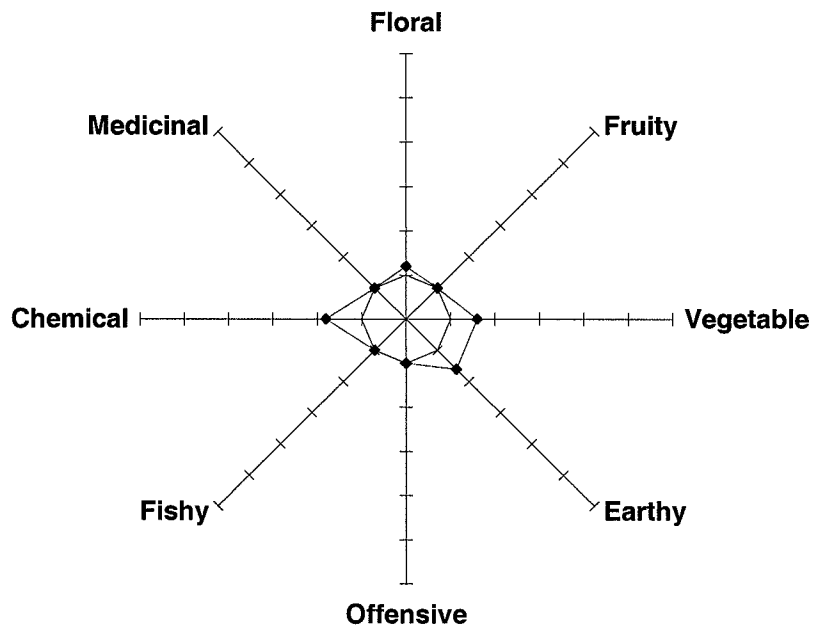
Client:	URS Corporation	Field No.:	NSP-2-10M-Odor-2-032007	Report No.:	**708001**
Project:	Ashland NSP	Description:	0-2 hr Odor Sample	Evaluation Date:	03/21/07

Sensation Descriptor Graph



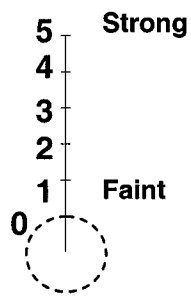
	Average Relative Strength
Warm	0.2
Tingling	0.0
Itching	0.0
Metallic	0.0
Cool	0.4
Sharp	0.0
Pungent	0.4
Burning	0.2

Odor Descriptor Graph



	Average Relative Strength
Floral	0.2
Fruity	0.0
Vegetable	0.6
Earthy	0.6
Offensive	0.0
Fishy	0.0
Chemical	0.8
Medicinal	0.0

KEY



Relative Strength

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client: URS Corporation

Field No.: NSP-2-10M-Odor-2-032007

Report No.: **708001**

Project: Ashland NSP

Description: 0-2 hr Odor Sample

Evaluation Date: 03/21/07

% of Assessors |**********|**********|**********|**********| 100%

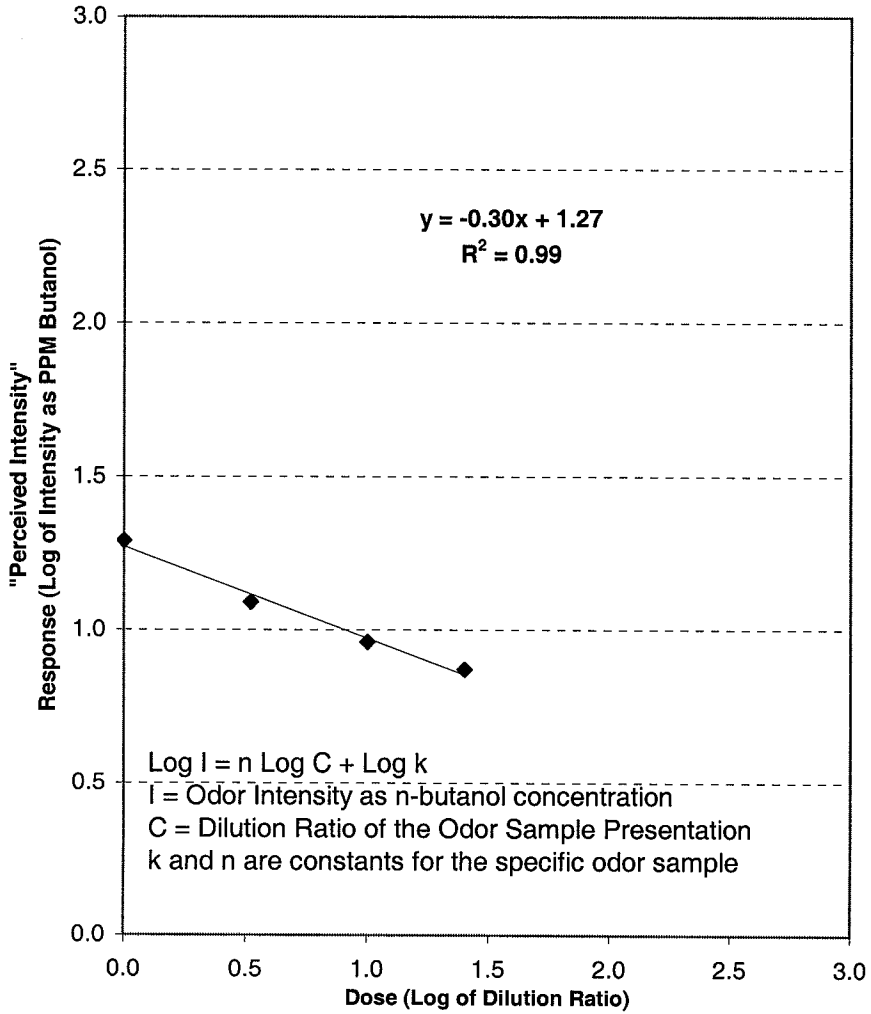
Garlic	**********
Fragrant	**********
Chemical	**********
Plastic	**********
Creosote	**********
Vinyl	**********
Earthy	**********
Musty	**********
Stale	**********

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

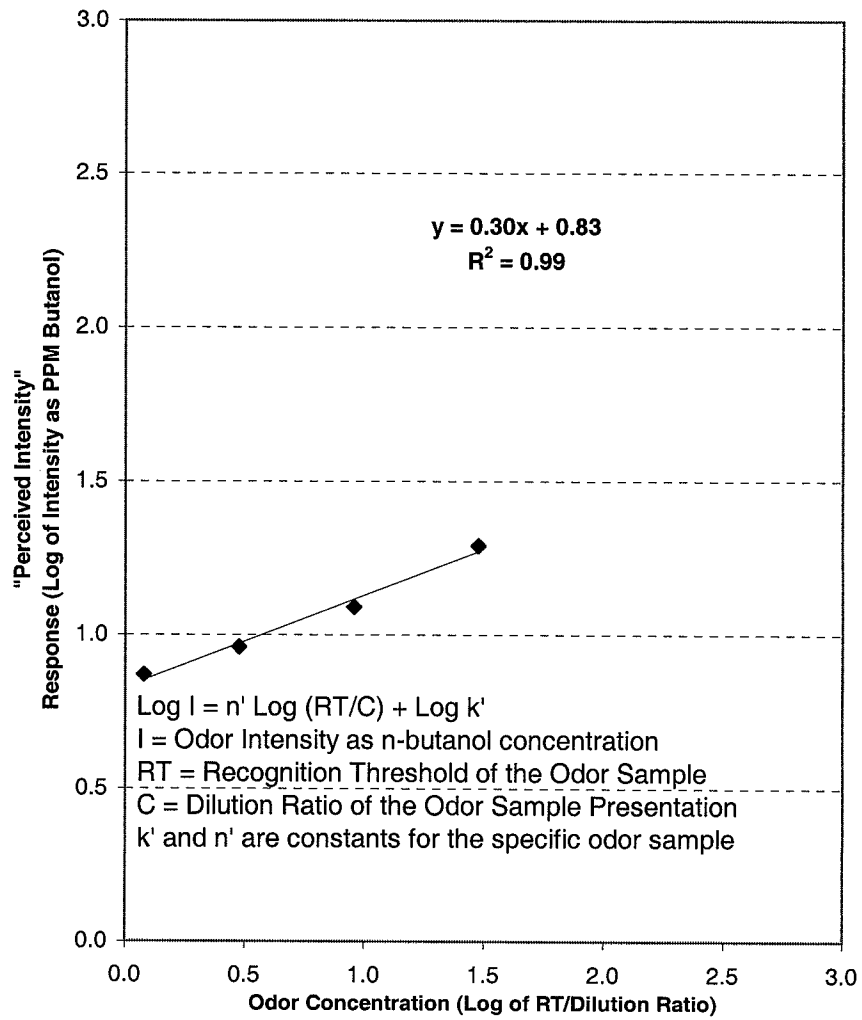
St. Croix Sensory, Inc. **Odor Evaluation Report**

Client:	URS Corporation	Field No.:	NSP-2-10M-Odor-2-032007	Report No.:	**708001**
Project:	Ashland NSP	Description:	0-2 hr Odor Sample	Evaluation Date:	03/21/07

Dose-Response



Dose-Response as Power Law

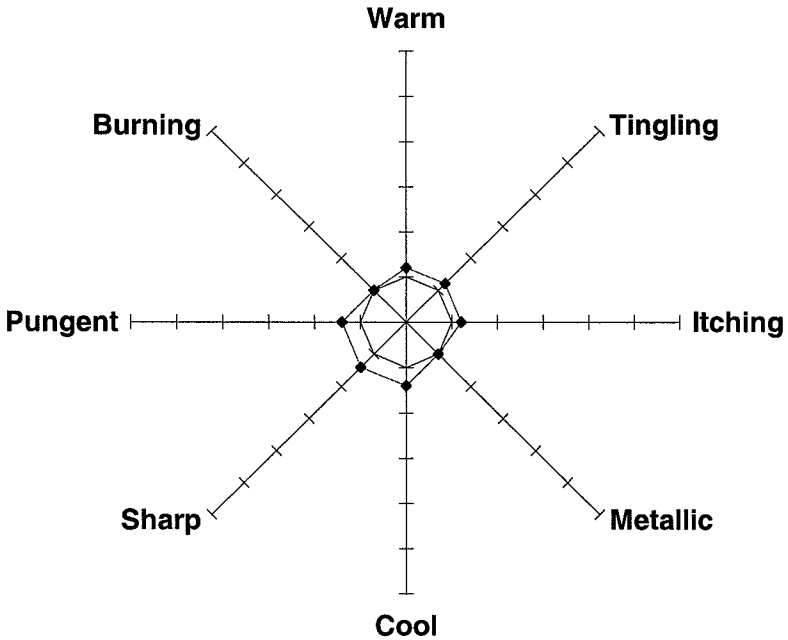


P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc. **Odor Evaluation Report**

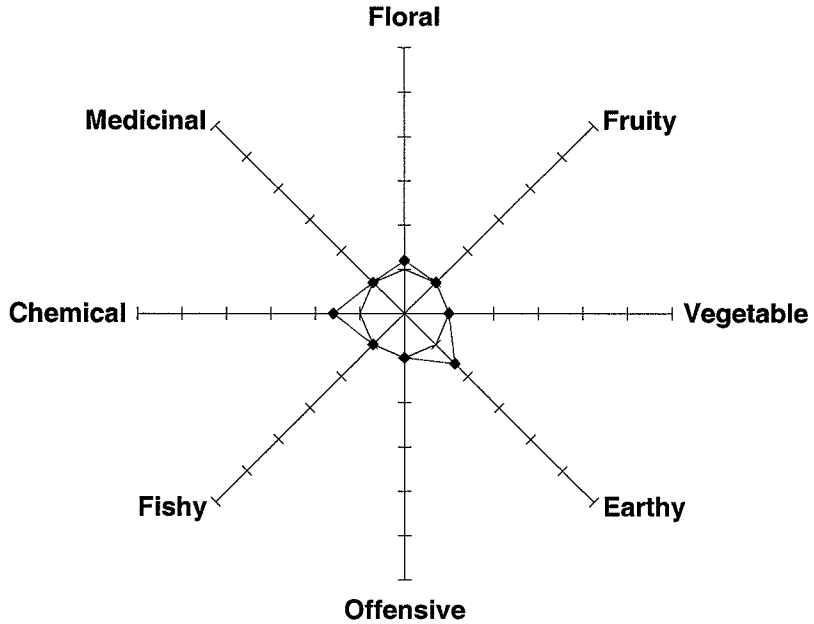
Client:	URS Corporation	Field No.:	NSP-2-10M-Odor-5-032007	Report No.:	**708001**
Project:	Ashland NSP	Description:	2-6 hr Odor Sample	Evaluation Date:	03/21/07

Sensation Descriptor Graph



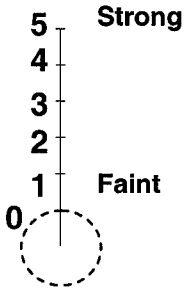
	Average Relative Strength
Warm	0.2
Tingling	0.2
Itching	0.2
Metallic	0.0
Cool	0.4
Sharp	0.4
Pungent	0.4
Burning	0.0

Odor Descriptor Graph



	Average Relative Strength
Floral	0.2
Fruity	0.0
Vegetable	0.0
Earthy	0.6
Offensive	0.0
Fishy	0.0
Chemical	0.6
Medicinal	0.0

KEY



Relative Strength

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client:	URS Corporation	Field No.:	NSP-2-10M-Odor-5-032007	Report No.:	**708001**
Project:	Ashland NSP	Description:	2-6 hr Odor Sample	Evaluation Date:	03/21/07

% of Assessors |**********|**********|**********|**********| 100%

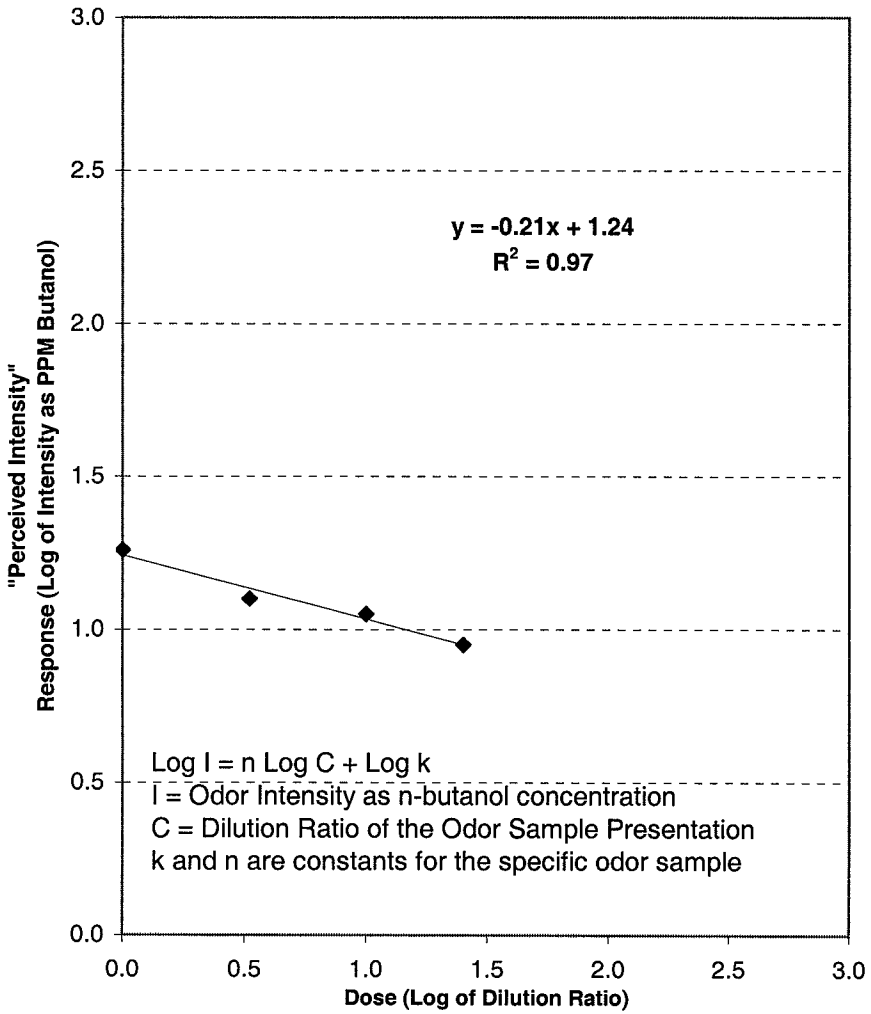
Floral	**********
Chemical	**********
Creosote	**********
Solvent	**********
Vinyl	**********
Sulfur	**********
Earthy	**********
Mold	**********
Musty	**********
Stale	**********

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

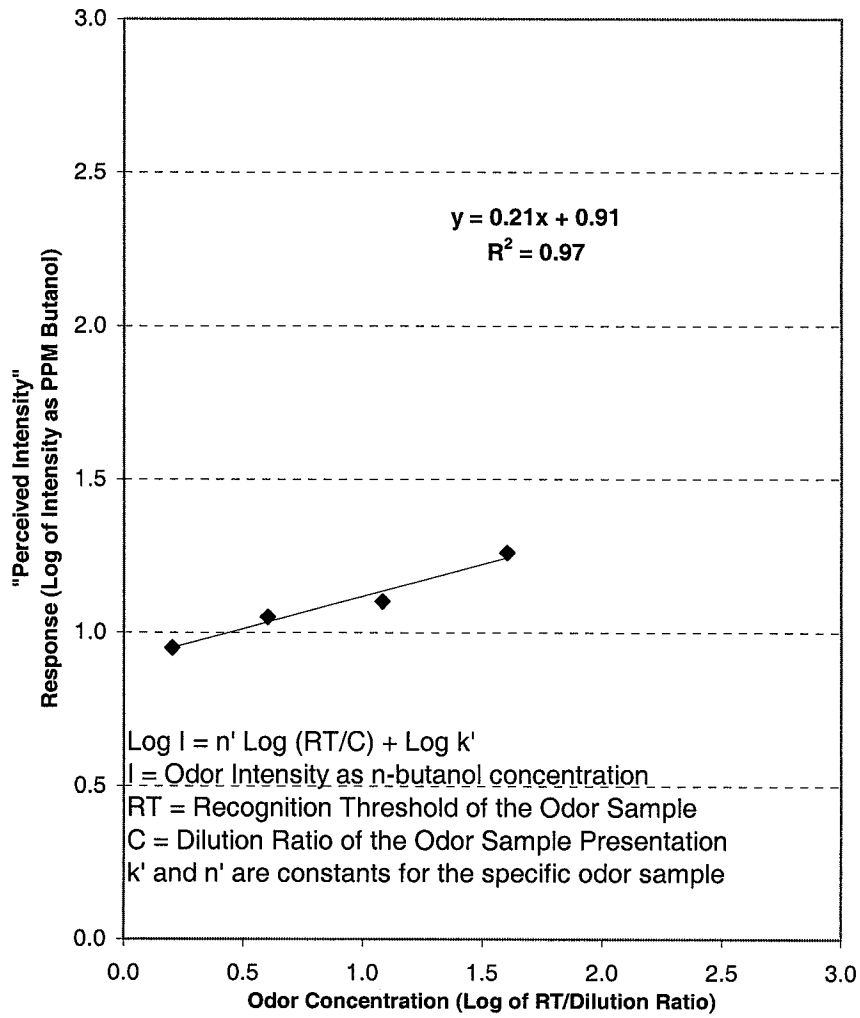
St. Croix Sensory, Inc. **Odor Evaluation Report**

Client:	URS Corporation	Field No.:	NSP-2-10M-Odor-5-032007	Report No.:	**708001**
Project:	Ashland NSP	Description:	2-6 hr Odor Sample	Evaluation Date:	03/21/07

Dose-Response



Dose-Response as Power Law

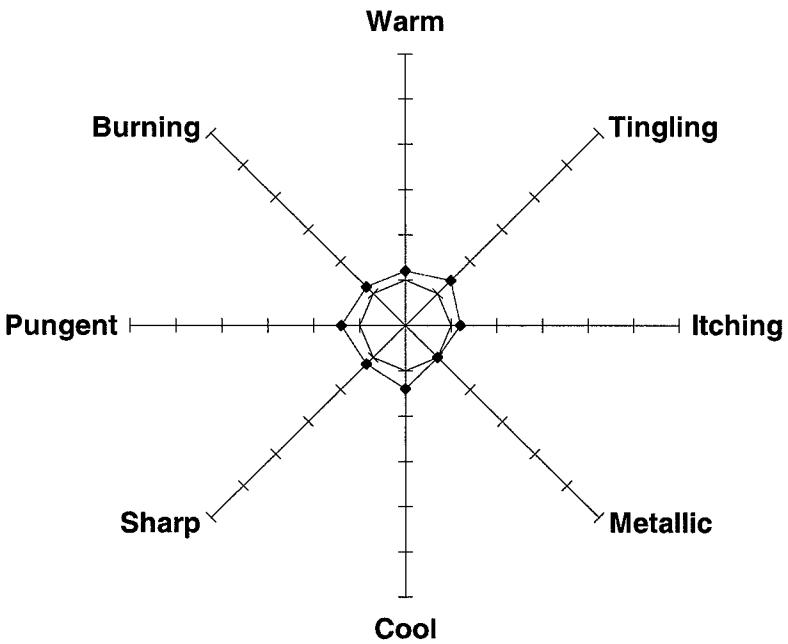


P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc. **Odor Evaluation Report**

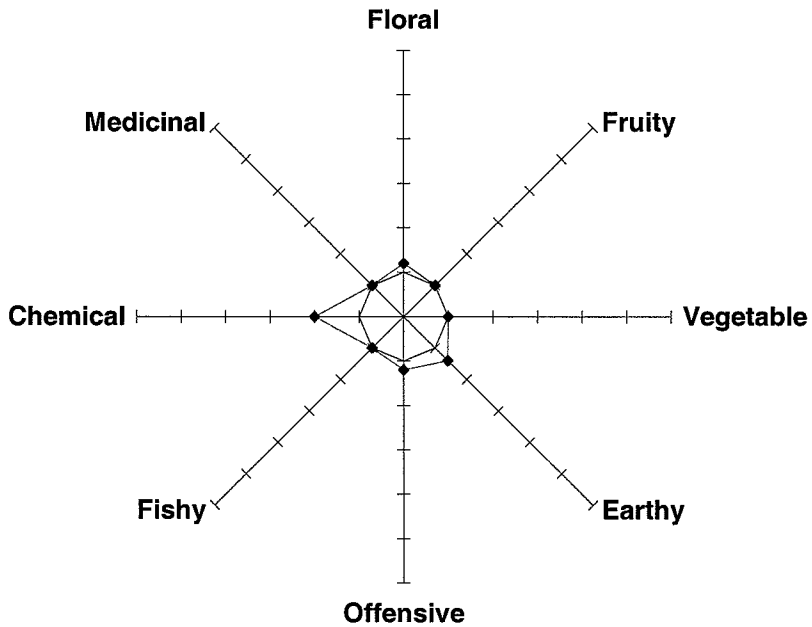
Client:	URS Corporation	Field No.:	NSP-2-10M-Odor-6-032007	Report No.:	**708001**
Project:	Ashland NSP	Description:	6-22 hr Odor Sample	Evaluation Date:	03/21/07

Sensation Descriptor Graph



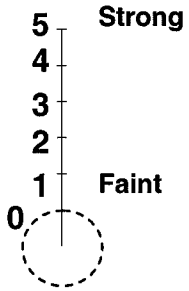
	Average Relative Strength
Warm	0.2
Tingling	0.4
Itching	0.2
Metallic	0.0
Cool	0.4
Sharp	0.2
Pungent	0.4
Burning	0.2

Odor Descriptor Graph



	Average Relative Strength
Floral	0.2
Fruity	0.0
Vegetable	0.0
Earthy	0.4
Offensive	0.2
Fishy	0.0
Chemical	1.0
Medicinal	0.0

KEY



Relative Strength

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client: URS Corporation

Field No.: NSP-2-10M-Odor-6-032007

Report No.: **708001**

Project: Ashland NSP

Description: 6-22 hr Odor Sample

Evaluation Date: 03/21/07

% of Assessors |**********|**********|**********|**********| 100%

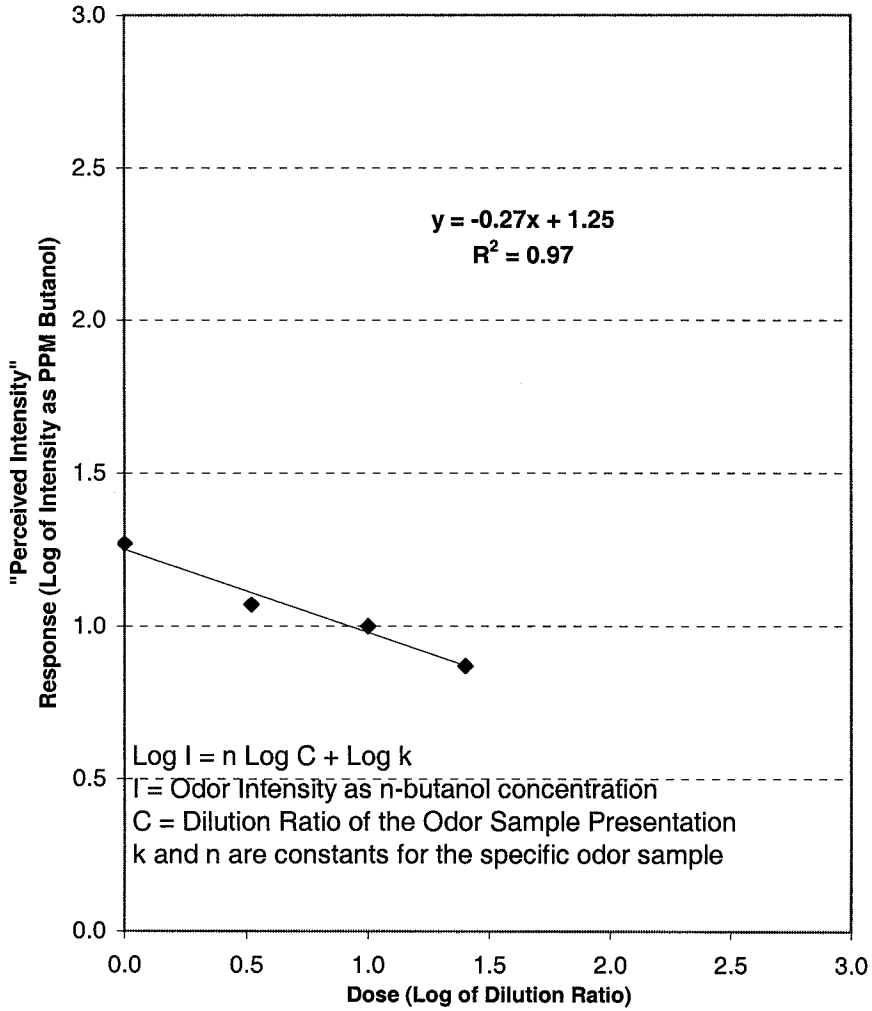
Floral	**********
Chemical	**********
Plastic	**********
Creosote	**********
Vinyl	**********
Sulfur	**********
Sewer	**********
Earthy	**********
Musty	**********
Stale	**********

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

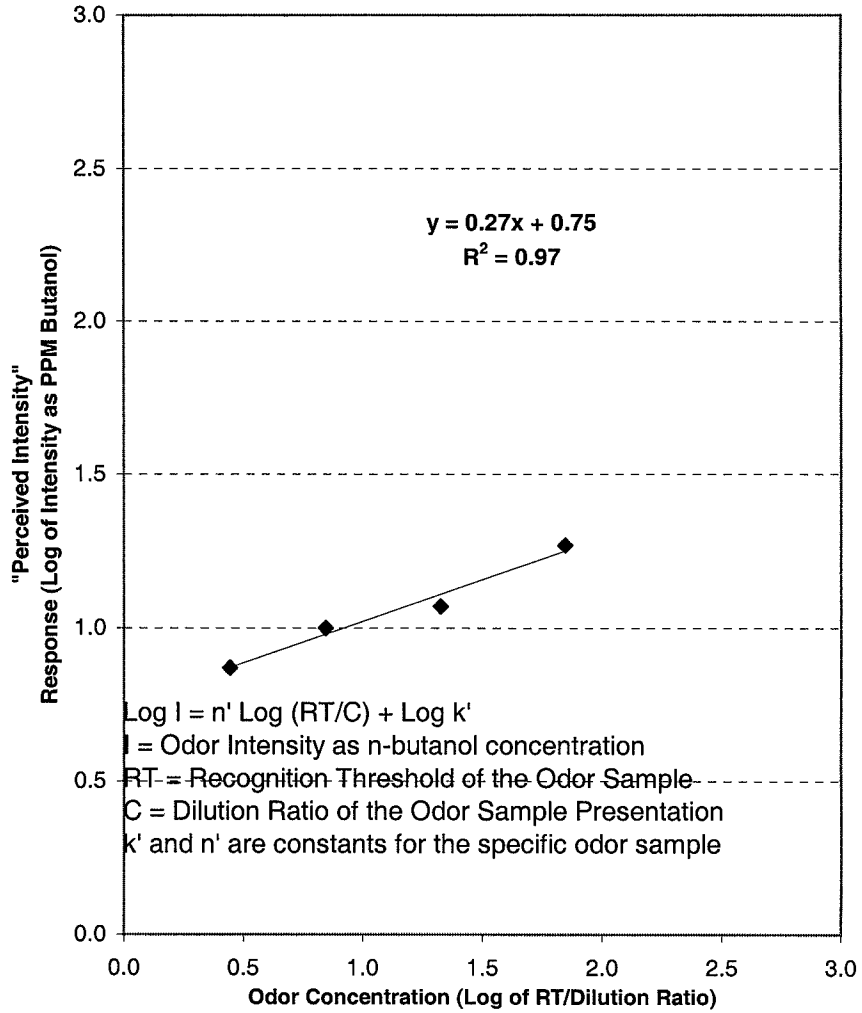
St. Croix Sensory, Inc. **Odor Evaluation Report**

Client:	URS Corporation	Field No.:	NSP-2-10M-Odor-6-032007	Report No.:	**708001**
Project:	Ashland NSP	Description:	6-22 hr Odor Sample	Evaluation Date:	03/21/07

Dose-Response



Dose-Response as Power Law



P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

CHAIN OF CUSTODY RECORD FOR ODOR SAMPLES

Page 1 of 1

Client: URS Corp

Sampled By: [illegible]

Project Name: Ashland NSP

Sampling Date: 03/20/07

Comments:

Odor Evaluations Requested: (X)

For Laboratory use Only

Odor Evaluation Report No.

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Odor Concentration* (Detection & Recognition Threshold)	Odor Intensity* (PPM 1-Butanol)	Odor Characterization (Hedonic Tone & Descriptors)	Odor Persistency ("Dose-Response")	Laboratory Sample No.	
									Lab	DN
1	NSP-2-10m-odor-2-032007	0-2 hr Odor Sample 03/20/07	10:58 Start 11:18 End		X	X		X		
2	NSP-2-10m-odor-5-032007	2-6 hr Odor Sample 03/20/07	12:32 Start 12:48 End		X	X		X		
3	NSP-2-10m-odor-6-032007	6-22 hr Odor Sample 03/20/07	16:37 Start 17:05 End		X	X		X		
4										
5										
6										
7										
8										
9										
10										
11										
12										

Transmittal

Number of Shipping Boxes 1

Relinquished By	Date	Time	Accepted By	Date	Time	Comments & Exceptions Noted
[illegible]	03/21/07	07:45				
Received at St. Croix Sensory Laboratory			Natasha Kosloff	3/21/07	920	

*Odor Concentration: ASTM E679-04 and EN13725:2003 and Odor Intensity: ASTM E544-99(2004)

St. Croix Sensory, Inc. • 3549 Lake Elmo Avenue North • Lake Elmo, MN 55042 U.S.A. • Tel:800-879-9231 • Fax:651-439-1065 • Email:reports@fivesenses.com • Web:www.fivesenses.com

LAB COPIES WHITE & YELLOW

CLIENT COPY PINK

St. Croix Sensory, Inc.

URS Corp.

Ashland NSP

Odor Evaluation Report

Report No. 708802

03/29/07

Data Release Authorization:

Melissa McGinley

Melissa McGinley
Laboratory Associate

Reviewed and Approved:

Michael A. McGinley, P.E.
Laboratory Director

St. Croix Sensory is a laboratory dedicated to practicing state-of-the-art sensory evaluation and to advancing the science of sensory perception.

We are a family owned and operated business providing our clients with personal customer service, flexible scheduling, timely results.

Our focus is to provide the best professional services available to help make your project or product a success.

www.fivesenses.com

3549 Lake Elmo Avenue North
P.O. Box 313
Lake Elmo, Minnesota 55042 U.S.A.

Tel: 800-879-9231
Fax: 651-439-1065

Email: stcroix@fivesenses.com

St. Croix Sensory, Inc. **Odor Evaluation Report**

Client: URS Corp.

Project: Ashland NSP

Report No.: **708802**

Evaluation Date: 03/29/07

			ASTM E679 & EN13725		ASTM E544	PERSISTENCY	CHARACTERIZATION		
#	Field No.	Sample Description	Detection Threshold	Recognition Threshold	Intensity	Dose-Response Slope	Hedonic Tone	Principal Odor Descriptors	**Comments**
1	NSP-2A-10M-Odor-2-032807	0-2 hr Odor Sample	65	50	15	-0.20	-0.2	Chemical, Plastic	
2	NSP-2A-10M-Odor-5-032807	2-6 hr Odor Sample	180	100	18	-0.23	0.2	Chemical	
3	NSP-2A-10M-Odor-6-032807	6-22 hr Odor Sample	160	85	15	-0.17	0.2	Chemical, Plastic, Fragrant, Vinyl	
4									
5									
6									
7									
8									
9									
10									

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client: URS Corp.

Project: Ashland NSP

Report No.: **708802**

Evaluation Date: 03/29/07

			ASTM E679 & EN13725		ASTM E544	PERSISTENCY	CHARACTERIZATION		
#	Field No.	Sample Description	Detection Threshold	Recognition Threshold	Intensity	Dose-Response Slope	Hedonic Tone	Principal Odor Descriptors	**Comments**
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client: URS Corp.

Project: Ashland NSP

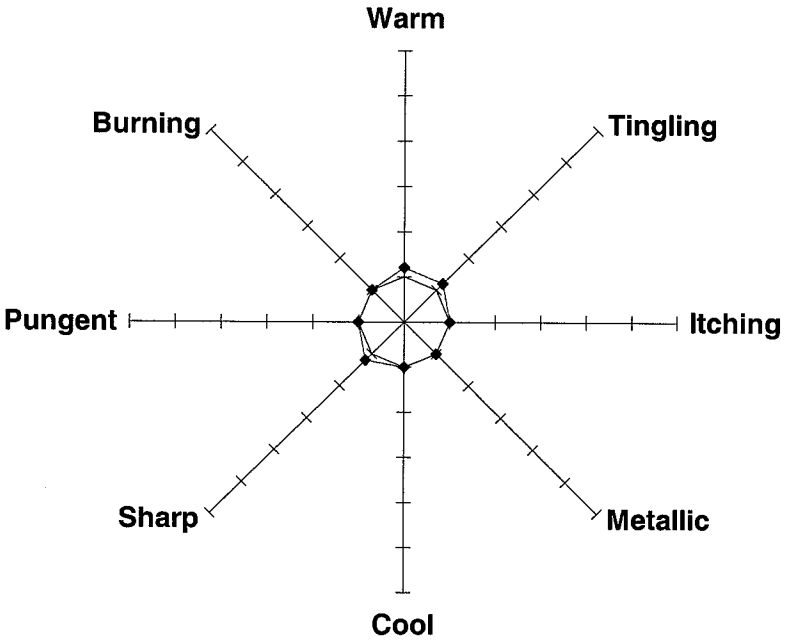
Field No.: NSP-2A-10M-Odor-2-032807

Description: 0-2 hr Odor Sample

Report No.: **708802**

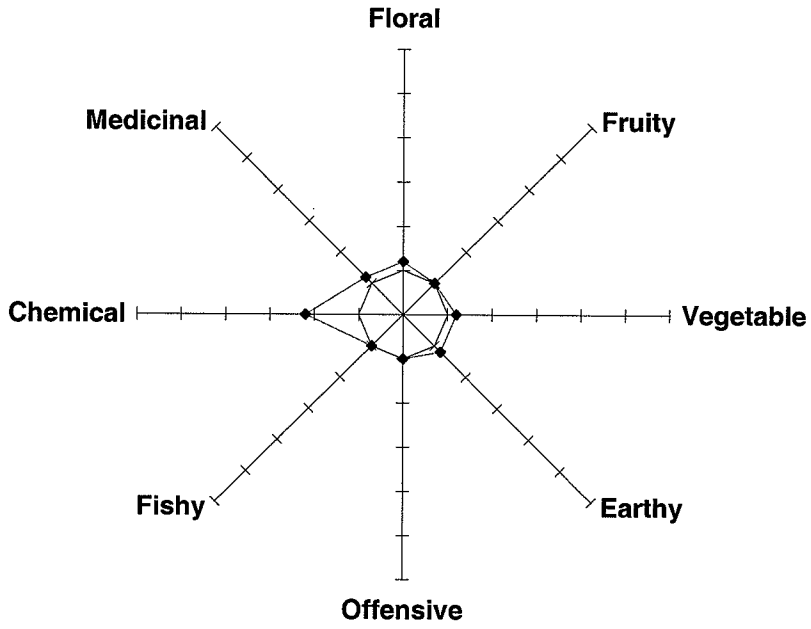
Evaluation Date: 03/29/07

Sensation Descriptor Graph



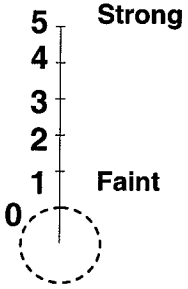
	Average Relative Strength
Warm	0.2
Tingling	0.2
Itching	0.0
Metallic	0.0
Cool	0.0
Sharp	0.2
Pungent	0.0
Burning	0.0

Odor Descriptor Graph



	Average Relative Strength
Floral	0.2
Fruity	0.0
Vegetable	0.2
Earthy	0.2
Offensive	0.0
Fishy	0.0
Chemical	1.2
Medicinal	0.2

KEY



Relative Strength

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc. **Odor Evaluation Report**

Client:	URS Corp.	Field No.:	NSP-2A-10M-Odor-2-032807	Report No.:	**708802**
Project:	Ashland NSP	Description:	0-2 hr Odor Sample	Evaluation Date:	03/29/07

% of Assessors |**********|**********|**********|**********| 100%

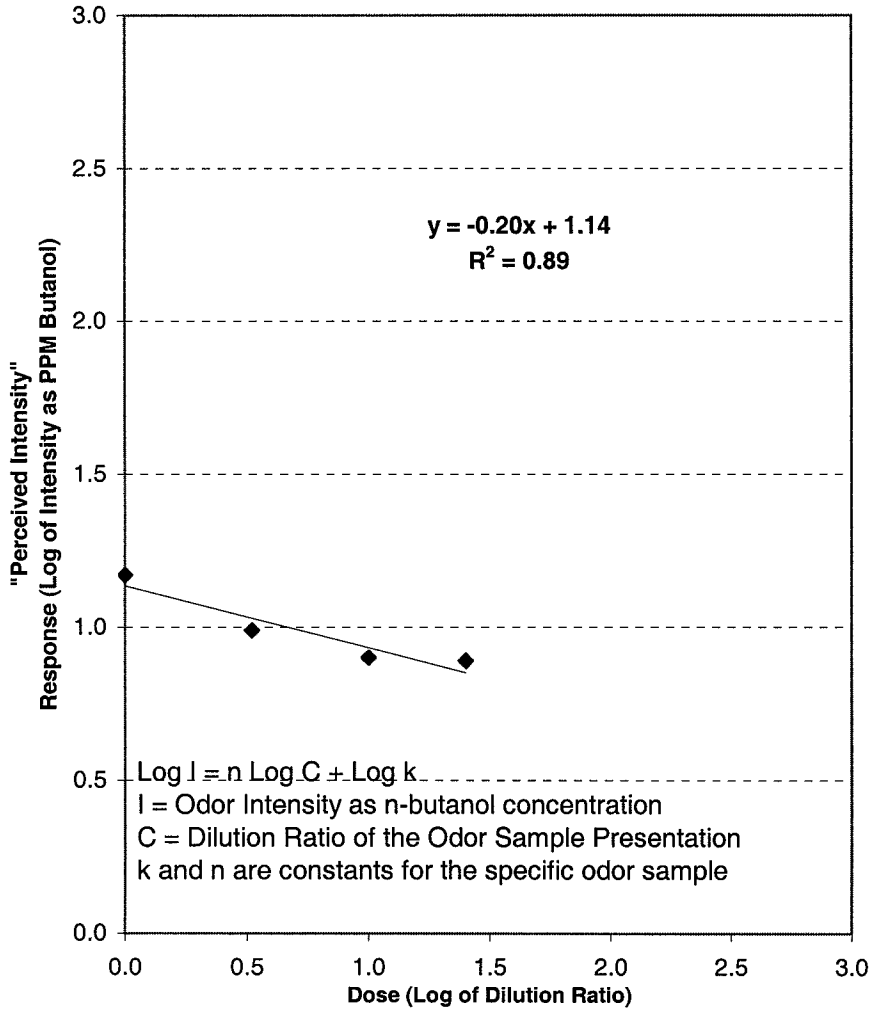
Vegetable	**********
Celery	**********
Floral	**********
Medicinal	**********
Chemical	**********
Car exhaust	**********
Petroleum	**********
Plastic	**********
Solvent	**********
Vinyl	**********
Earthy	**********

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

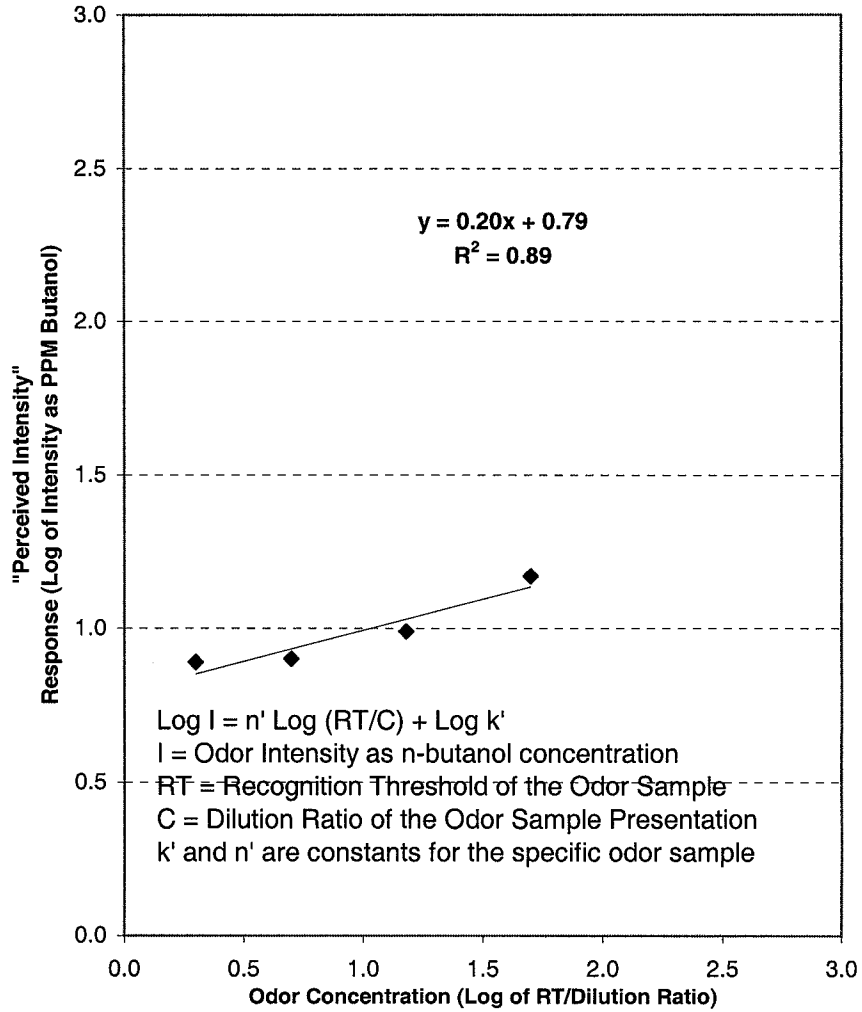
St. Croix Sensory, Inc. **Odor Evaluation Report**

Client:	URS Corp.	Field No.:	NSP-2A-10M-Odor-2-032807	Report No.:	**708802**
Project:	Ashland NSP	Description:	0-2 hr Odor Sample	Evaluation Date:	03/29/07

Dose-Response



Dose-Response as Power Law



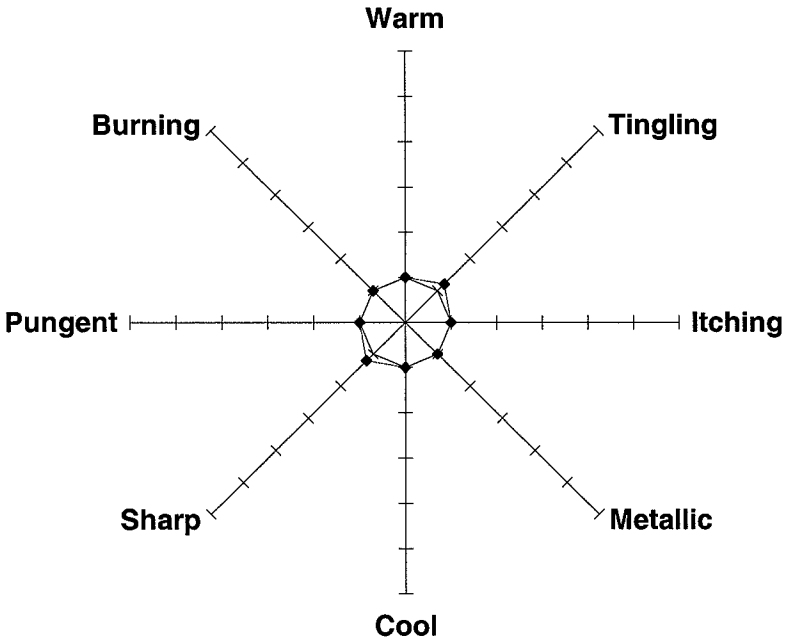
P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

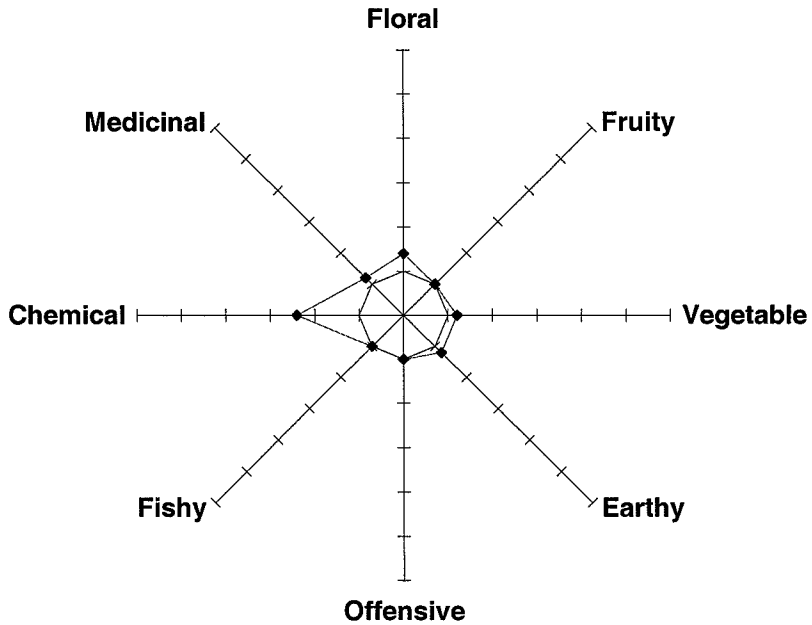
Client:	URS Corp.	Field No.:	NSP-2A-10M-Odor-5-032807	Report No.:	**708802**
Project:	Ashland NSP	Description:	2-6 hr Odor Sample	Evaluation Date:	03/29/07

Sensation Descriptor Graph



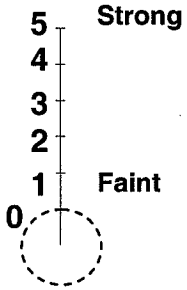
	Average Relative Strength
Warm	0.0
Tingling	0.2
Itching	0.0
Metallic	0.0
Cool	0.0
Sharp	0.2
Pungent	0.0
Burning	0.0

Odor Descriptor Graph



	Average Relative Strength
Floral	0.4
Fruity	0.0
Vegetable	0.2
Earthy	0.2
Offensive	0.0
Fishy	0.0
Chemical	1.4
Medicinal	0.2

KEY



Relative Strength

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client:	URS Corp.	Field No.:	NSP-2A-10M-Odor-5-032807	Report No.:	**708802**
Project:	Ashland NSP	Description:	2-6 hr Odor Sample	Evaluation Date:	03/29/07

% of Assessors |**********|**********|**********|**********| 100%

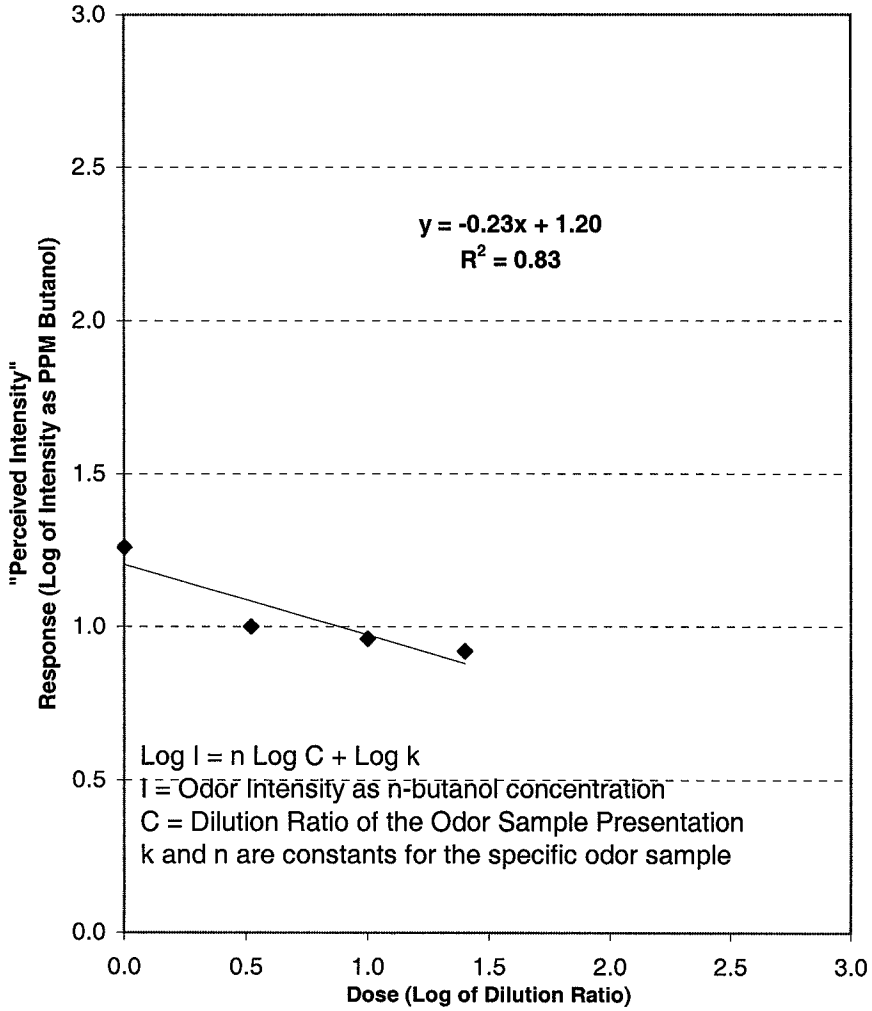
Vegetable	**********
Celery	**********
Green pepper	**********
Fragrant	**********
Medicinal	**********
Chemical	**********
Car exhaust	**********
Plastic	**********
Solvent	**********
Vinyl	**********
Gasoline	**********
Oil	**********
Earthy	**********

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

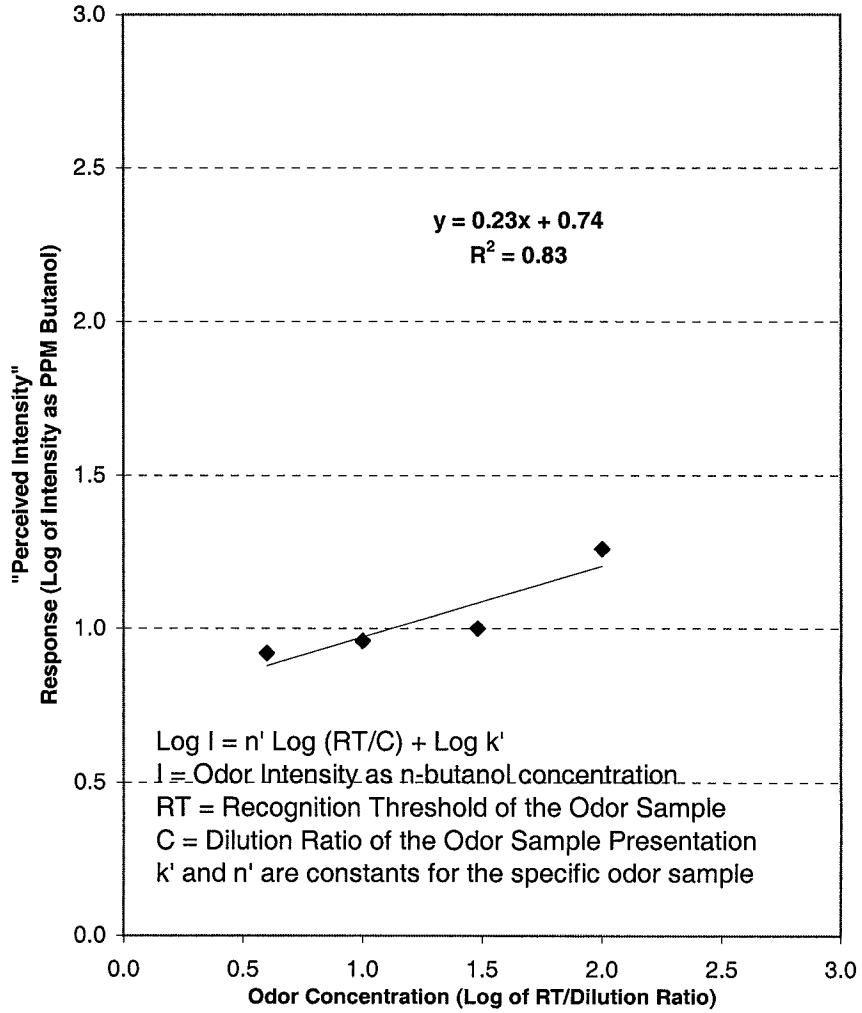
St. Croix Sensory, Inc. **Odor Evaluation Report**

Client:	URS Corp.	Field No.:	NSP-2A-10M-Odor-5-032807	Report No.:	**708802**
Project:	Ashland NSP	Description:	2-6 hr Odor Sample	Evaluation Date:	03/29/07

Dose-Response



Dose-Response as Power Law



P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client: URS Corp.

Project: Ashland NSP

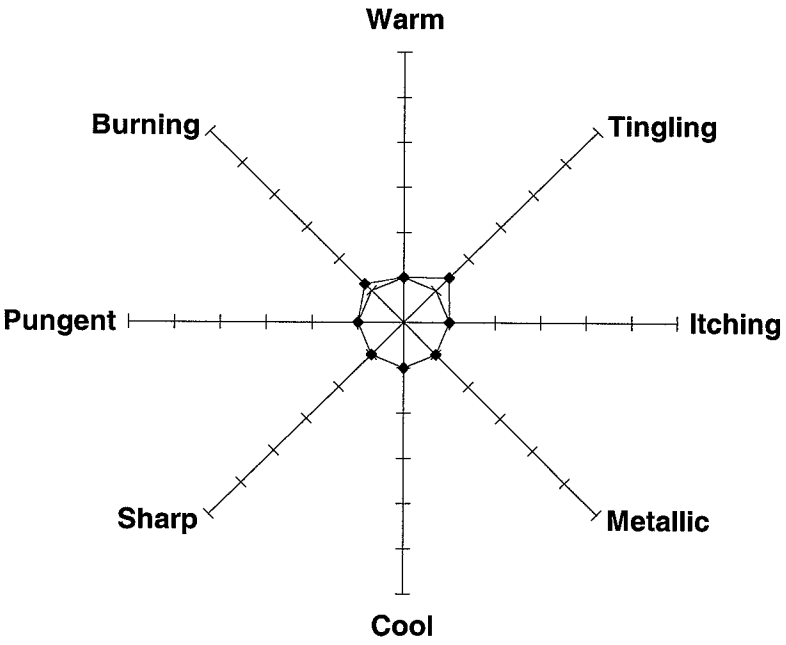
Field No.: NSP-2A-10M-Odor-6-032807

Description: 6-22 hr Odor Sample

Report No.: **708802**

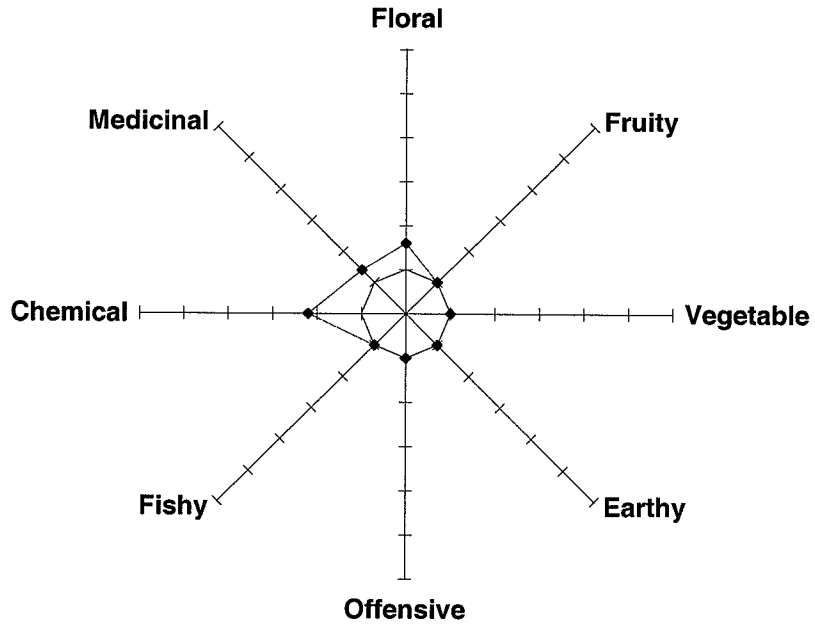
Evaluation Date: 03/29/07

Sensation Descriptor Graph



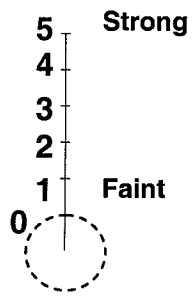
	Average Relative Strength
Warm	0.0
Tingling	0.4
Itching	0.0
Metallic	0.0
Cool	0.0
Sharp	0.0
Pungent	0.0
Burning	0.2

Odor Descriptor Graph



	Average Relative Strength
Floral	0.6
Fruity	0.0
Vegetable	0.0
Earthy	0.0
Offensive	0.0
Fishy	0.0
Chemical	1.2
Medicinal	0.4

KEY



Relative Strength

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

Odor Evaluation Report

Client: URS Corp.

Field No.: NSP-2A-10M-Odor-6-032807

Report No.: **708802**

Project: Ashland NSP

Description: 6-22 hr Odor Sample

Evaluation Date: 03/29/07

% of Assessors |**********|**********|**********|**********| 100%

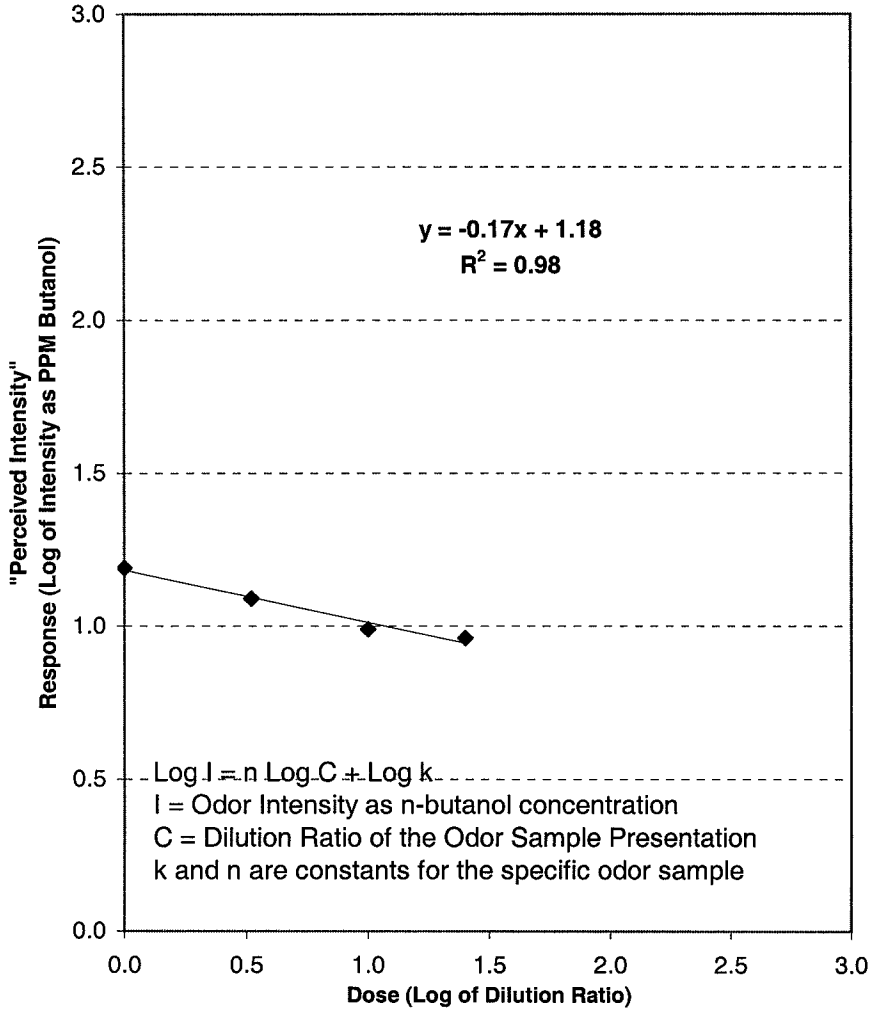
Fragrant	**********
Camphor	**********
Menthol	**********
Chemical	**********
Cleaning fluid	**********
Plastic	**********
Vinyl	**********

P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

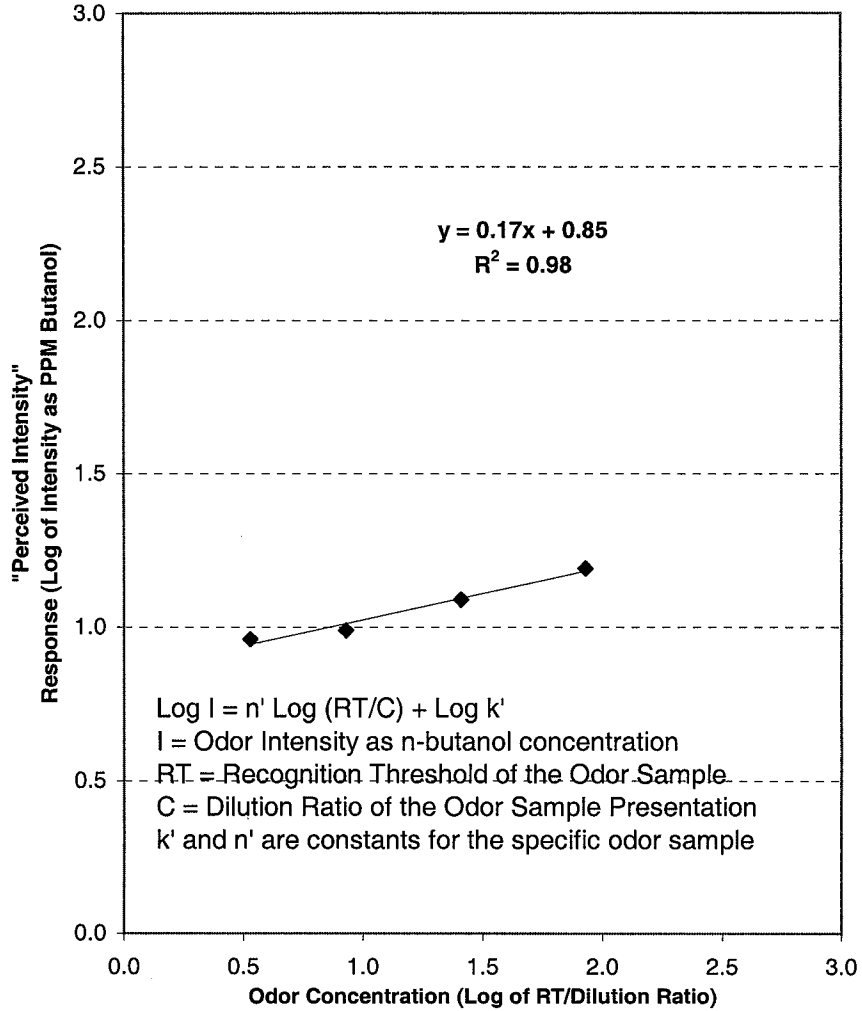
St. Croix Sensory, Inc. **Odor Evaluation Report**

Client:	URS Corp.	Field No.:	NSP-2A-10M-Odor-6-032807	Report No.:	**708802**
Project:	Ashland NSP	Description:	6-22 hr Odor Sample	Evaluation Date:	03/29/07

Dose-Response



Dose-Response as Power Law



P.O. Box 313, 3549 Lake Elmo Ave. N., Lake Elmo, MN 55042 U.S.A. Tel:800-879-9231 Fax:651-439-1065 E-mail:stcroix@fivesenses.com Web:www.fivesenses.com

St. Croix Sensory, Inc.

CHAIN OF CUSTODY RECORD FOR ODOR SAMPLES

Client: URS Corp.

Sampled By: Will C. [illegible]

Project Name: Ashland NSP

Sampling Date: 03/28 - 03/29/07

Comments:

Odor Evaluations Requested: (X)

For Laboratory use Only

Odor Evaluation Report No.

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Odor Concentration* (Detection & Recognition Threshold)	Odor Intensity* (PPM 1-Butanol)	Odor Characterization (Hedonic Tone & Descriptors)	Odor Persistency ("Dose-Response")	Laboratory Sample No. LN	Laboratory Sample No. FN
1	NSP-2A-10m-Odor-2-032807	0-2 hr Odor Sample	03/28/07 09:49		X	X		X		
2	NSP-2A-10m-Odor-5-032807	2-6 hr Odor Sample	03/28/07 11:49		X	X		X		
3	NSP-2A-10m-Odor-6-032807	6-22 hr Odor Sample	03/28/07 15:56		X	X		X		
4										
5										
6										
7										
8										
9										
10										
11										
12										

Transmittal

Number of Shipping Boxes 1

Relinquished By	Date	Time	Accepted By	Date	Time	Comments & Exceptions Noted
Will C. [illegible]	03/29/07	08:00				
Received at St. Croix Sensory Laboratory			Melu Melody	3/29/07	9:25 am	

*Odor Concentration: ASTM E679-04 and EN13725:2003 and Odor Intensity: ASTM E544-99(2004)

St. Croix Sensory, Inc. ♦ 3549 Lake Elmo Avenue North ♦ Lake Elmo, MN 55042 U.S.A. ♦ Tel:800-879-9231 ♦ Fax:651-439-1065 ♦ Email:reports@fivesenses.com ♦ Web:www.fivesenses.com

LAB COPIES WHITE & YELLOW

CLIENT COPY PINK

APPENDIX B4

MULTIPHASE TESTING REPORT

MULTIPHASE FLOW AND CONSOLIDATION TESTING - ASHLAND/NORTHERN STATES POWER LAKEFRONT SUPERFUND SITE

Prepared for

Northern States Power Company - WI
1414 West Hamilton Avenue
Eau Claire, WI 54701

October, 2007

URS

6737 W. Washington Street, Suite 2265
Milwaukee, WI 53214
25688375

Executive Summary

This report presents the results of the Multiphase Flow and Consolidation Testing, one of several treatability studies recommended in the Candidate Technologies and Testing Needs Technical Memorandum [Treatability Studies Memorandum (Task 6 of the SOW): URS 2007a] that was originally submitted to USEPA on September 22, 2006 and approved on February 21, 2007. This test is a type of triaxial test setup known as a Seepage Induced Consolidation (SIC) test. The purpose of this testing is to provide data to be used for evaluating the technical implementability of capping and disposal technologies. The SIC setup was especially designed for very soft sediments to determine multiphase flow and consolidation properties of the sediments at low and medium high stress levels.

As explained in the introduction to the report, the SIC test works by subjecting a test sample to a constant downward flow rate and measuring the hydraulic pressure differential over the sample. As the stress is applied in this way, the pore fluid is expelled and consolidation occurs resulting in permeability changes within the sediment. These changes can be used to determine the:

1) Compressibility of the sediment;
2) Permeability of the sediment for gas (bubbles), water and non aqueous phase liquids (NAPL);
3) Threshold flow rate necessary to mobilize NAPL;
4) Threshold for air entry into the interstitial spaces which can then be used to evaluate the probability for gas bubble growth (ebullition); and
5) Amount of fluid released upon consolidation.

These characteristics can then be used as inputs to a model (the DELCON model) to predict the behavior of gas, fluid and NAPL in the underlying sediment during capping and during the period that underlying sediments are being consolidated by the cap. The cap can either be one that is applied subaqueously to in-place sediments or a cap applied to sediments after they have been deposited in a confined disposal facility (CDF).

The sediments used for this testing were collected by coring from a representative area of the Site known to be contaminated with polycyclic aromatic hydrocarbons (PAHs), volatile organic carbons (VOCs) and NAPL.

The SIC test was conducted using water, air (nitrogen) and NAPL (diesel fuel) as boundary conditions. Water, air and diesel fuel were forced through the sediment sample in separate tests and various measurements such as pressure, displacement and temperature were made.

A numerical model (DELCON) then was used to simulate the behavior of the sediments under a hypothetical subaqueous or CDF cap. In addition to the data developed in the SIC test supplemental data on the characteristics of Site sediment were used to "populate" the model. Characteristics of Site geology, bathymetry and stratigraphy also were incorporated into the model. Lastly, deposition rates of contaminated material and capping material for various

remedial alternatives as well as the properties of sand that will be used as cap material grain (particle) size distribution, minimum and maximum porosity, etc., were provided.

The DELCON model was used to simulate sediment behavior under two remedial alternatives: dredging and disposal into a CDF (SED 2) and placement of a subaqueous cap (SED 3). Results of the DELCON model indicated:

1) Under the CDF remedial scenario there would be relatively rapid consolidation of the wood layer under the CDF.
2) Only a small amount of consolidation in the Miller Creek clay layer under the wood layer will occur, but that will take place relatively rapidly (within the first five years).
3) Ebullition (gas release) in the underlying wood layer during the consolidation period is possible, however, conditions would no longer favor gas releases after the relatively rapid consolidation of the wood layer and the dredged slurry layer that would take place during the slurry deposition and cap placement time, say 180 days.
4) There would be no NAPL displacement expected from filling the CDF and subsequent consolidation since the predicted pore water discharges through the top layer of the dredged sediment are much smaller than are needed to mobilize NAPL.
5) Settlement consolidation after mechanical dredging under the CDF scenario was predicted to be almost the same as for the hydraulic dredging scenario because of the rapid consolidation of the wood layer beneath the CDF. Assuming the same depth CDF cap, settlement of the mechanically dredged material would be approximately 0.2 ft more than for settlement after hydraulic dredging.
6) Simulation of remedial scenario that includes dredging approximately 4 feet and then placement of a subaqueous cap, indicated that there would be virtually no consolidation of the native sediment given that the level cap re-establishes original bathymetry. Under this remedial scenario the discharges of pore water during capping are not sufficient to mobilize NAPL, nor should the capping result in gas releases substantially greater than what may presently occur.

Multiphase Flow and Consolidation Testing: Ashland/Northern States Power Lakefront Superfund Site

Ashland, Wisconsin

Draft Report

October, 2007

Z4336

Prepared for:

URS Corporation

Prepared for:

URS Corporation

Walther van Kesteren

Draft Report

October, 2007

Contents

1 Introduction....1
2 Objective and Scope of Work....2
2.1 Objective....2
2.2 Scope of work....2
3 Seepage Induced Consolidation tests....7
3.1 Sample preparation....7
3.2 Test Set-up - Seepage Induced Consolidation....8
3.3 Test results Seepage Induced Consolidation....10
3.3.1 Test SIC#3....10
3.3.2 Test SIC#4....15
3.3.3 Test SIC#5....18
4 Supplemental Analyses....22
4.1 Gas content and production rates....22
4.2 Vane tests....27
4.3 Particle Size Distribution....28
4.4 Atterberg limits....29
4.5 Sediment composition....29
4.6 Contamination Filtrate SIC-test....30
5 Schematization of Ashland Site....32
5.1 Geological description....32
5.2 Bathymetry....32
5.3 Stratigraphy....34
5.4 Material properties sediment layers....36
5.4.1 Miller Creek clay....36
5.4.2 Miller Creek Silt....37
5.4.3 Miller Creek sand....39
5.4.4 Contaminated wood layer....40
5.4.5 Dredged wood layer slurry....40
5.4.6 Cap material....41
5.5 Temperature....42
6 DELCON Simulations....44
6.1 Alternatives remediation....44
6.2 Timeline....45
6.3 Boundary conditions....46
6.4 Results simulations alternative #2....48
6.5 Results simulations alternative #3....58
7 Conclusions and Recommendations....60
7.1 Conclusions....60
7.2 Recommendations....61
8 References....62
A Appendix....1

LIST OF ACRONYMS AND ABBREVIATIONS

CAD	Confined Aquatic Disposal Cell
CDF	Confined Disposal Facility
CF	Copper Falls Formation
CL	CLay deposit (Miller Creek Formation)
DELCON	DELft CONsolidation software for finite strain consolidation
FID	Flame Ionization Detector
GC	Gas Chromatograph
NAPL	Non Aqueous Phase Liquid
PAH	Polycyclic Aromatic Hydrocarbons
OM	Organic Matter
SIC	Seepage Induced Consolidation test
TOC	Total Organic Carbon
SD	SanD beach deposit (Miller Creek Formation)
SI	SIlt deposit (Miller Creek Formation)
VOC	Volatile Organic Compounds
WD	contaminated Wood Layer

LIST OF SYMBOLS AND UNITS

symbol	name	unit
A	activity	[-]
C_0, C_1	creep coefficients	[-]
c_v	vertical consolidation coefficient	[m^2/s]
c_u, c_{ur} [Pa=N/m^2]	undrained shear strength (remoulded)	
D_p	pore diameter	[μm=10^{-6}m]
e	void ratio	[-]
Fo	Fourier number	[-]
g	gravity acceleration	[m^2/s]
H	layer thickness	[m]
k	permeability	[m/s]
k^i_{NAPL}, k^i_w	intrinsic permeability NAPL and water phase	[m^2]
k_1, k_2	coefficents decay organic matter	[-]
LL	liquid limit	[% wt]
m_v	vertical compressibility	[m^2/N]
p_g	gas pressure inside bubble	[Pa]
p_{ae}	air entry suction pressure	[Pa]
PL	plastic limit	[% wt]

PI	plasticity index (=LL-PL)	[% wt]
S_v	specific surface area	[m^2/m^3]
t	time	[s, min, yr]
u_{cap}	capillary pressure	[Pa]
T	temperature	[^oC]
ε	vertical strain	[-]
η	dynamic viscosity	[Pas]
ν	kinematic viscosity	[m^2/s]
ρ	density	[kg/m^3]
σ	surface tension	[N/m]
σ'	effective stress	[Pa]
ξ_I	solid fraction by weight	[-]
ξ^{OM}	organic content by weight	[-]

1. Introduction

As part of the treatability testing for the remedial investigation and feasibility study at the Ashland/Northern States Power Lakefront site in Ashland county, Wisconsin (see Fig.1), URS requested WL|Delft Hydraulics perform combined multiphase flow and consolidation experiments in the triaxial test set-up known as the Seepage Induced Consolidation (SIC) test. The combined multiphase flow and consolidation parameters are used to model impacts of capping of in-place sediments, i.e. subaqueous capping, or for dredged material disposal in a confined aquatic disposal cell (CAD), or in a confined disposal facility (CDF) when sediments are dredged and placed in these disposal facilities. The results of this testing will be used by URS to evaluate the implementability of capping, dredging and disposal technologies. For this evaluation, quantification of the behavior of gas, NAPL and fluid in the sediment beneath a cap or in a CDF is required. Therefore this report also includes simulations with the DELCON model, which predicts gas, NAPL and fluid behavior during deposition, consolidation and capping as function of time, depth and temperature.

Figure 1.1 Location Ashland site

2. Objective and Scope of Work

2.1 Objective

The objective of the experimental study is to determine multiphase flow and consolidation properties of contaminated sediment from the Ashland site (Site), and apply the results in simulations with the DELCON model for gas, NAPL and fluid behavior in the sediment beneath a cap or in a CDF. Data derived from this study will be used for evaluating the technical implementability of several remedial alternatives for sediments.

2.2 Scope of work

In the experimental study the multiphase flow and consolidation properties of Site sediments were determined with the SIC test. In this test consolidation can be realized in two ways:

- loading by a constant discharge through the sample, which results in consolidation only at the lower boundary
- loading by an external load, which results in consolidation over the full height of the sample)

The SIC test set-up, shown in Figure 2.1, was especially designed for very soft sediments to determine multiphase flow and consolidation properties at low and medium high stress levels. A constant flow rate through the sample downwards is precisely controlled by a syringe pump with the suction side connected to the lower drain system. In the drain system the hydraulic pressure is measured with a transducer with respect to the cell pressure. This pressure difference consolidates the sediment, which is measured with a displacement gauge. As the pore fluid is expelled, consolidation occurs and the permeability changes. By measuring the pressure difference for different flow rates the permeability and effective stress as function of void ratio can be determined.

When an external load is applied to consolidate the sample, the lower drain system is closed and the syringe pump is inactive. As a result, expelled pore water is drained through the top platen.

The multiphase flow characteristics of the NAPL/water pore system are dependent upon the threshold for NAPL flow and intrinsic permeability of water phase and NAPL phase in the pore system. These properties are determined by seepage tests at different discharge rates, where the boundary at the top platen is either water or NAPL. For the NAPL boundary diesel fuel is used in these SIC tests. When the diesel in the top platen chamber is not entering the sample the settlement of the top

platen equals the applied specific discharge and the sample consolidates. When diesel enters the sample the settlement will be less than the applied specific discharge and the difference is the amount of diesel in the sample. The total amount of diesel that went through the sample is measured together with the amount of diesel in the sample after the test. The threshold for NAPL flow is determined by its rheological properties in terms of apparent viscosity. Given the higher molecular weight (higher Cn) of the NAPL present in the sample than diesel, the apparent viscosity will be higher and therefore the measured threshold level can be regarded as a minimum.

Figure 2.1 Seepage Induced Consolidation test set-up

The SIC test has been used to:

1. measure the settlement characteristics (compressibility) of the sediment matrix;
2. measure the permeability of the sediment for gas, water and NAPL;
3. determine the threshold flow rate that is necessary to mobilize NAPL;
4. determine the threshold for air entry in the pore system, which is important for evaluating the potential for gas bubble growth (ebullition) in the sediment matrix;
5. measure the amount of fluid released upon consolidation.

Besides the SIC tests, supplemental analyses were performed for determining sediment properties that are necessary for the DELCON simulations. Some of these properties are also required as a reference to compare to the results of other treatability testing conducted on Ashland sediment, i.e., the cap flux testing.

In the associated numerical study, simulations were performed with the DELCON model, which can compute multiphase flow and consolidation of the contaminated sediments during deposition and after capping. The required input data for DELCON was obtained from the SIC tests and the supplemental testing. The

simulation was conducted for the local boundary conditions and lithographic structure.

The following tasks were defined:

Task 1 Seepage Induced Consolidation tests

The following 2 SIC tests were performed on the contaminated sediment:

- SIC test with water boundary; at the end of the test a gas boundary was applied in order to determine the "air entry value"; and
- SIC test with NAPL boundary (diesel fuel) in order to determine threshold flow rate to mobilize NAPL.

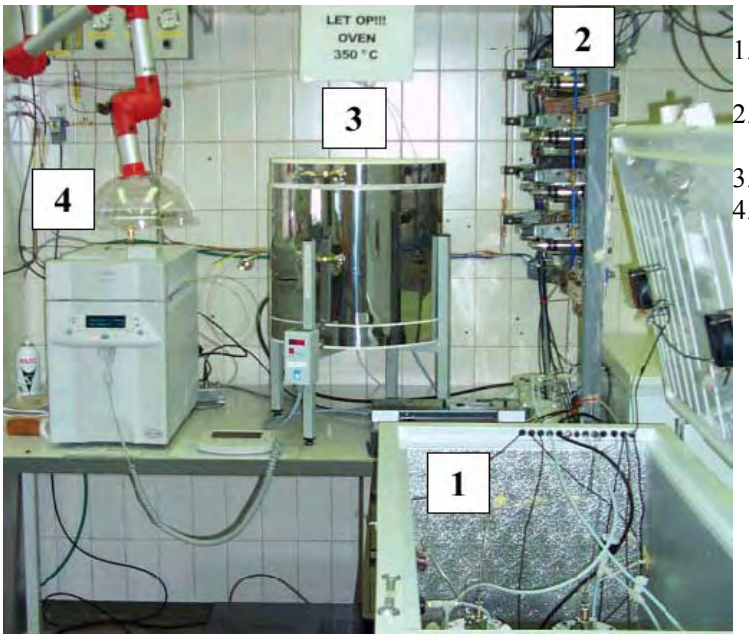
Diesel fuel is used as hydrophobic (non-wetting) fluid in the pore system and as solvent for the NAPL phases in the pore system.

The duration of each test depends on consolidation characteristics of the sediments

Task 2 Supplemental analyses

Supplemental analyses were conducted to measure additional sediment properties for DELCON simulations and as a reference. The following supplemental analyses were conducted on the contaminated sediment:

- Gas content (methane and carbon dioxide) and gas production rates (4 temperatures) (WL|Delft Hydraulics; see Fig.2.2);
- Water content (WL|Delft Hydraulics);
- Grain (particle) size distribution (GeoDelft);
- Atterberg limits (plasticity and liquid limit) (GeoDelft);
- Total organic carbon (TOC) (GeoDelft);
- Carbonate content (GeoDelft);
- TerrAtest on filtrate SIC test measuring PAHs, VOCs and mineral oil (Analytico); and
- NAPL content in sediment measuring PAHs and mineral oil (Analytico).



1. refrigerator with samples
2. switch and sampling loops
3. methanizer for CO_2
4. Gas Chromatograph

Figure 2.2 Gas generation test set-up at WL|Delft Hydraulics

Task 3 Data analysis

The analysis of the SIC tests assessed:

- settlement characteristics (compressibility) of the sediment matrix;
- permeability of the sediment for gas, water and NAPL;
- threshold flow rate that is necessary to mobilize NAPL; and
- amount of fluid released upon consolidation.

These results and the results from the supplemental analyses were used as input data for the DELCON model.

Task 4 DELCON simulations

DELCON simulations are performed for 2 alternatives:

1) Dredge sediment and place dredged slurry in a confined disposal facility (CDF) on site. The CDF will be capped with a sand cap of variable thickness (2, 3.5, 5.2 and 7 ft).
2) Dredge surface sediment (2-4 feet) and cap the whole dredged area with sand with variable thickness. (1, 2, 3, 4 or 5 ft).

It was assumed that the surcharge sediment has the same properties as the contaminated sediment, except for the contamination levels, and that the base sediment underlying the CDF is consolidated clay with properties measured by the cores collected during the field program.

For each alternative, varying cap layer thicknesses have been simulated. The simulation output consisted of a time series of sediment layer thickness, water content as function of depth, gas- NAPL- and water-fluxes through all sediment layers and gas ebullition fluxes.

For the simulations the following information was provided by URS:

- Local lithographic structure including aquifers (if any);
- Boundary conditions pore water pressures;
- Water level;
- Seasonal temperature variations;
- Deposition rates of contaminated material and capping material;
- Properties of sand that will be used as cap material (grain (particle) size distribution, minimum and maximum porosity); and
- Properties of base clay sediment layer (consolidation properties and water content as function of depth).

3. Seepage Induced Consolidation Tests

3.1 Sample preparation

Two sample cores from the Site were shipped to Delft and received on 12 March 2007. These two cores were taken in Area 2 (see Fig.3.1): Core sample 200 ft SE and core sample 150 ft W (the nomenclature for these samples is based upon the grid coordinates at the Site). Only the first core was used for testing. The 2nd core was back-up in case of test failures or sample losses. The upper half of the core volume was tested by GeoDelft for supplemental analyses (see Ch.4), the other half was used for SIC tests. Given the size of the brass sample ring in the SIC facility (height 30 mm, diameter 83 mm) the wood particles larger than 10 mm were separated by sieving. The composition of the original sample and sieved sample are provided in Table 3.1. In order to determine the water phase, wood phase, mineral phase and NAPL phase, subsamples were dried at different temperatures:

105 ^{o}C: evaporation of pore water and VOC's

450 ^{o}C: humus content without decomposing carbonates

1100 ^{o}C: burning all organic mater and decomposing carbonates: mineral solids

Carbonate content is determined on the residue after 450 ^{o}C.

The 36.8% coarse material (>10 mm) is not able to build up a skeleton[1] by its own in the original sediment and therefore the skeleton of the sediment is determined by the fraction smaller than 10 mm. The coarse fraction (>10 mm) is only occupying space in the original sediment and therefore will affect permeability and compressibility by its volume fraction. The results of the SIC tests can be corrected for this presence of the coarse material.

Table 3.1 Sample composition

	GeoDelft < 2.8 mm	**Delft Hydraulics < 10 mm**	**Delft Hydraulics > 10 mm**	**total Delft Hydraulics**
fraction by weight [%]		63.2	36.8	100
water content W [%]	385.4	401.5	251.2	337.7
solid content C [%]	20.6	19.6	28.5	23.1
mineral content [%]	44.3	32.8	16.1	25.2
organic content [%]	52.1	63.5	78.7	70.4
carbonate content	3.6	3.6	5.3	4.4

[1] The skeleton of solids in a sediment is defined as the solid matrix that is transferring stresses.

[%]				

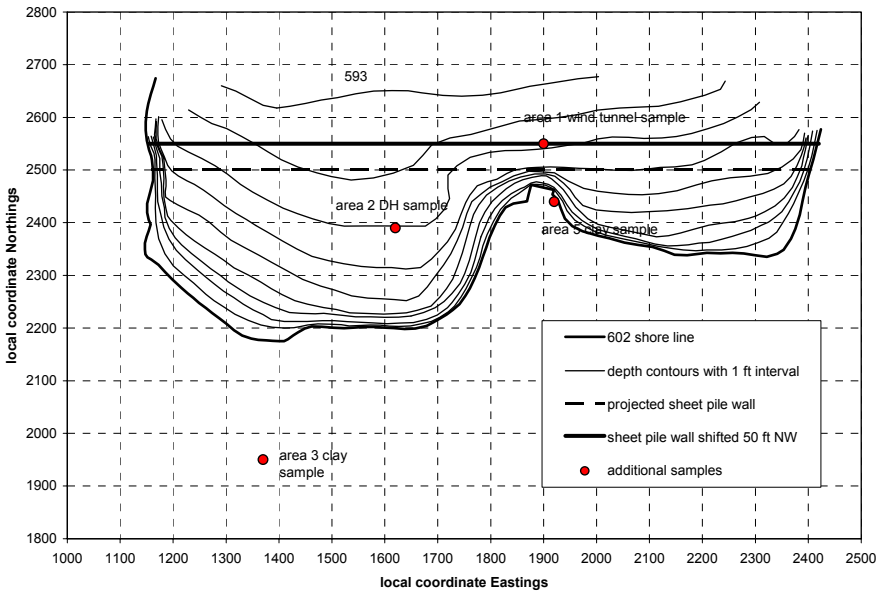


Figure 3.1 Sample locations in Ashland site

3.2 Test Set-up - Seepage Induced Consolidation

A schematic set-up of the SIC test is given in Fig.3.2. The main components are the flow controlled pump and the triaxial cell that contains the brass ring with sample and filter stones and filter paper on both sides. The drain system below the sample is connected with the pump. On top of the sample different boundary conditions can be applied. The top platen has a chamber in which different liquids can be placed or just used for the gas phase of the cell. The chamber can be loaded with an external load. The flow controlled pump generates a negative pressure in the drain system that forces pore fluid to flow downwards (seepage). Due to the hydraulic gradient the sample starts consolidating at the lower boundary of the sample.

The following 2 SIC tests were conducted on the contaminated sediment:

- SIC test with water boundary; at the end of the test a gas boundary is applied
- SIC test with NAPL boundary (diesel fuel)

Five tests were conducted (see Table 3.2); the first 2 of which were with water boundary and failed due to small wood fragments that got stuck in between the brass ring and

Table 3.2 SIC test program

Test number	boundary	before test			after test		
		W %	c_u Pa	$c_{u,r}$ Pa	W %	c_u Pa	$c_{u,r}$ Pa
SIC #1	water	425					
SIC #2	water	425					
SIC #3	water	425	196 169	39 39	256	39000	1800
SIC #4	diesel fuel	351			244		
SIC #5	air	301			224		

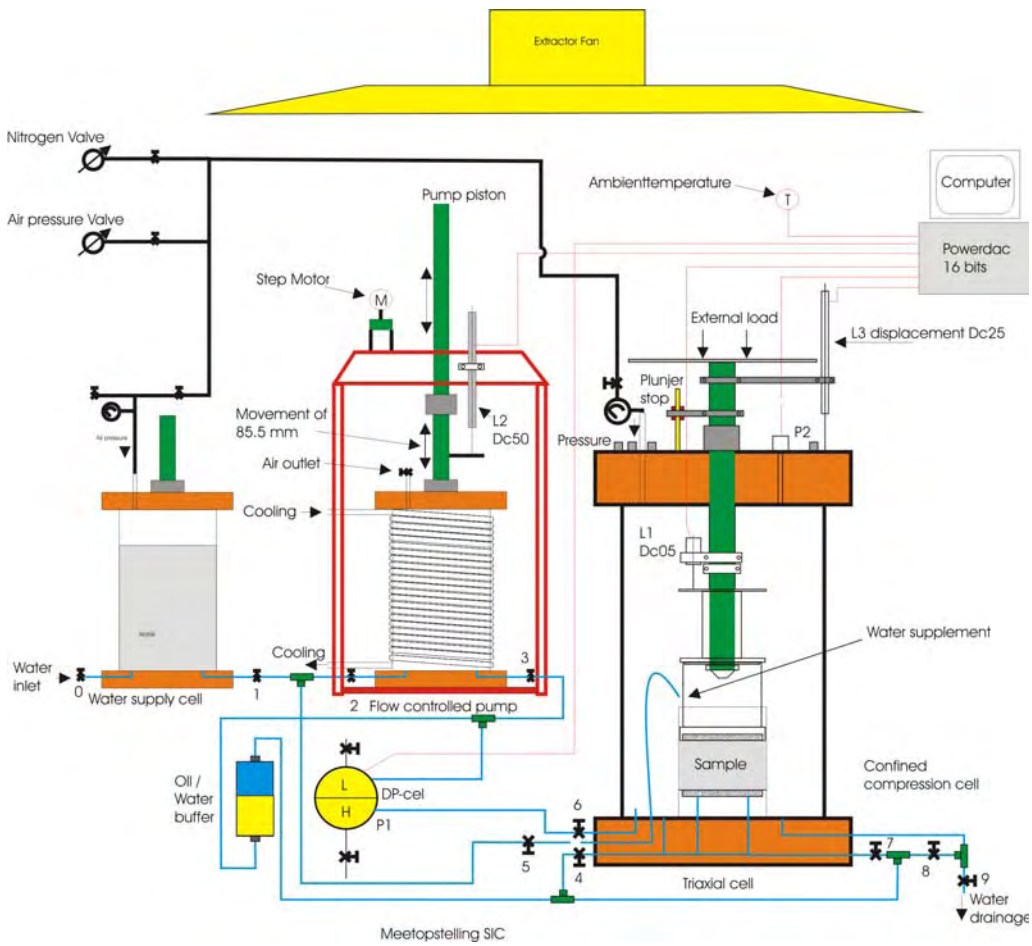


Figure 3.2 Test set-up Seepage Induced Consolidation

the top platen. The 3 following tests worked well. It was decided to do the gas boundary on a separate sample in order to be able to determine the "air entry value" at low effective stress. It is necessary that the capillary force is able to show displacement of the top plate before air enters the sample. Furthermore a separate test enables the measurement of water content and vane shear strength after the test

with the water boundary (SIC#3). The initial water content and water content after the tests are given in Table 3.2. Also the undrained peak and remoulded shear strength for SIC#3, are included (see Ch. 4.2).

All SIC tests were executed with the same sequence of loading steps as given Table 3.3. The first load of 363 Pa is the weight of the top platen. After consolidation, seepage suction with the piston pump was applied. This pump yields a controlled downward flux of pore water through the sample. Six different discharges were applied (see Table 3.3): 7.68, 15.72, 31.45, 47.27, 62.9 and 78.62 mm^3/s. The 2nd discharge was applied first, in order to get the piston pump started. By measuring the pore pressure in the drain below the sample the permeability was determined as function of the discharge.

Additional loading was applied by external weights on the sample. The drain below the sample was closed during the loading in order to measure the change in pore water pressure during consolidation. In total 5 external loads were applied: 4092, 11551, 22740, 33929 and 70191 Pa. After consolidation of each loading step a seepage suction sequence of six discharges was applied. The last stage of the test is unloading the external loads.

Table 3.3 Loading steps in SIC-test

loading step	**load [Pa]**	**discharge [mm^3/s]**
top platen	363	
seepage		15.72, 7.68, 31.45, 47.27, 62.9, 78.62
external load	4092	
seepage		15.72, 7.68, 31.45, 47.27, 62.9, 78.62
external load	11551	
seepage		15.72, 7.68, 31.45, 47.27, 62.9, 78.62
external load	22740	
seepage		15.72, 7.68, 31.45, 47.27, 62.9, 78.62
external load	33929	
seepage		15.72, 7.68, 31.45, 47.27, 62.9, 78.62
external load	70191	
seepage		15.72, 7.68, 31.45, 47.27, 62.9, 78.62
unloading		

3.3 Test results Seepage Induced Consolidation

3.3.1 Test SIC#3

During the test the following data were collected:

- pore water pressure in the drain below the sample with respect to cell pressure;
- vertical displacement of the top platen inside cell;
- vertical displacement of top platen during external loading outside cell;

- vertical displacement of piston pump;
- absolute pressure outside cell;
- pressure inside cell; and
- temperature.

A typical result of an external loading step is shown in Fig. 3.3 for SIC#3 (70191 Pa), where the vertical displacement or settlement and pore water pressure is plotted as function of time. The consolidation phase is relatively short and in most cases less than 100 minutes. The consolidation phase corresponds to the change in pore water pressure. After 10 minutes the pore water pressure is stabilizing. However the vertical displacement is continuing (creep) and shows on logarithm time scale a linear relationship.

This creep can be modeled by:

$$\varepsilon = C_0 + C_1 \ln(t)$$
(3.1)

in which ε is the vertical strain, t time in minutes, C_0 and C_1 creep coefficients.

The creep coefficients were determined from the linear fit on logarithm time scale. This was only done for SIC#3.

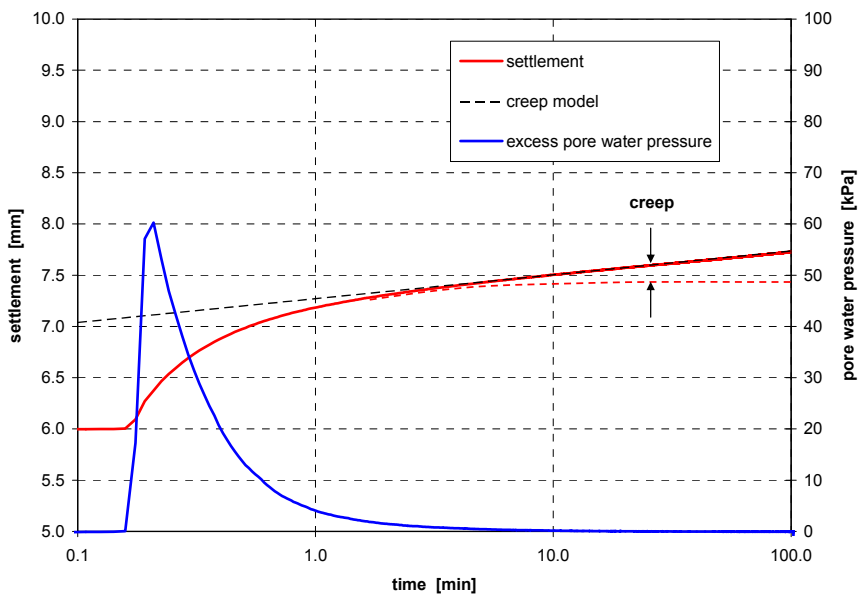


Figure 3.3 External loading step to 70191 Pa SIC#3

A typical result for the seepage loading phase is given in Fig.3.4, where the vertical displacement and water pressure in the drain is plotted as function of time. The water pressure response is within several seconds, resulting in a step wise pore water pressure change for the six different discharges. At higher discharges the step has a

linear increase in suction pressure, which is more as discharge increases. This is caused by the decrease in water level on top of the sample. The vertical displacement is relatively small during the seepage steps and is the example about 0.02 mm. In Fig.3.5 the measured pore water pressures are plotted as function of discharge. In most cases the data points show a linear relationship, from which the permeability can be determined. In the multiphase SIC tests #4 and #5 the relationship is not always linear as will be discussed in section 3.3.2 and 3.3.3.

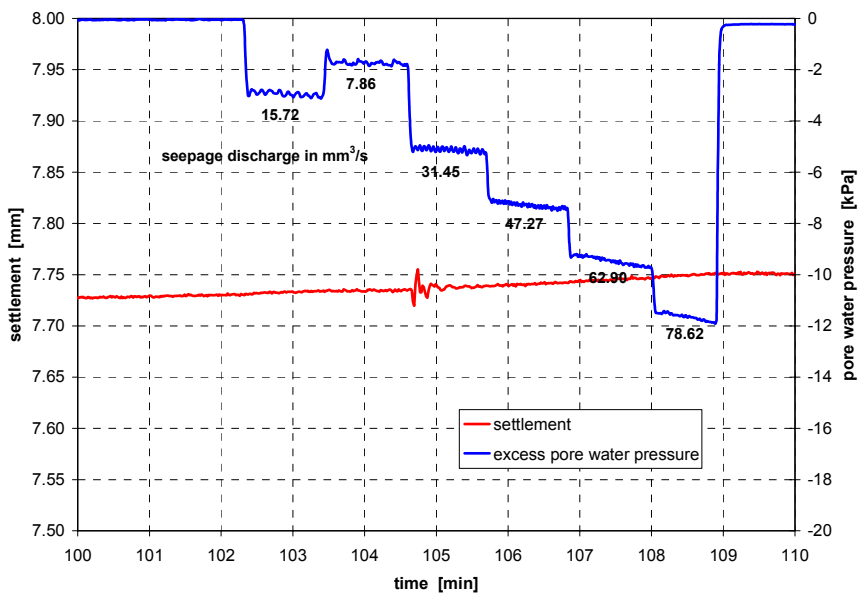


Figure 3.4 Seepage loading step at 70191 Pa SIC#3

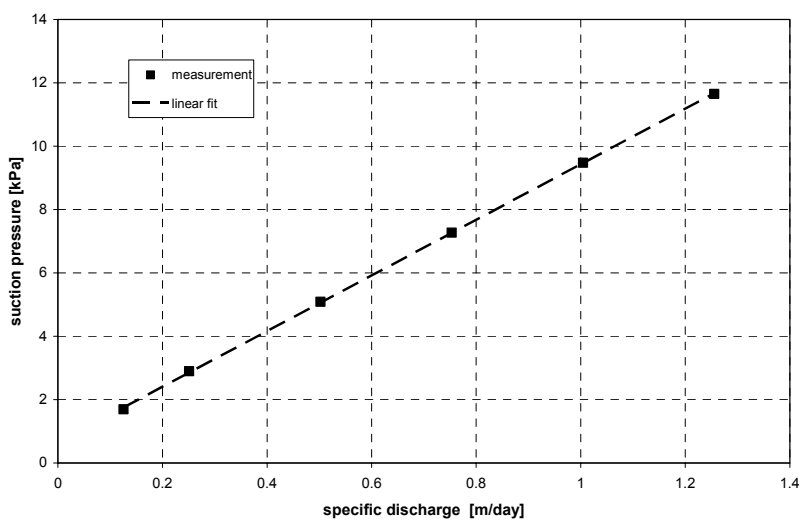


Figure 3.5 Determining permeability from seepage loading step at 70191 Pa SIC#3

From the consolidation at different vertical effective stresses the relationship between effective stress and void ratio is obtained. This is shown in Fig.3.6. The data are fitted with the power law model that is used for the DELCON computations:

$$e = A(\sigma' + Z)^B \tag{3.2}$$

in which e is void ratio, σ' is vertical effective stress [kPa], A and B coefficients of the power law model and Z is coupled to the void ratio at zero effective stress.

The coefficients are given in Table 3.4. In Fig.3.6 the measured peak strength is also plotted (see Table 3.2).

The permeability as function of void ratio is shown in Fig.3.7 and shows also a power law relationship:

$$k = C\,e^D \tag{3.3}$$

in which e is void ratio, k is permeability [m/s], C and D coefficients of the power law model.

The coefficients are given in Table 3.4.

From eq.(3.2) and eq.(3.3) the consolidation coefficient can be determined:

$$c_v = \frac{k}{\gamma_w m_v}\ ;\ m_v = -\frac{\mathrm{d}e}{\mathrm{d}\sigma'}\frac{1}{1+e} \quad \Rightarrow c_v = \frac{C}{\gamma_w B} A^{-1/B} e^{D-1+1/B}(1+e) \tag{3.4}$$

in which c_v is consolidation coefficient [m^2/s], γ_w is specific weight water [kN], m_v compressibility [m^2/N].

The consolidation coefficient is plotted in Fig.3.6 and is about 2.4 10^{-5} m^2/s in the test range.

Table 3.4 Coefficients SIC#3

A	***B***	***Z***	***C***	***D***
5	-0.128	5.71623	2.2610E-11	8.35080

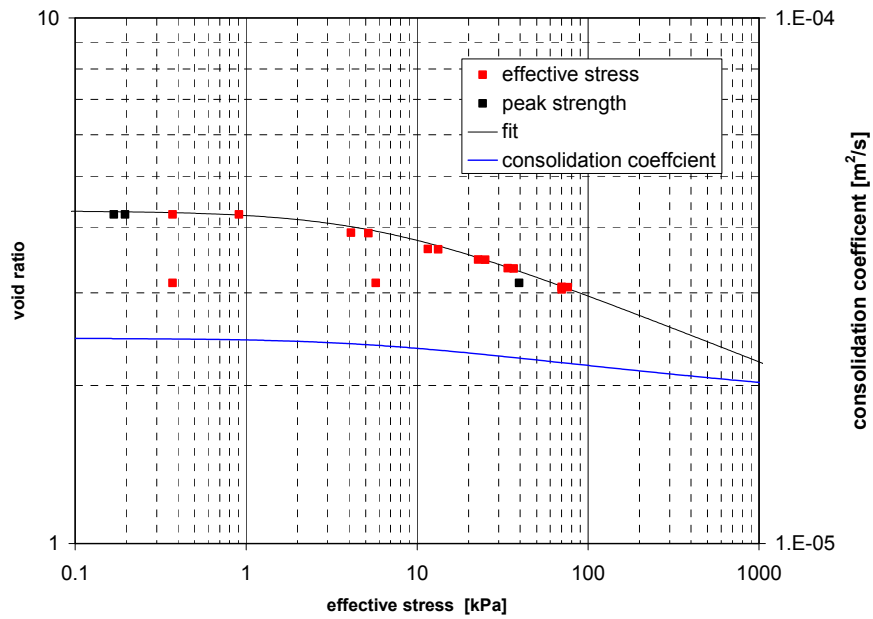


Figure 3.6 Effective stress and peak strength as function of void ratio SIC#3

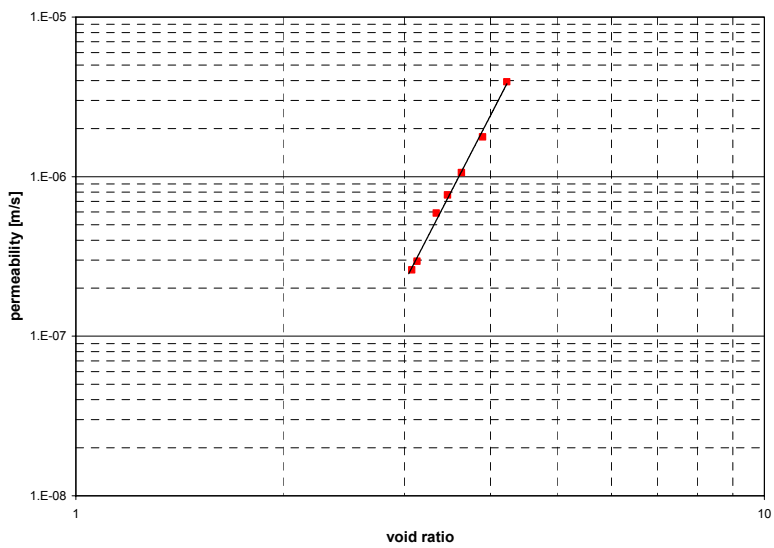


Figure 3.7 Permeability as function of void ratio SIC#3

The typical time scale for consolidation is obtained from the Fourier number defined by:

$$Fo = \frac{c_v t}{H^2} \tag{3.5}$$

in which t the time [s] and H the layer thickness [m] with drainage on both sides.

The layer thickness in the SIC test is 0.03 m, but with only drainage on the upper boundary. Therefore *H* is 0.06 m and results in a time scale for consolidation of 2.5 min. This corresponds well with the time scale observed in Fig.3.3.

The creep coefficients are determined for the different effective stress loadings and are shown in Fig.3.8. The fits are used in the DELCON computation for the long term settlements and are given by:

$$C_0 = 6.0067 \cdot 10^{-2} \ln(\sigma') - 0.43524$$
$$C_1 = 9.1738 \cdot 10^{-4} \ln(\sigma') - 6.8865 \cdot 10^{-3} \qquad (3.6)$$

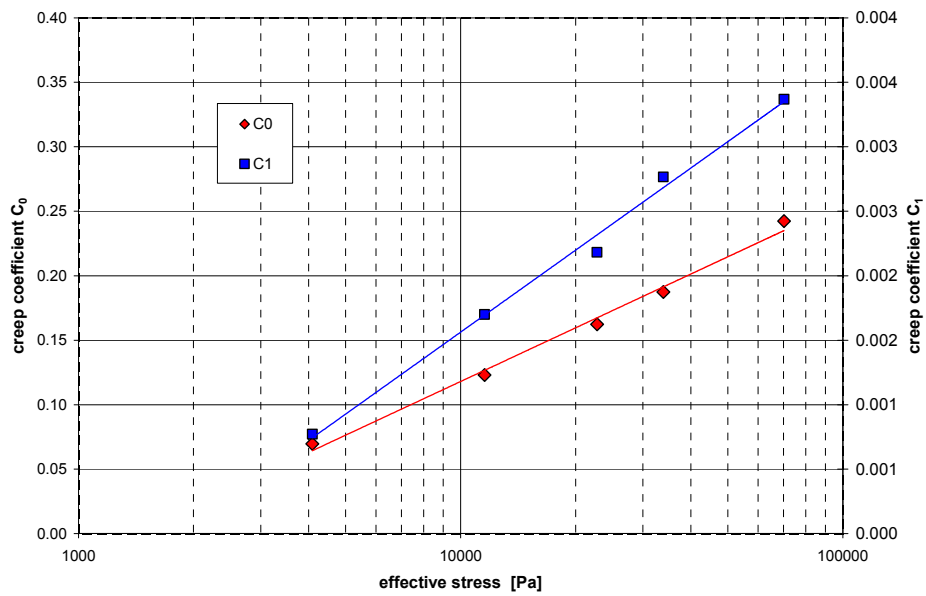


Figure 3.8 Creep coefficients as function of effective stress SIC#3

3.3.2 Test SIC#4

This test is performed with a diesel boundary on top of the sample. The diesel fuel has a density of 824 kg/m^3 and dynamic viscosity of 4.43 mPas (at 20 ^{o}C). During the consolidation by the vertical loading the diesel boundary will be pushed upward in the sample and will go downwards during the seepage loading phases. The relationship between effective stress and void ratio is given in Fig.3.9 and is similar to SIC#3 which fit is also shown. The coefficients for SIC#4 are listed in Table 3.5.

The permeability shows a different behavior as function of the specific discharge due to the entrainment of diesel in the sample. This is depicted in Fig.3.10 where the permeability is given as function of specific discharge for different consolidation stresses. At low effective stresses (black squares) the relationship is linear, but at 4092 Pa effective stress an increase in the slope is observed above a discharge of 0.75 m/day. The increase in suction pressure is related to the entrainment of diesel

fuel in which surface tension between diesel, water and solid are important. At higher effective stresses the relationship is reversed with a lower gradient above 0.75 m/day than below 0.75 m/day specific discharge. In Fig.3.11 the gradients above 0.75 m/day are shown with blue squares and indicate an increase in permeability. This increase is related to the contribution of pores filled with the NAPL phase of the initial sediment. The threshold flow rate for mobilizing the NAPL phase is 0.75 m/day.

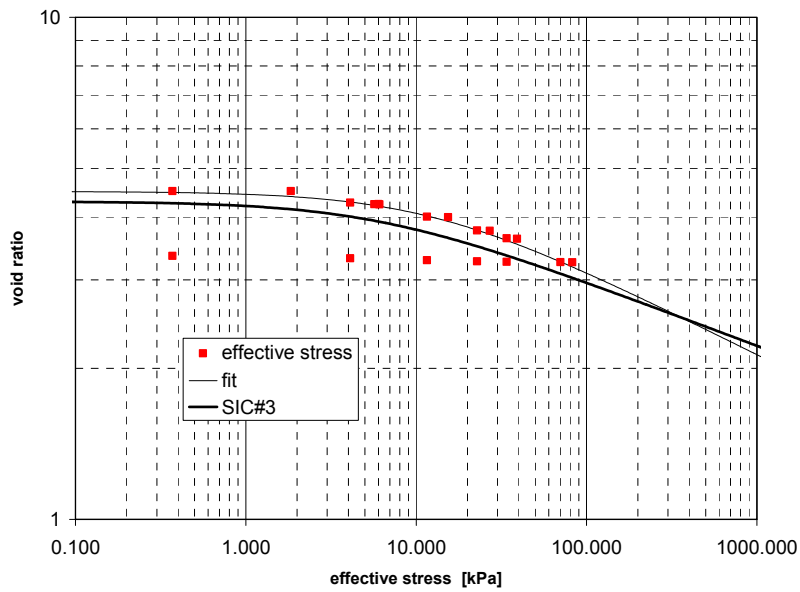


Figure 3.9 Effective stress as function of void ratio SIC#4

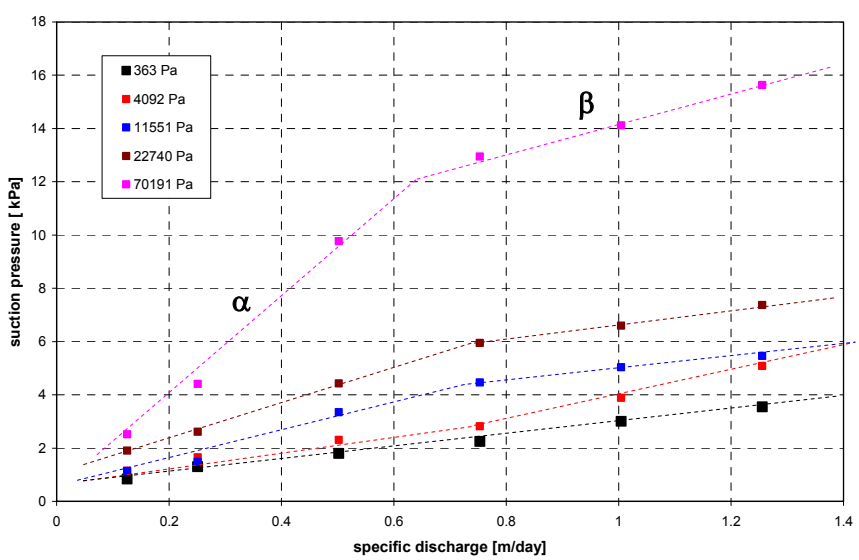


Figure 3.10 Permeability as function of specific discharge SIC#4

From the ratio in gradient before (α) and after the threshold flow rate (β) the intrinsic permeability of the water phase and NAPL phase can be determined (see. Marle, 1981):

$$\frac{\eta_w}{k_w^i}\frac{k_{NAPL}^i}{\eta_{NAPL}} = \frac{\alpha}{\beta} - 1 \quad ; \alpha = \frac{\eta_w}{k_w^i} \quad ; \quad \frac{1}{\beta} = \frac{1}{\alpha} + \frac{k_{NAPL}^i}{\eta_{NAPL}} \tag{3.7}$$

in which η_w is dynamic viscosity water [Pas], η_{NAPL} is dynamic viscosity NAPL [Pas], k_w^i intrinsic permeability water phase [m^2] and k_{NAPL}^i intrinsic permeability NAPL phase [m^2].

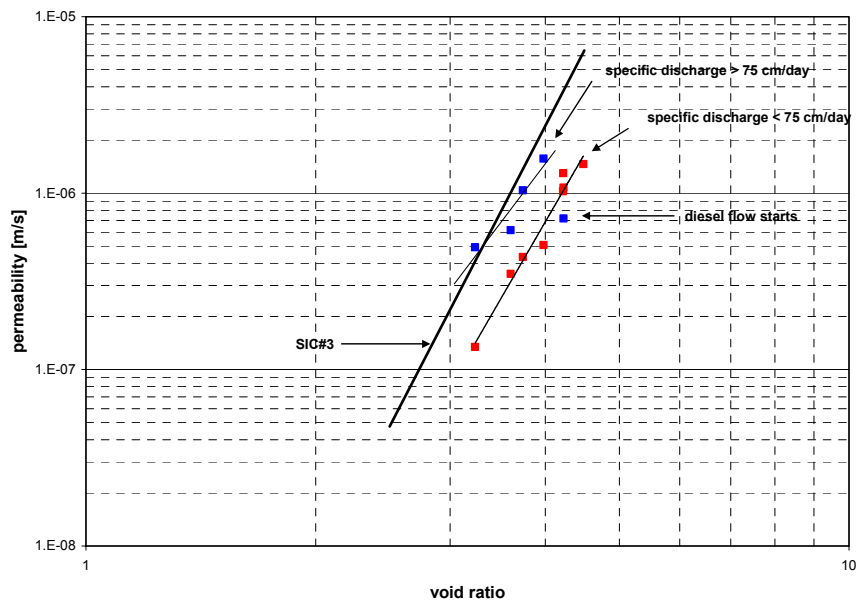


Figure 3.11 Permeability as function of void ratio SIC#4

The relation between permeability k in terms of [m/s] and intrinsic permeability is given by:

$$k = \rho_w g \frac{k_w^i}{\eta_w} \tag{3.8}$$

In Fig.3.11 the permeability's are given according to eq.(3.8). From that plot a ratio between α and β of 2.5 can be obtained. With the viscosities of the diesel fuel and water the ratio intrinsic permeability is k_{NAPL}^i / k_w^i=6.65. This means that the NAPL phase occupies the largest pores.

During the test diesel fuel and pore water that was flowing out the sample (the filtrate) was collected. After the test the total amount was 20 ml diesel fuel and 340 ml of pore water. With a density of diesel fuel of 824 g/l and water of 1000 g/l the diesel concentration by weight is 4.8%. The sample after the test was dried in the oven, as indicated in section 3.1, but with an additional first step: drying the sample in a 100 % humidity jar at 55 ^{o}C. In this way the diesel and other VOC's are evaporated from the sample without changing the water content. The measured diesel+VOC's concentration by weight of the pore water was 7.1%. The difference of 2.3% is related to the presence of mineral oils and PAHs in the original sample. From the analysis of Analytico on the original sample a mineral oil concentration of 3.3% weight dry solids (wt ds) and total PAH concentration of 1.7% (wt ds) was found (see section 4.6). With a pore fluid content after the test of 236 % (wt ds) the initial concentration of mineral oil and PAHs is (3.3+1.7)/2.36=2.1%.

Table 3.5 Coefficients SIC#4

A	***B***	***Z***	***C***	***D***
6.9	-0.17	12.36	2.1713E-11	7.4763

3.3.3 Test SIC#5

This test is performed with a gas (nitrogen) boundary on top of the sample and aimed at determining the "air entry value", which is important for gas bubble formation in sediments. The upper filter stone was saturated with water before the test. After consolidation by the weight of the top platen of 363 Pa three seepage loading phases were applied. During the first two seepage phases the water level was sufficiently high to do all six seepage discharges (see Table 3.3) for determining permeability.

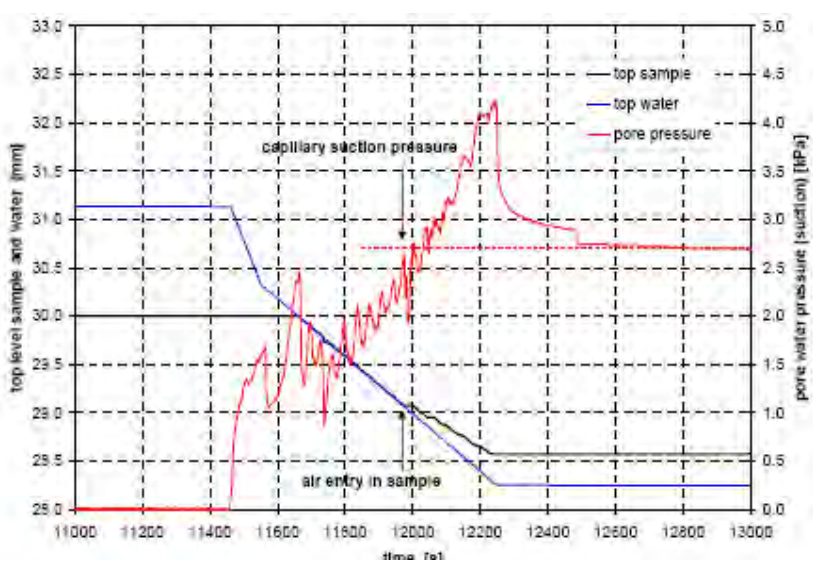


Figure 3.12 Measurement of air entry pressure SIC#5

The 3rd seepage phase was used to determine the "air entry value". This loading phase is shown in Fig.3.12, where the top level of water (blue line), the top level of the sample (black line) and the suction pressure in the drain system (red line) are plotted as function of time. The seepage discharge was started at 0.75 m/day, but reduced to 0.25 m/day after 100 seconds in order to get higher accuracy for the air entry value. At 11650 seconds the water level hits the top of the sample and the capillary force starts consolidating the sample. As long as the capillary force is less than the failure suction pressure of the menisci in the largest pores, the top sample must follow the water level. This forced displacement of the top level of the sample results in an increasing suction pressure in the drain system. At 11990 seconds, the top level of the sample is deviating from the water level, indicating that the menisci in the largest pores starts failing and nitrogen enters the sample. The corresponding capillary suction pressure is 2.69 kPa, which is also defined as the "air entry value". After this point the suction pressure is still increasing due to the capillary forces of the smaller pores. After 12250 seconds the maximum volume has been displaced by the pump and the seepage stops. The suction pressure is dropping to the level of the "air entry value". The capillary pressure can be related to the pore diameter with:

$$u_{cap} = 4\frac{\sigma \cos\alpha}{D_p}$$

(3.9)

in which u_{cap} is capillary pressure in [Pa], D_p is pore diameter, σ is surface tension in [N/m] and α is wetting angle on solid surface.

With a surface tension of 0.071 N/m and zero wetting angle (assuming water film on solid surface) the pore diameter corresponding to the air entry value of 2.69 kPa is 106 μm. For gas bubble formation in a sediment the air entry value should be larger then the pressure to squeeze away the sediment matrix. This condition is given by (Winterwerp & Van Kesteren, 2004):

$$p_g = Nc_u < p_{ae}$$

(3.10)

in which p_g is gas pressure inside bubble [kPa], p_{ae} is air entry value [kPa], N a constant ≈ 7.5 and c_u the untrained peak strength of the sediment [Pa].

With an air entry value of 2.69 kPa, the strength of the sediment must be smaller than 360 Pa for bubble formation. A larger strength will result in desaturation of the pore system. Given strength of 200 Pa of the wood layer (see Fig.3.6), bubble formation can occur and gas will be trapped in the sediment. However during consolidation the strength will increase rapidly, while the void ratio remains almost the same resulting in a small increase in air entry value. The results is that desaturation of the pore system will occur, which enables a pathway for gas releases.

The test is continued by external loading phases and seepage phases as indicated in Table 3.3. The relationship between effective stress and void ratio is given in Fig.3.13 and is similar to SIC#3 which fit is also shown. The permeability as function of void ratio is shown in Fig.3.14. The first two seepage phases, which has been applied before the nitrogen entered the sample, correspond to the SIC#3 relationship. Due to desaturation of the largest pores the permeability is changing and increasing above the SIC#3 relationship. The higher permeability is related to channeling effect in the largest pores. The coefficients for SIC#5 are listed in Table 3.6.

Table 3.6 Coefficients SIC#5

A	***B***	***Z***	***C***	***D***
5	-0.128	5.72	1.2154E-09	5.3727

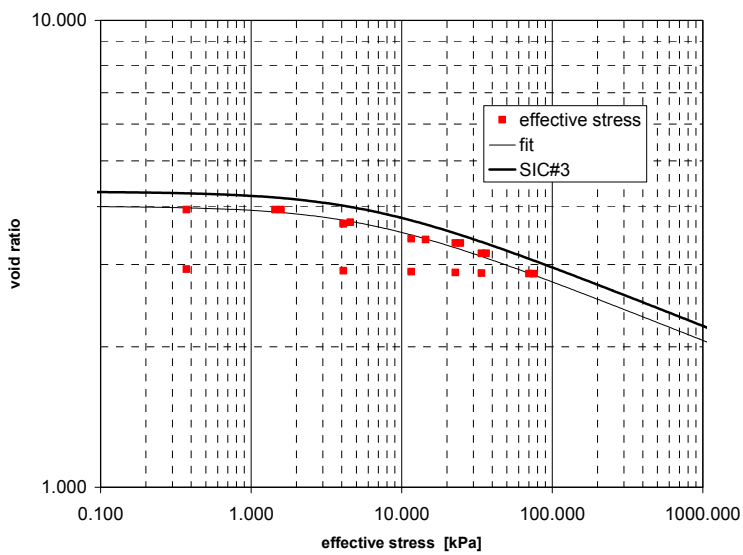


Figure 3.13 Effective stress as function of void ratio SIC#5

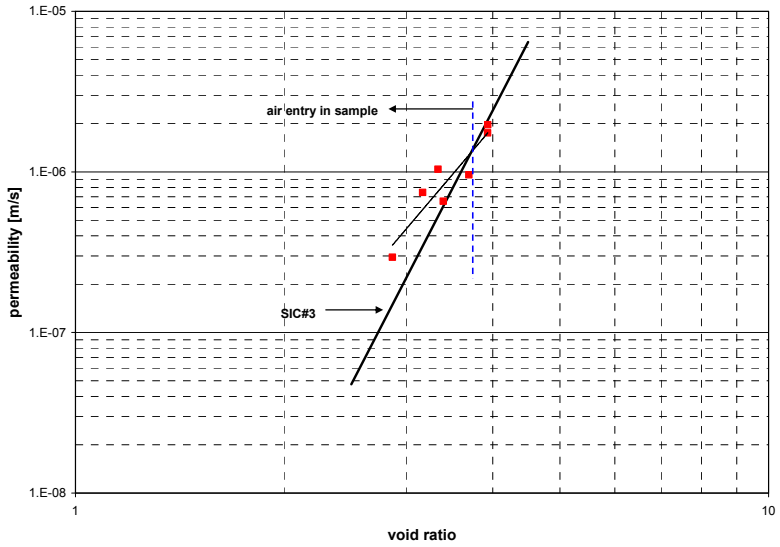


Figure 3.14 Permeability as function of void ratio SIC#5

4. Supplemental Analyses

The following analyses were conducted on the contaminated sediment:

- Gas content (methane and carbon dioxide) and gas production rates (4 temperatures) (WL|Delft Hydraulics);
- Vane tests and water content (WL|Delft Hydraulics);
- Particle size distribution (GeoDelft);
- Atterberg limits (plasticity and liquid limit) (GeoDelft);
- Sediment composition:
  - Water content (WL|Delft Hydraulics);
  - NAPL content (Analytico);
  - Organic content (OC) (GeoDelft, WL|Delft Hydraulics);
  - Carbonate content (GeoDelft);
  - NAPL content in sediment measuring PAHs and mineral oil (Analytico)
- TerrAtest on filtrate SIC test measuring PAHs, VOCs and mineral oil (Analytico).

4.1 Gas content and production rates

Two samples from the same batch, which has been used for the SIC tests, were placed in cell #1 and cell #2 of the gas facility at WL|Delft Hydraulics. A schematic set-up is shown in Fig.4.1. This facility measures methane and carbon dioxide that is present in the sediment, and anaerobic bacterial or chemical production rate as function of temperature. Methane is measured with a GC (FID). Carbon dioxide is measured by transforming it into methane with hydrogen via a Ni-catalyst. For calibration 2 standard gasses with 10 ppm and 1000 ppm of CH_4/CO_2 mixture (50%/50%) are measured each time samples are measured (default four times a day). Gas samples are taken from the head space of each cell. The carrier gas is nitrogen. When the concentration in the head space is in the order of 1000 ppm the cells are flushed with humid nitrogen in order to prevent drying of the sediment samples.

The sample in cell #2 was aimed at measuring chemical induced production rates, which was achieved by adding a bacteria killing agent (formaldehyde) after the degassing period and one week of bacterial activity. The sample in cell #1 was aimed at measuring both bacterial and chemical production rate as function of temperature: 10 ^{o}C and 20 ^{o}C. The samples were very soft and therefore placed on the bottom of the cell. The sample volume was 90 ml, resulting in a layer thickness of 18 mm.

Due to malfunction of the Ni-catalyst, carbon dioxide could not be measured. For production rates methane and carbon dioxide will be similar, however the initial concentration of carbon dioxide is not known and must be assessed with DELCON (see Ch. 6).

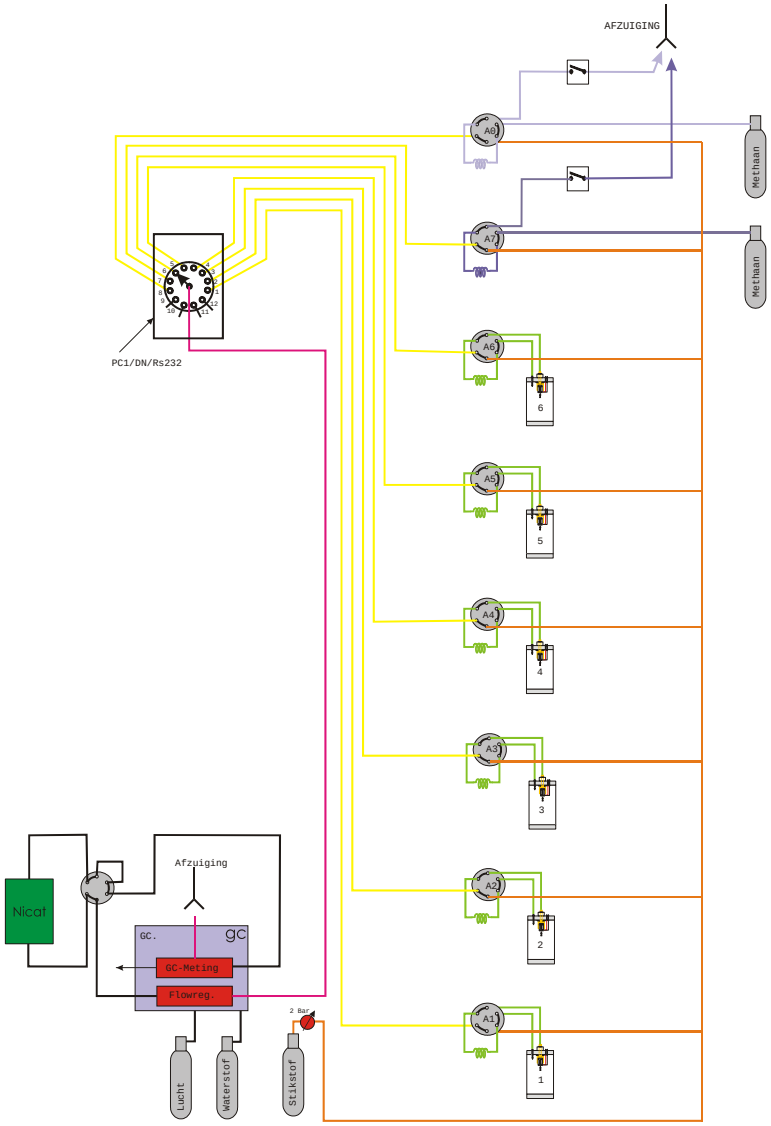


Figure 4.1 Test set-up gas facility

The results for methane at 10 ^{o}C are shown Fig.4.2 and Fig.4.3 as function of time for respectively cell #1 and #2. The measured data are fitted with the theoretical diffusion flux superimposed on a linear production rate. The fit parameters are the diffusion coefficient, the initial methane concentration and production rate and are given in Table 4.1. The results for cell #1 and #2 are similar, except that in cell #2 after 780 hours the methane production

rate reduces to zero due to the addition of bacteria killing agent (formaldehyde). In Fig.4.4 the methane production rate at 20 ^{o}C in cell #1 is shown. The only fit parameter is the production rate (see Table 4.1).

Production rates are measured as an increase in head space concentration in ppm CH_4 per hour. Given the amount organic matter in the sample of 67.4% (wt ds) (see Table 3.1) the production rate can be expressed in mmol CH_4 per gram OM per year. The DELCON model is based on the 2nd order degradation model of Middelburg (1989) which requires degradation rate of organic matter per year. These numbers are also given in Table 4.1 and plotted as function of temperature in Fig.4.5. The linear fit results in a critical temperature for bacterial activity of 6.76 ^{o}C.

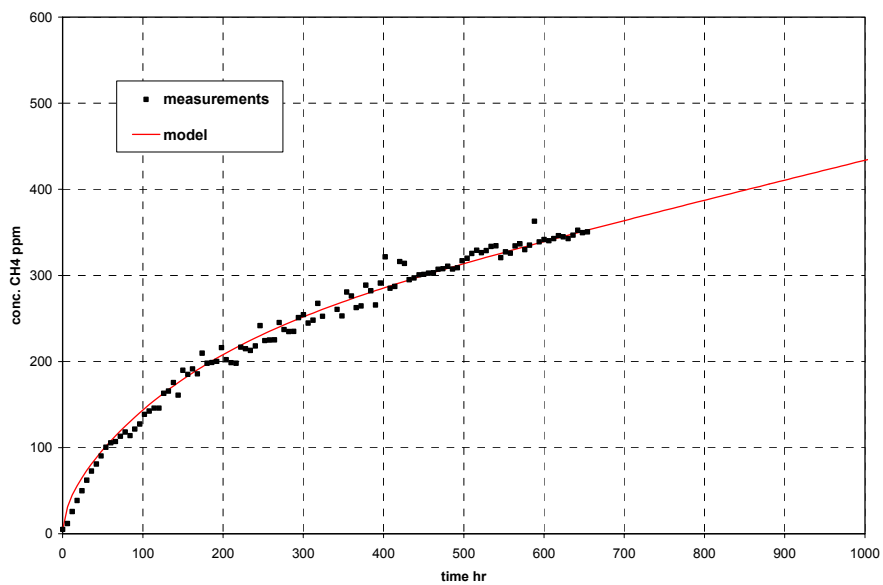


Figure 4.2 Concentration methane in headspace cell #1 at 10 ^{o}C

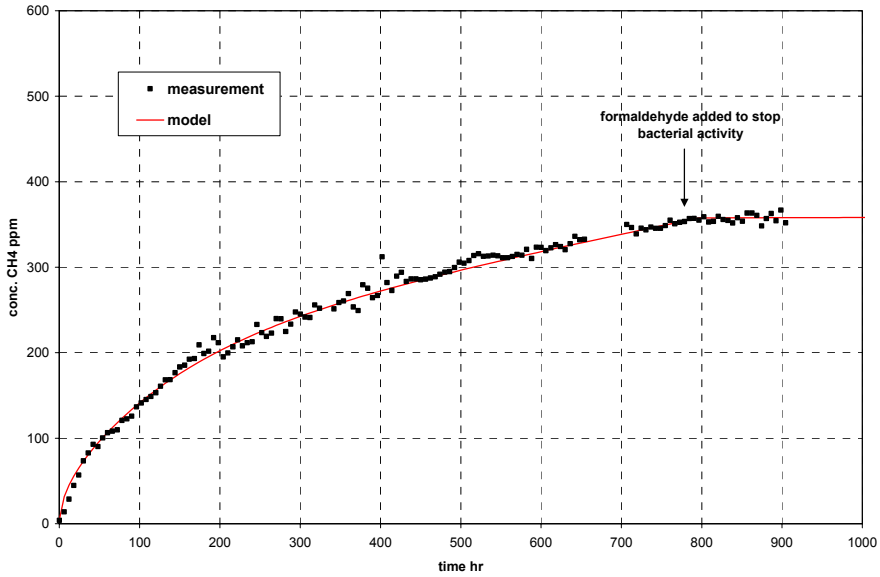


Figure 4.3 Concentration methane in headspace cell #2 at 10 °C

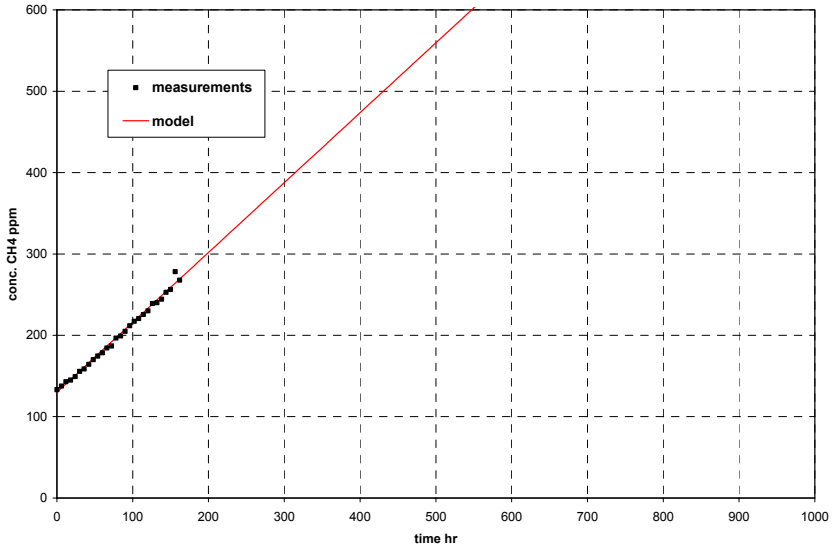


Figure 4.4 Concentration methane in headspace cell #1 at 20 °C

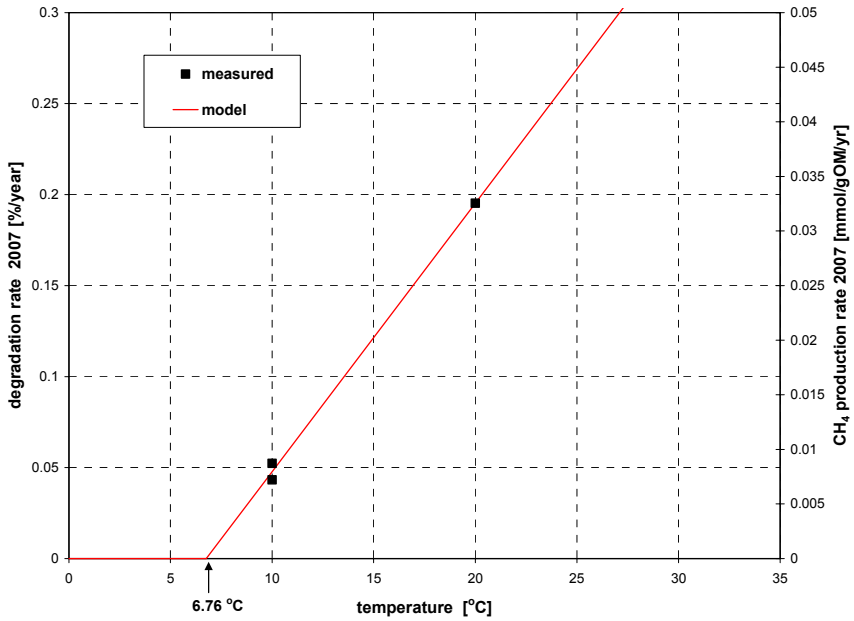


Figure 4.5 Degradation rate and gas generation rate as function of temperature

Table 4.1 Fit parameters CH_4 production tests

parameter	cell #1 10 °C	cell #1 20 °C	cell #2 10 °C
diffusion coefficient [m^2/s]	$1\ 10^{-9}$	$1\ 10^{-9}$	
initial concentration in headspace in ppm	204		207
initial concentration in pore fluid in mmol/mol	0.00209		0.00208
production rate in headspace ppm/hr	0.23	0.86	0.19
production rate in mmol/gOM/yr	0.00871	0.0325	0.00720
degradation rate of organic matter in % per year	0.0523	0.195	0.0432

4.2 Vane Tests

Vane tests[2] are performed on the sample used for SIC test #3 before and after the test. The vane tests are done with Haake M1500 rotoviscometer with vane elements FL100 and FL1000. The rotation speed was 0.512 rpm. The results are given in Table 4.2 and shown in Fig.4.6 (before SIC test) and Fig.4.7 (after SIC test). The wood chips and fibres affected the vane test, especially the sample after the test. That may have contributed to the continuous decay of the strength in the sample after the test. The failure in the sample was such that a duplicate test was not possible.

Table 4.2 Vane test results

Test	number	W %	c_u Pa	$c_{u,r}$ Pa
SIC #3 before test	1	411.1	196	39
SIC #3 before test	2	411.1	168	38
SIC #3 after test	1	247.9	39500	1800

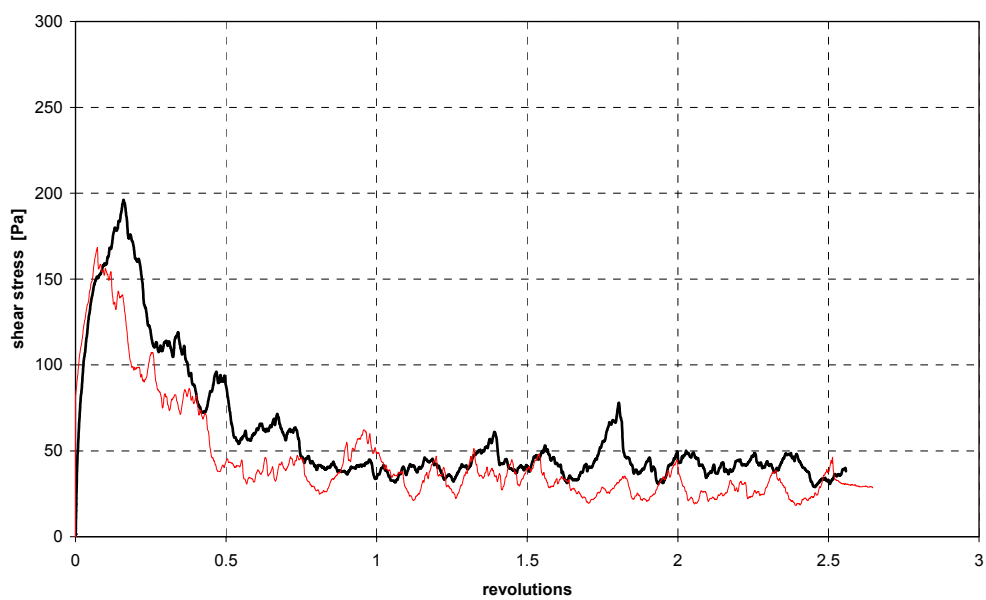


Figure 4.6 Vane test SIC#3 before test (in duplicate with vane element FL100)

[2] A vane test is a simple but efficient method to measure the yield stress among other properties of non-Newtonian fluids.

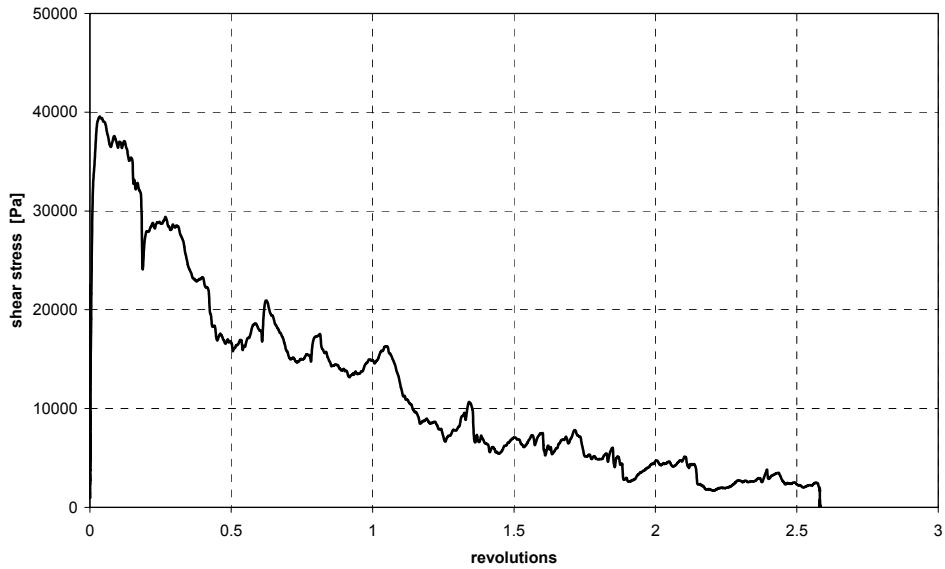


Figure 4.7 Vane test SIC#3 after test (with vane element FL1000)

4.3 Particle Size Distribution

The particle size distribution was determined by GeoDelft on the mineral fraction of the upper half of core sample from area 2 (see Fig.3.1): Sample 200 ft SE. The mineral fraction was obtained after drying at 1100 °C and was 44.3% of the total solids remaining after drying at 105 °C (see Table 3.1). The mineral solids were dry sieved down to 38 µm; the fraction smaller than 38 µm was measured with a Sedigraph. The result is shown in Fig.4.8. The clay content is 3.4 %, silt content is 21.9 %, and sand+gravel content is 74.7 % or respectively 1.5%, 9.7% and 33% of the total solids defined by drying at 105 °C.

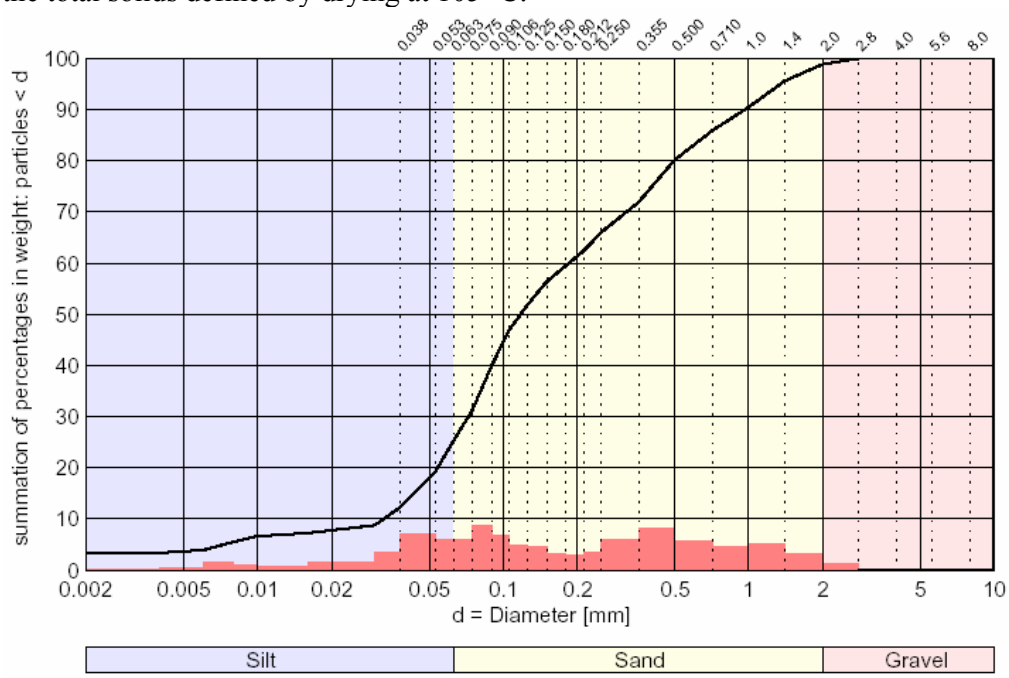


Figure 4.8 Particle Size Distribution contaminated wood layer after 1100 ^{o}C

4.4 Atterberg limits

The Atterberg limits couldn't be determined due to the high sand content in the mineral fraction and high organic content in the total solids. The cohesive nature is mainly determined by the organic (wood) fibre structure of the sediment and not by the clay fraction of the mineral part. The clay mineral content of the total solids is 1.5% (3.4% of 44.3%; see section 4.4). The behaviour is similar to peat soils in which fibre structure and reduced permeability by the clay fraction results in a cohesive behaviour. It must be noted that cohesive behaviour is related to the rate of pore water pressure dissipation when the sediment is loaded (see Winterwerp&VanKesteren, 2004)

4.5 Sediment composition

The water content, solid content, organic content, mineral content and carbonate content were measured by GeoDelft and WL|Delft Hydraulics and listed in Table 3.1 (section 3.1). The PAH's and petroleum hydrocarbons were measured by Analytico and are listed in Table 4.3. The sum PAH's and mineral oil is assumed to be in the NAPL phase, which yields a NAPL content of 5% by weight of dry solids (105 ^{o}C).

Table 4.3 Analysis Analytico

solid content	20.6 % m/m	
PAH		
Naphthalene	5800	mg/kg ds
Acenapthalene	<5.0	mg/kg ds
Acenaphthene	2500	mg/kg ds
Fluorene	870	mg/kg ds
Phenanthrene	2800	mg/kg ds
Anthracene	1000	mg/kg ds
Fluoranthene	880	mg/kg ds
Pyrene	1100	mg/kg ds
Benzo(a)anthracene	390	mg/kg ds
Chrysene	280	mg/kg ds
Benzo(b)fluoranthene	230	mg/kg ds
Benzo(k)fluoranthene	90	mg/kg ds
Benzo(a)pyrene	370	mg/kg ds
Dibenzo(a,h)anthracene	25	mg/kg ds
Benzo(g,h,i)perylene	140	mg/kg ds
Indeno(123-c,d)pyrene	140	mg/kg ds
Total PAHs	17000	mg/kg ds
Petroleum Hydrocarbons		
C10-C40	33000	mg/kg ds
C10-C12	17.5 %	
C12-C22	81.2 %	
C22-C30	0.9 %	
C30-C40	0.4 %	

4.6 Contamination Filtrate SIC-test

The contamination in the filtrate of SIC test SIC #3 and SIC #4 are determined by Analytico and are listed in Table 4.4. The high mineral oil level in SIC #4 is due to the presence of diesel fuel that was used in the test as an upper boundary condition.

Table 4.4 Contamination level in filtrate of SIC #3 and SIC #4

		SIC #3	SIC #4
Soil analyses			
pH		7.1	7.8
pH-temperature	°C	17.9	18.1
EC (electrical conductivity temperature	°C	17.9	18.1
EC (25°C)	mS/m	12	<10
EC-temp. corr. factor (mathematisch)		1.171	1.166
Metals			
Barium (Ba)	µg/L	27	27
Cadmium (Cd)	µg/L	1.0	1.0
Cobalt (Co)	µg/L	2	1
Copper (Cu)	µg/L	110	170
Lead (Pb)	µg/L	35	64
Nickel (Ni)	µg/L	270	460
Zinc (Zn)	µg/L	940	1200
Benzene	µg/L	0.8	
Toluene	µg/L	0.9	
o-Xylene	µg/L	0.2	
m+p-Xylene	µg/L	0.4	
Xylenes (sum)	µg/L	0.6	
1,2,4-Trimethylbenzene	µg/L		87
Phenols			
o-Cresol	µg/L	0.76	
Cresol (som)	µg/L	0.76	
2,4-Dimethylphenol	µg/L	0.65	
2,5-Dimethylphenol	µg/L	1.2	2.1
2,6-Dimethylphenol	µg/L	3.3	
3,4-Dimethylphenol	µg/L	0.08	
o-Ethylphenol	µg/L	1.6	
2,3/3,5-Dimethylphenol + 4-Ethylphenol	µg/L	6.7	
PAH			
Naphthalene	µg/L	0.4	
Acenapthalene	µg/L	0.2	
Acenaphthene	µg/L	0.07	9.9
Fluorene	µg/L	0.56	12
Phenanthrene	µg/L	0.24	2.5
Anthracene	µg/L	0.51	3.0
Fluoranthene	µg/L	0.7	7.0
Pyrene	µg/L	1.2	
Benzo(a)anthracene	µg/L	0.87	
Chrysene	µg/L	2.2	
Benzo(b)fluoranthene	µg/L	1.8	
Benzo(k)fluoranthene	µg/L	0.2	
Benzo(a)pyrene	µg/L	1.3	
Dibenzo(a,h)anthracene	µg/L	0.9	
Total PAK VROM (10)	µg/L	9.9	18
Total PAH EPA (16)	µg/L	11	35
Chlorophenols			
Pentachlorophenol	µg/L	0.33	
Miscellaneous			
Biphenyl	µg/L		11
Petroleum Hydrocarbons			
C10-C16	µg/L		37000
C16-C22	µg/L		41000
C22-C30	µg/L		5500
C30-C40	µg/L		260
(som C10 - C40)	µg/L		84000

5. Schematization of Ashland Site

5.1 Geological Description

The regional and site geology is described in RI report (URS, 2006). The Site geological units are given in Figure 5.1, which shows a typical cross section (C-C') from SE to NW. Unconsolidated glacial deposits consists of the Miller Creek Formation and Copper Falls Formation and are overlying Precambrian aged sedimentary bedrock (Oronto sandstone). The Miller Creek Formation is a fine-grained clayey silt to silty clay formed by lacustrine deposits and glacial till deposit. The Copper Falls Formation consists mainly of gravel, sand and silty sand with silty clay and clay lenses. The low permeability of the Miller Creek Formation acts as an aquitard for the Copper Falls aquifer. Close to the Chequamegon Bay shoreline the excess pore pressure at the base of the Miller Creek Formation is 12 feet or more above Lake Superior water level (602 ft).

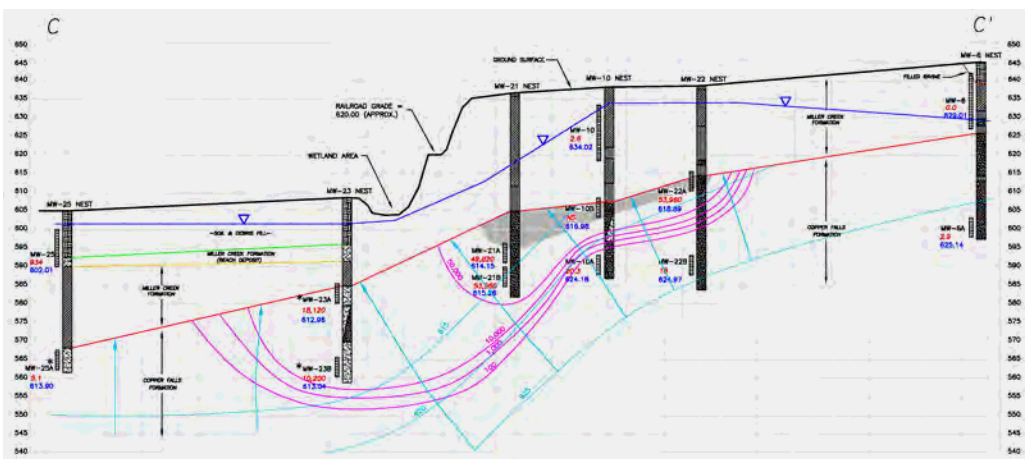


Figure 5.1 Site geological units in Cross Section C-C' (from RI-report fig. 3-4)

5.2 Bathymetry

In Fig.5.2 the bathymetry of the Ashland site is given together with the location of the sheet pile wall for the CDF. Initially the sheet pile wall was located at 2500 ft Northing, but in order to increase capacity the sheet pile wall was shifted 50 ft northward. From the bathymetry the hypsometric curve, i.e. surface area as function of depth, can be determined and is given in Fig.5.3. For the DELCON computation the hypsometric curve is schematized with 5 boxes, with a total volume that equals the area of the hypsometric curve. By using the hypsometric curve each box is bounded by two depth contours (see Table 5.1). At the sheet pile wall all contour

lines coincide. In table 5.1 also the bottom level, surface area of each box, cumulative area, and volume are given.

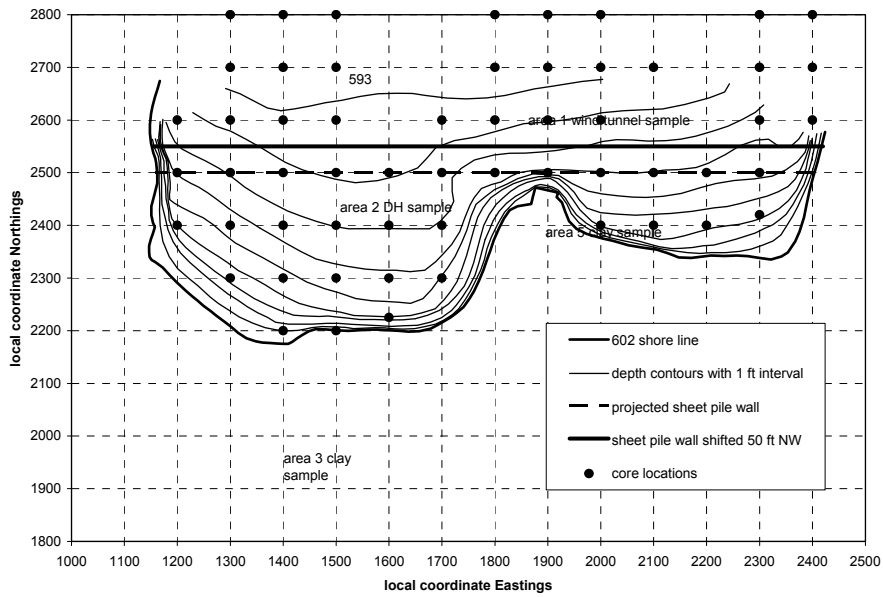


Figure 5.2 Bathymetry and core locations Ashland site

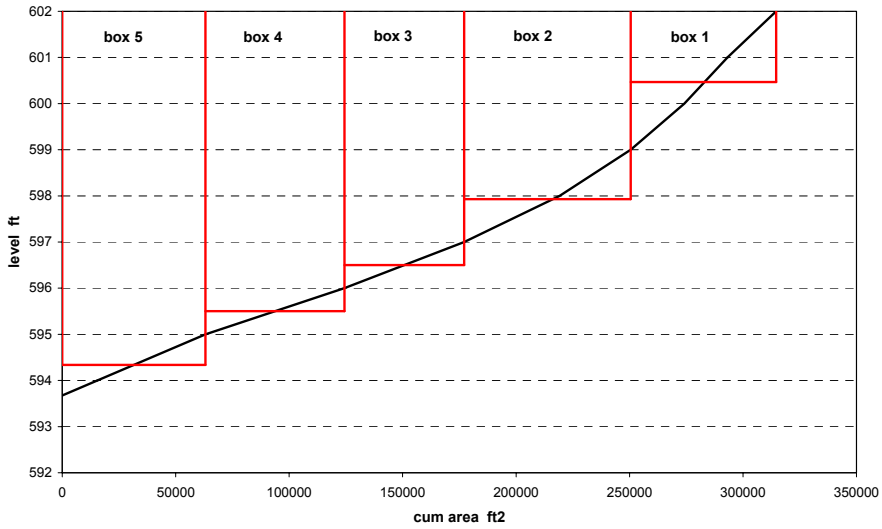


Figure 5.3 Hypsometric curve and schematization into 5 boxes

Table 5.1 Box schematization

box	depth contours [ft]	bottom level [ft]	surface area [ft^2]	cum. surface area [ft^2]	volume [yd^3]
#1	599 - 602	600.46	64098	314575	3647
#2	597 - 599	597.93	73379	250477	11070
#3	596 - 597	596.50	52716	177098	10738
#4	595 - 596	595.50	61291	124382	14755
#5	- 595	594.34	63091	63091	17907
sum			314575		58117

5.3 Stratigraphy

The core information in the locations indicated in Fig. 5.2 enables quantification of the stratigraphy in the CDF area between the shore line and sheet pile wall. There are 5 sediment layers identified from the core logs:

1. contaminated wood layer (WD)
2. sand layer (SD): Miller Creek Formation beach deposit
3. silt layer (SI): Miller Creek Formation silt deposit
4. clay layer (CL): Miller Creek Formation clay deposit
5. sand layer (CF): Copper Falls Formation

For each box the thickness of each layer has been assessed by averaging between contours of each box. The wood layer is the most compressible layer and will determine mainly the settlement when loaded with dredged material and when capped with sand. The thickness of the wood layer is shown in Fig.5.4. It shows that within the CDF area the estimated wood layer thickness roughly follows the bathymetry. Therefore the box schematization based on depth contours will be able to represent the effect of wood layer compression.

The result for the schematized stratigraphy is shown in Fig.5.5 and listed in Table 5.2. The top of the Copper Falls formation is assumed to be the base of the stratigraphy in the DELCON computations and is set to a level of 547 ft in all boxes.

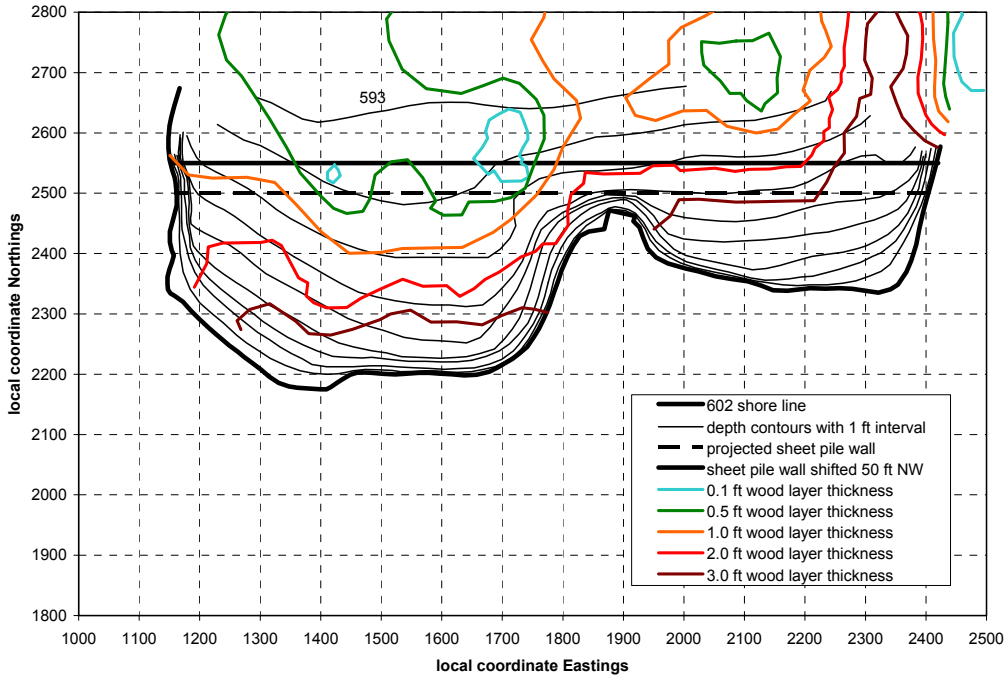
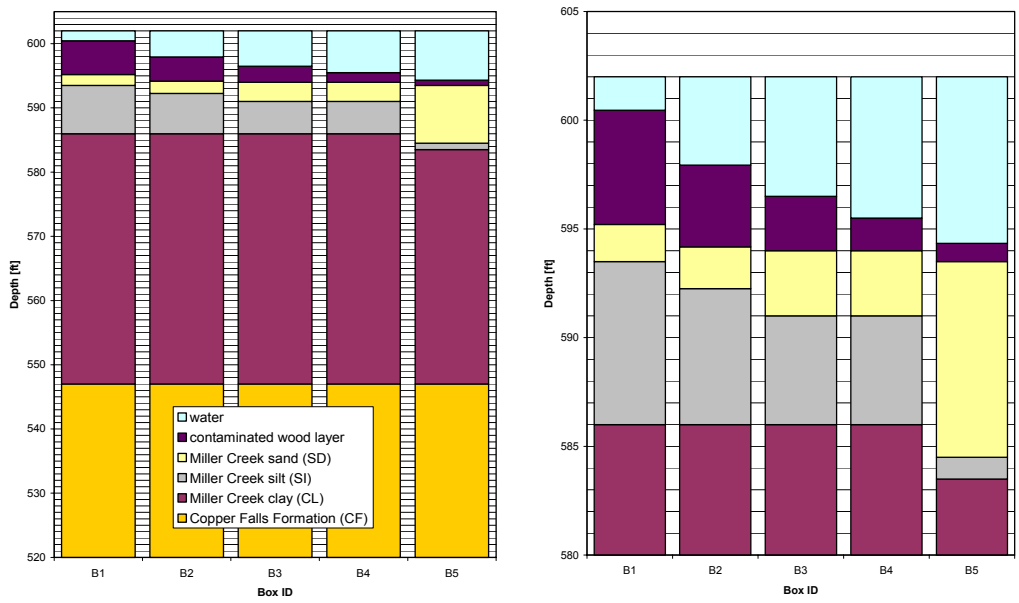


Figure 5.4 Wood layer thickness



a) all layers *b) detail top layers*

Figure 5.5 Schematized stratigraphy

Table 5.2 Schematized stratigraphy

top unit [ft]	B 1	B 2	B3	B4	B5
water	602	602	602	602	602
wood layer	600.46	597.93	596.5	595.5	594.34
MC sand	595.21	594.18	594	594	593.5
MC silt	593.5	592.25	591	591	584.5
MC clay	586	586	586	586	583.5
CF sand	547	547	547	547	547

5.4 Material properties sediment layers

5.4.1 Miller Creek Clay

For the properties of the Miller Creek clay, samples from area 3 and 5 (Figure 3.1) were analyzed. The available properties were Atterberg limits (LL, PL and PI), particle size distributions and water content. The plasticity index (PI=LL-PL) is given in Fig.5.6 as function of the clay content. It shows that both area 3 and 5 samples coincide on a straight line. The gradient is defined as the activity A of the clay fraction and is about 0.7. Given a constant activity in different samples, the consolidation characteristic can be obtained from one oedometer test. This test was done by SET on a sample from area 5 (see Appendix A). The void ratio as function of effective stress can be fitted with eq.(3.2), which is shown in Fig.5.7a. The permeability is determined from the consolidation coefficient given in Appendix A. The results are shown in Fig.5.7b. The back calculation of the permeability from the consolidation coefficient is only allowed on the compression line that corresponds to the 2 lower void ratio's in Fig.5.7a. Therefore the power law according to eq.(3.3) is fitted on these 2 points. The fit coefficients *A,B,Z,C* and *D* are listed in Table 5.3. The consolidation coefficient at the in-situ effective stress of about 100 kPa or 14 psi is 9.8 10^{-7} m^2/s (see Appendix A). With eq.(3.5) and layer thickness of 39 ft (see Fig.5.5a) the time scale for consolidation of the Miller Creek clay is about 5 years.

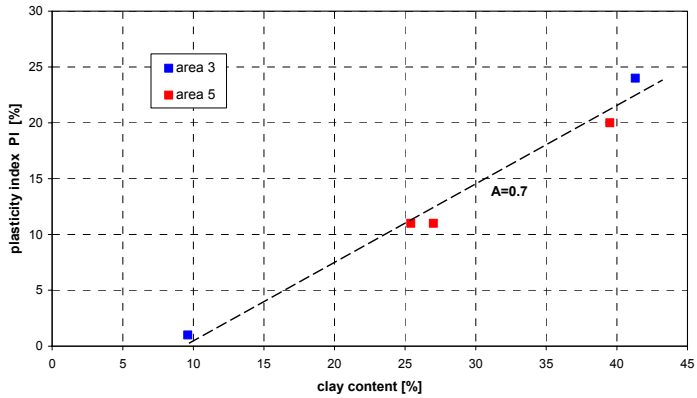
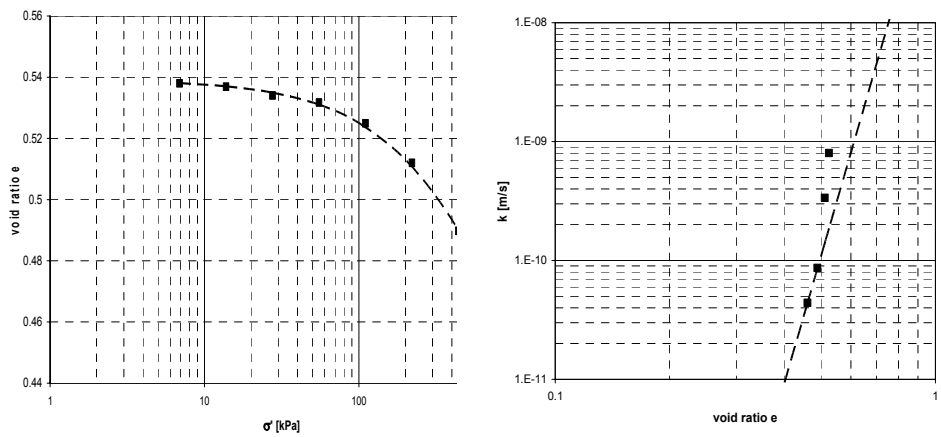


Figure 5.6 Activity plot Miller Creek clay



a) effective stress *b) permeability*

Figure 5.7 Effective stress and permeability as function of void ratio

5.4.2 Miller Creek Silt

For Miller Creek silt, properties are obtained from the core information in the locations indicated in Fig.5.2. From the physical properties (water content, depth; see URS report 2007) an assessment can be made of the consolidation properties. From the depth an effective stress level can be assessed assuming a consolidated state of the silt skeleton. From the water content the porosity and void ratio can be calculated. However when the silt skeleton is dominating the effective stress is determined mainly by the void ratio with respect to the silt skeleton. The same holds for the permeability. Therefore an assessment is made of the sand content in each Miller Creek silt sample. From the sediment phase theory (Winterwerp and Van Kesteren, 2004) a relation is found between the change in void ratio as function of sand content. With the computed effective stress level for each sample and the power law in eq.(3.2), the void ratio with respect to the silt skeleton can be

expressed in the coefficients A, B and Z. The void ratio with respect to silt skeleton can also be expressed in the actual void ratio and the sand fraction. The coefficients A, B and Z can be optimized in a way that the measured void ratio and computed sand fraction correspond to the sediment phase theory. The result is shown in Fig.5.8 for coefficients: A=1.5, B=-0.15 and Z=3.

The permeability is determined with Kozeny Karman formulation, given by:

$$k = \frac{g}{\upsilon}\frac{1}{k_0}\frac{e_{si}^3}{1+e_{si}}\frac{1}{S_v^2} \;;\; e_{si} = \frac{1+e}{\xi_{si}} - 1;\; S_v = \frac{N}{D_{10}} \;;\; N \approx 9.5 \;;\; k_0 \approx 12.5 \quad (5.1)$$

in which D_{10} the diameter with 10% lower, e_{si} void ratio silt and ξ_{si} the silt fraction.

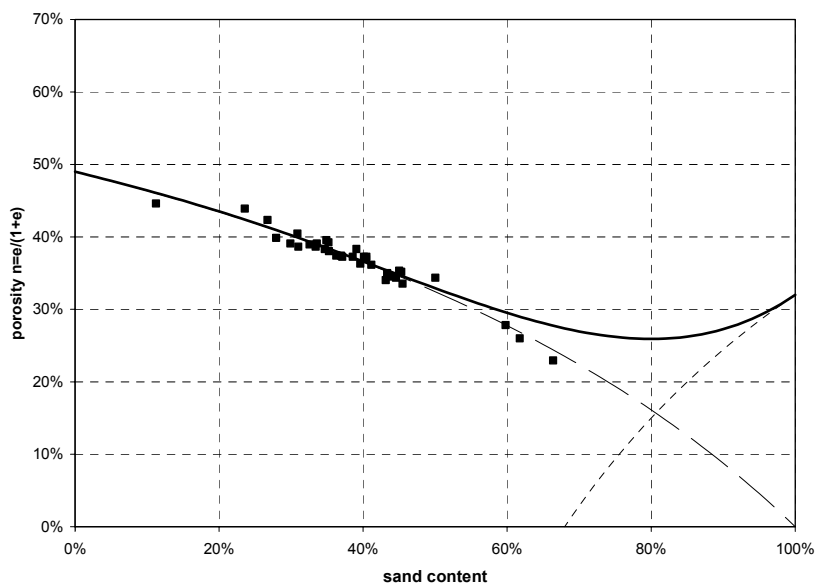


Figure 5.8 Optimization coefficients A,B and Z with sediment phase theory

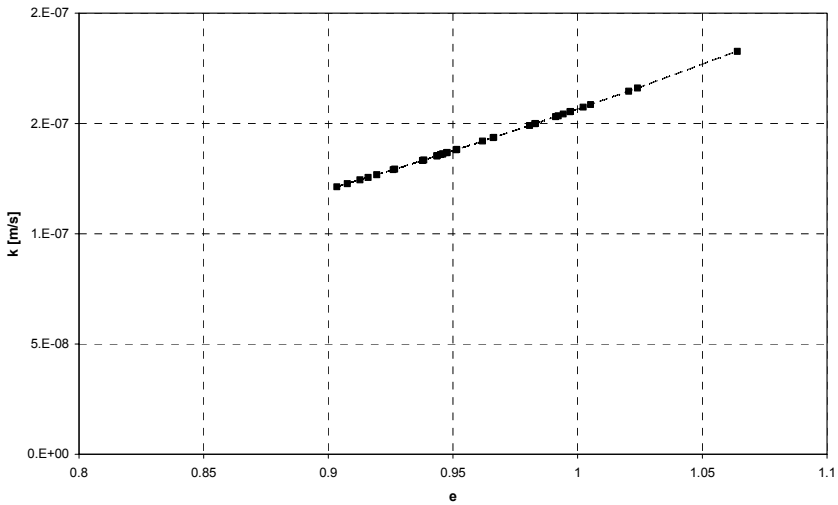


Figure 5.9 Permeability as function of void ratio Miller Creek silt

With a D_{10} of 6 μm the permeability is calculated as function of void ratio and plotted in Fig.5.9. The data is fitted with the power law function eq.(3.3): C=1.56 10^{-7}, D=2.507 (see also Table 5.3).

5.4.3 Miller Creek Sand

In a similar way as the Miller Creek silt, the coefficients are determined for the Miller Creek sand. In this case it is assumed that the sand skeleton dominates the consolidation behaviour, with a constant porosity with respect to the sand fraction. The measured data is shown in Fig.5.9 and correspond to the coefficients: A=2.5, B=-0.18 and Z=237.7. The permeability is determined with Kozeny Karman formulation eq.(5.1) and plotted in Fig.5.10 for a D_{10} of 80 μm. The coefficients of the power law function are: C=3 10^{-5}, D=2.621 (see also Table 5.3).

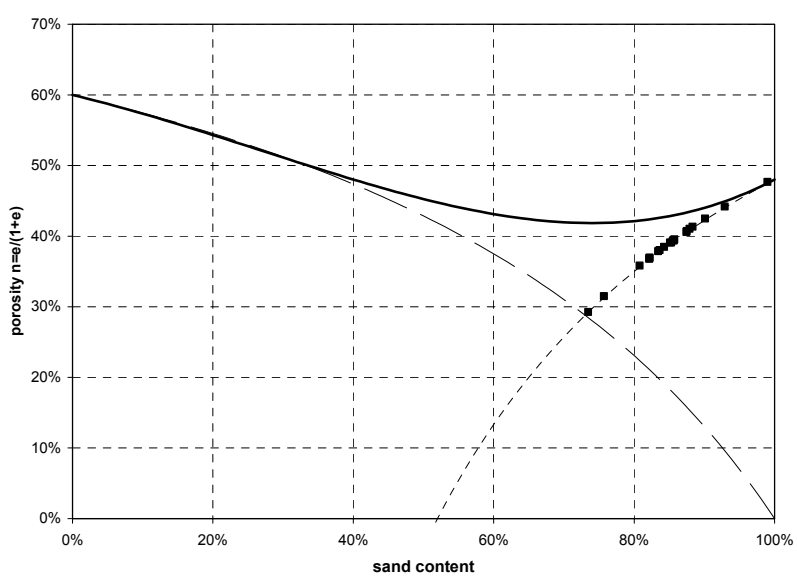


Figure 5.10 Optimization coefficients A,B and Z with sediment phase theory

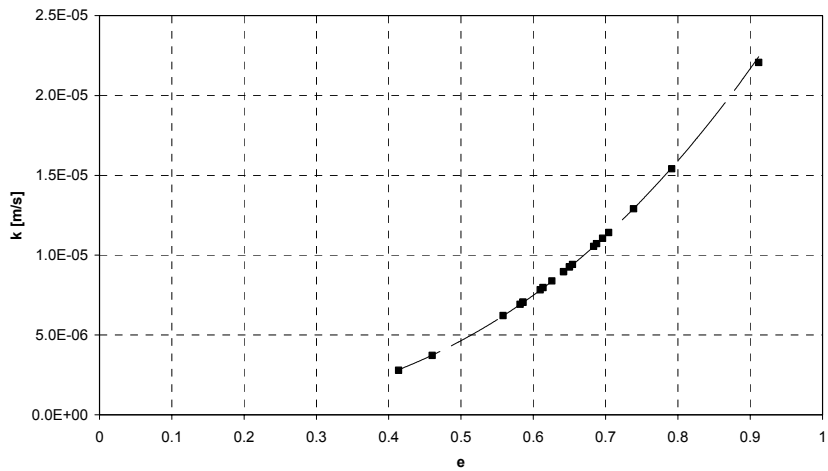


Figure 5.11 Permeability as function of void ratio Miller Creek sand

5.4.4 Contaminated Wood Layer

In this study only samples of the contaminated wood layer from area 2 (see Fig.3.1) has been tested for consolidation properties (see Ch.3). These properties were determined on the fraction smaller than 10 mm with a solid content (105°C) of 19.6% (see Table 3.1). The total sample solid content was 23.1% with a 33% sand in the solids (see section 4.3). However the averaged solid content of the wood layer is 44.9%. It is assumed that the variation in solid content of the wood layer is caused by difference in the sand fraction. In order to get the averaged solid content of 44.9% a sand content of 63.9% is required. The addition of sand changes the void ratio's proportionally and therefore the coefficients for permeability and effective stress as given in Table 3.4 must be corrected. The corrected coefficients are listed in Table 5.3 together with the corrected densities, void ratio, NAPL content and organic content. It is known that in the wood layer near shore large logs are piled up in such a fashion that they form a skeleton which is able to partly bear the load of the dredged slurry. This may result in less consolidation of the wood layer. Due to lack of information about log concentration it was decided to do the DELCON simulations without the effect of logs.

5.4.5 Dredged Wood Layer Slurry

The dredged wood layer has the same effective stress and permeability relation with void ratio except that the deposition void ratio is higher and the Z value is close to zero (0.02).

For hydraulic dredging the solids content was set at 18% (see section 6.1), which corresponds to a void ratio of 8.58 with a solid density of 1889 kg/m^3 (see Table 5.3). With the coefficients in Table 5.3 for the dredged wood layer an effective

stress of 0.23 Pa and permeability of 0.21 m/s. The very low effective stress indicates a regime of hindered settling with different settling velocities with an average of 2 cm/s. In this settling regime sand particles will segregate from the wood material. DELCON assumes a non-segregating slurry. The minimum possible solids content is 28% or maximum void ratio of 4.867 (see Table 5.3), which corresponds to an effective stress of 21 Pa and a shear strength of 10 Pa (see Fig.3.6). This shear strength is sufficient to keep all particles in suspension.

For mechanical dredging the solids content was set at 40% (see section 6.1), which corresponds to a void ratio of 2.81 and effective stress of 1.46 kPa or shear strength of 0.7 kPa.

5.4.6 Cap Material

The particle size distribution of the cap material was measured by Soil Technology and is shown in Fig.5.12. For the effective stress void ratio relation the same coefficients are applied as for the Miller Creek sand, but with a lower void ratio: A=2.0, B=-0.18 and Z=237.7 (see also Table 5.3). The permeability was also measured by Soil Technology at a void ratio of 0.563: $k=10^{-4}$ m/s. For the relation between permeability and void ratio Kozeny-Karman formulation eq.(5.1) was used with a D_{10} of 200 μm in order to fit the measured permeability. The relation is plotted in Fig.5.13. The coefficients of the power law function are: $C=4.486\ 10^{-4}$, D=2.611 (see also Table 5.3).

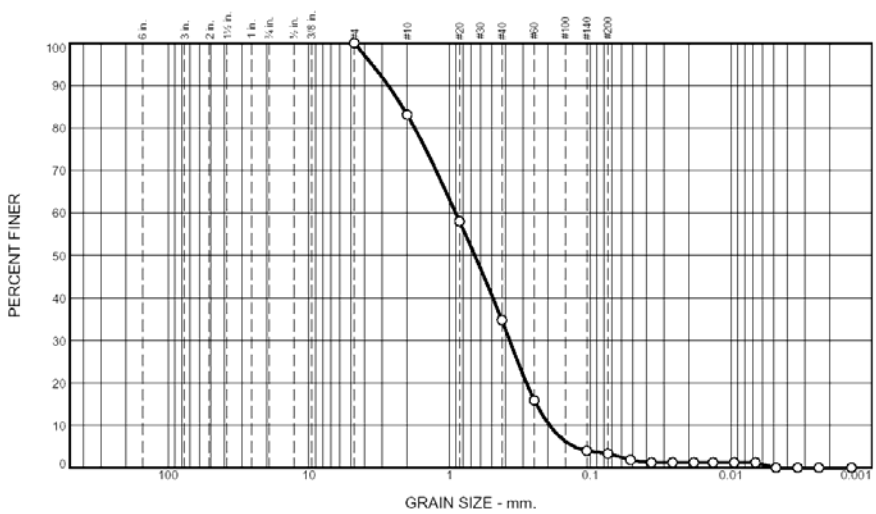


Figure 5.12 Particle size distribution cap material (source URS)

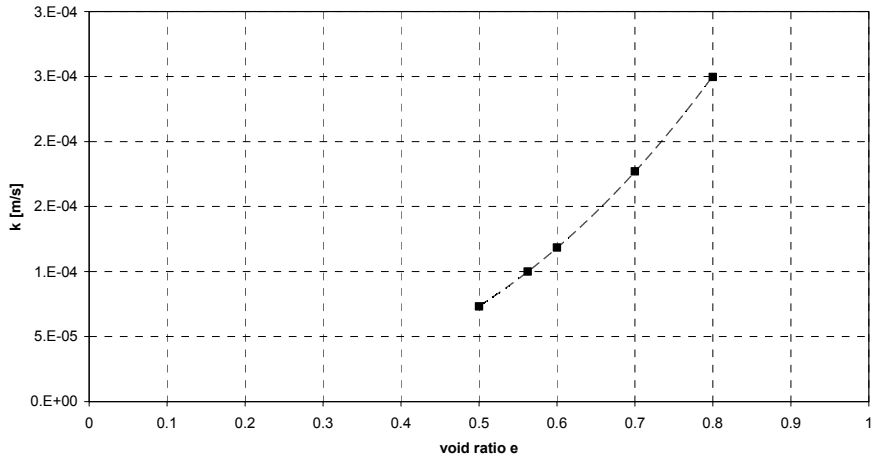


Figure 5.13 Gas generation test set-up

Table 5.3 Properties sediment layers for DELCON

parameter	MC clay	MC silt	MC sand	wood layer	dredged wood	cap
A	1.72	1.5	2.5	2.95	2.95	2
B	-0.18	-0.15	-0.18	-0.128	-0.128	-0.18
Z	629.8	3.0	237.7	5.716	0.0	237.8
C	$2.328\ 10^{-7}$	$1.565\ 10^{-7}$	$3.0\ 10^{-5}$	$3.368\ 10^{-9}$	$3.368\ 10^{-9}$	$4.486\ 10^{-4}$
D	11.061	2.507	2.621	8.351	8.351	2.611
e_0	0.539	1.271	0.934	2.360	4.867	0.747
ρ_w kg/m^3	1000	1000	1000	1000	1000	1000
ρ_s kg/m^3	2650	2650	2650	1889	1889	2650
ρ_{NAPL} kg/m^3				1124	1124	
org. content %	0	0	0	24.41	24.41	0
NAPL content %	0	0	0	1.25	1.25	0

5.5 Temperature

There are limited surface water temperature data available for the Ashland site area. Water temperatures measurements were made at the Ashland site in June 2005 (see Fig.5.14). However, cooling water intake temperatures are available over the period 2004-2006 from the Xcel Energy power plant in Ashland about one mile from the Site. The Ashland site temperature data from June 2005 were compared with the surface temperature water data from Stryker Bay (Duluth, MN) (Van Kesteren, 2002) (Fig 5.15). This temperature distribution curve is based on 11 years averaged data from 1991 until 2001. The Ashland site temperatures correspond well with the surface temperature water function developed from Stryker Bay. The Xcel Energy

intake water temperatures are somewhat lower in summertime and higher in winter time. This is caused by the 10 m water depth of the intake. It was concluded that based on the available data the existing surface water temperature function in DELCON can be applied for the Ashland site.

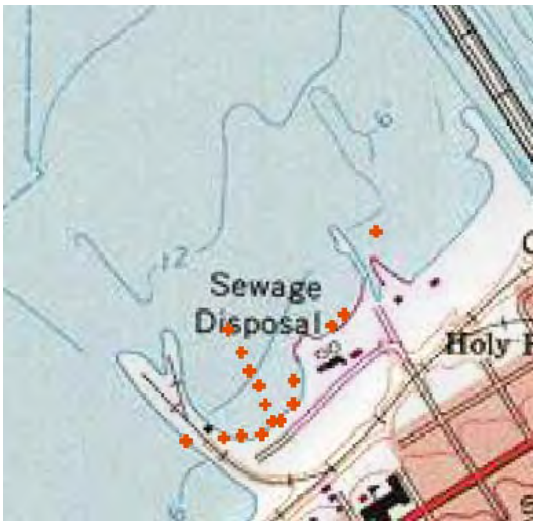


Figure 5.14 Locations surface water temperatures June 2004

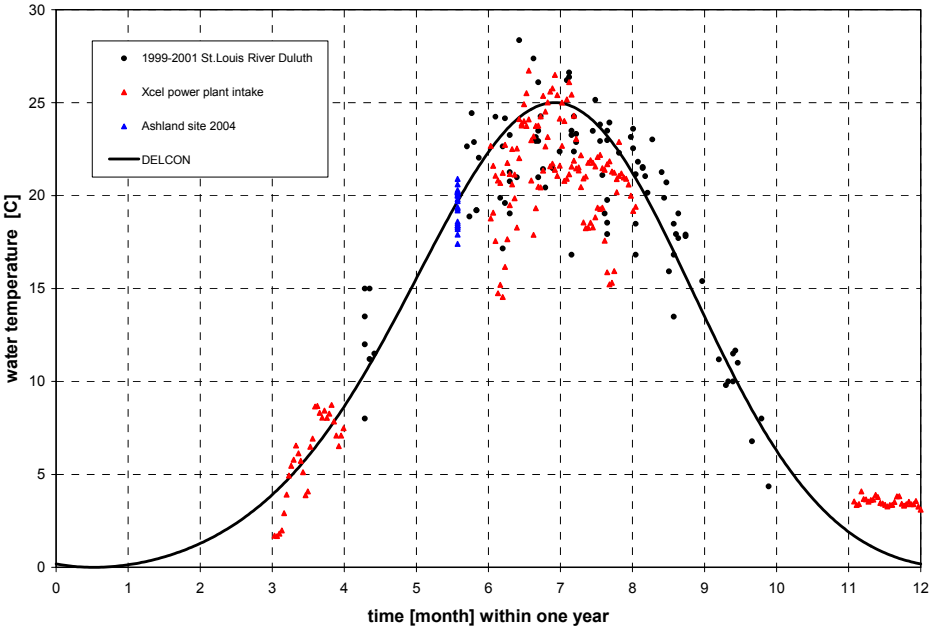


Figure 5.15 Temperature function Stryker Bay and temperature data Ashland site

6. DELCON Simulations

6.1 Alternatives remediation

URS defined four potential sediment remedial alternatives for the Ashland site:

Alternative #1:
No action.

Alternative #2:
Dredge sediment outside sheet pile with 6" overdredge and put dredged slurry in CDF between sheet pile wall and Ashland shoreline. The dredged slurry will be capped with sand of variable thickness: 2, 3.5, 5.2 and 7 ft (due to conversion factors different layer thicknesses were computed except the 2 ft). Dredging options include mechanical dredging at high solids (40% solids) and hydraulic dredging at low solids (18% solids). For this simulation, the dredging is assumed to occur for 6 months of operation per year with 5 working days in a week and 10 hrs per day. The production rate is about 60 cy/hr, which yields a weekly averaged production rate of 428 cy/day.

With the original location of the sheet pile wall at the 2500 ft coordinate vertical (see Fig.5.2) the total dredged volume was 73,771 cy, which corresponds to the revised clean-up goal of approximately 10 ppm TPAH. The shift 50 ft northwards reduces the dredging volume by 4,260 cy to 68,857 cy. This is still more than the nominal capacity of the CDF of 58,117 cy, but due to consolidation will fit in the CDF.

Alternative #3a:
Dredge sediment to a depth of 4 ft and cap the whole dredged area with sand with variable thickness: 1, 2, 3, 4 and 5 ft. The dredging rate is the same as in alternative #2. The model was used to determine what thickness of cap is required reach pre-dredge bathymetry after capping and consolidation.

Alternative #3b:
Dredge the contaminated wood layer to a depth of 2 ft and store it on site or landfill offsite and cap the whole dredged area with sand with variable thickness: 1, 2, and 3 ft. In between the cap and contaminated wood, a geotextile layer with activated carbon will be placed. Note that the carbon mat is for control of dissolved phase contaminants and not NAPL The dredging rate is half of alternative #2.

Alternative #4:
Dredge all sediments with PAHs above approximately 10 ppm. This means dredging to a depth of 10 ft or more and backfill with thin cap of sand or native clean sediment.

The DELCON simulations are done for alternatives #2 and #3.

6.2 Timeline

In the DELCON simulations the present situation before remediation is computed in a way that the present levels of in-situ layers are simulated. Therefore the simulation must follow the timeline of historical events at the site as shown schematically in Fig.6.1. The timeline of the simulations starts in 1650 AD with the placement of Miller Creek deposits (clay, silt and sand) on top of the Copper Falls Formation at a level of 547 ft. The Miller Creek clay is placed close to consolidation as one layer. The Miller Creek silt and sand are placed in 30 years. The period in between 1680 AD and the start of lumber activities at the site in 1884 AD are used to adjust the numerical simulation to the boundary conditions. In the period of 55 years from 1884 until 1939 AD lumber and tar residues are deposited forming the contaminated wood layer. Sedimentation of native sediment after 1939 is very limited (less than 10 cm) and therefore not included in the simulations.

The dredging activities were assumed to occur in 2007 AD from May 1st until October 31st. The capping activities were assumed to occur in 2008 AD from May 1st until October 31st. The simulations are continued until 2100 AD.

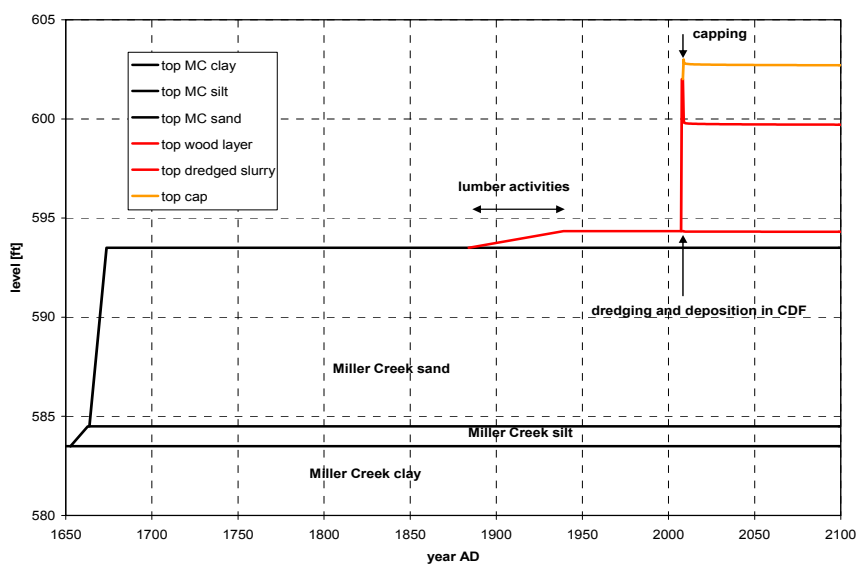


Figure 6.1 Timeline Ashland site (alternative #2 box B5)

6.3 Boundary Conditions

The lower boundary of the DELCON simulation is the Copper Falls Formation, which acts as an aquifer. Therefore, the lower boundary at a level of 547 ft is a drained boundary both for pore fluids and dissolved gasses. An excess pore pressure at the lower boundary is set at 12 ft water column with respect to water level in the bay.

In alternative #2 with a CDF, the top of the dredged slurry will be filled up to about 603.6 ft in order to store all the dredged material. Drains will be placed in the top of the slurry and the slurry covered by a membrane (see Fig.6.2). The cap on top of the membrane has its own drainage. The hydraulic head at the upper boundary of the dredged slurry is kept at 602 ft. Because there is no connection between the pore fluids of the cap and the slurry, the total weight of the cap, including pore water, act as vertical load for consolidating the slurry.

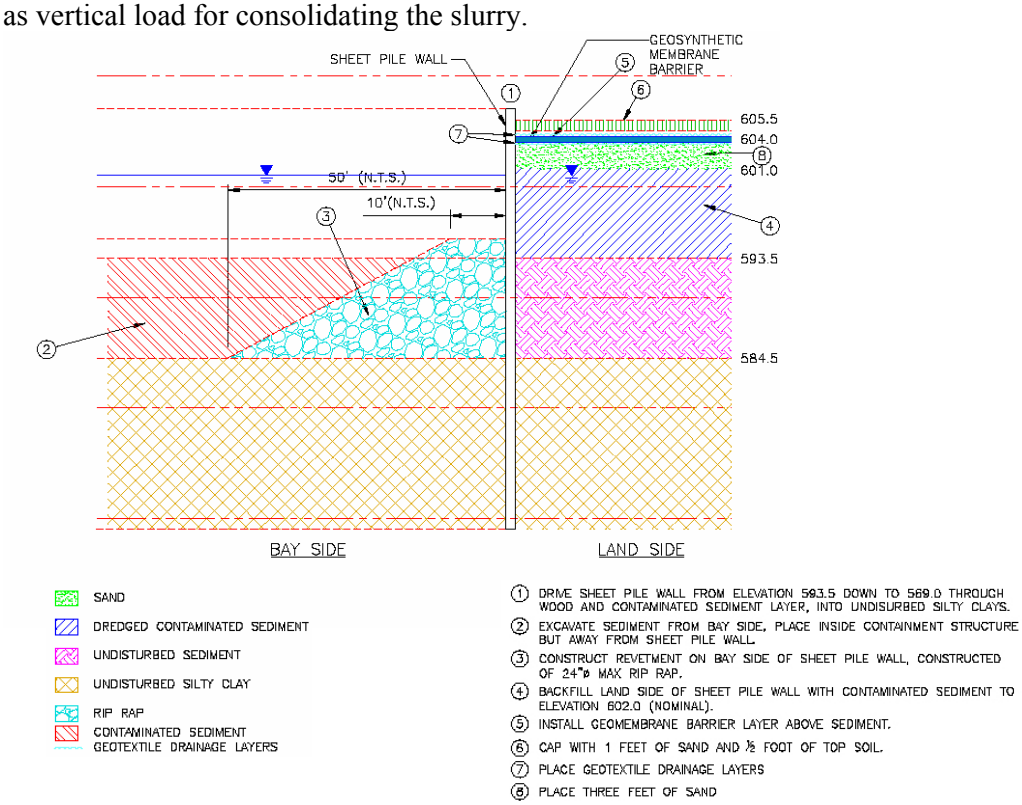


Figure 6.2 CDF cross section at sheet pile wall (alternative #2)(conceptual: source URS)

In alternative #3a and #3b the upper boundary condition is drained with the hydraulic head equal to the lake water level of 602 ft.

The generation of gas is a kind of internal time boundary that supplies at a certain rate of dissolved methane and carbon dioxide to the pore water and NAPL if present. There is only information about gas generation of the contaminated wood layer. Furthermore the organic content in the contaminated wood layer is very high and therefore only that layer is generating methane and carbon dioxide in the DELCON

simulations. The quantities of both gasses in mol/hr are assumed to be equal. The production rate of gas however will decrease over time. The second order degradation model of Middelburg (1989) is used in DELCON and is given by (see Winterwerp and Van Kesteren 2004):

$$\frac{\mathrm{d}\xi^{OM}}{\mathrm{d}t} = -k(t)\,\xi^{OM} \tag{6.1}$$

where ξ^{OM} is the content of organic matter in the total solids [kg/kg], t is time [year] and k the time-dependent decomposition decay function, given by:

$$k(t) = f(T)\; k_1\left(t_{age} + t\right)^{k_2} \quad [\text{year}^{-1}] \;\; ; \;\; f(T) = \frac{m^{T-T_c} - 1}{m^{T_r - T_c} - 1} \tag{6.2}$$

in which t [years] is time, k_1 and k_2 are coefficients, $f(T)$ is a correction function for temperature, m is a dimensionless temperature scale, T_c is the lowest temperature at which decomposition of organic matter occurs, T_r is a reference temperature, and T is the actual temperature, t_{age} represents the initial age of the organic matter.

The coefficients k_1 and k_2 are based on a large data set (Middelburg, 1989): k_1 = 0.178, k_2 = -0.95. In Fig.4.5 (section 4.1) a linear temperature effect is found, which can be simulated with $m \approx 1.001$. The reference temperature T_r is 20 ^{o}C and the critical temperature T_r is 6.76 ^{o}C. The 2nd order model is shown in Fig.6.3 and starts in 1884 AD for the wood layer. The decay of organic matter is such that it equals the amount of organic matter and measured decay rate in 2007.

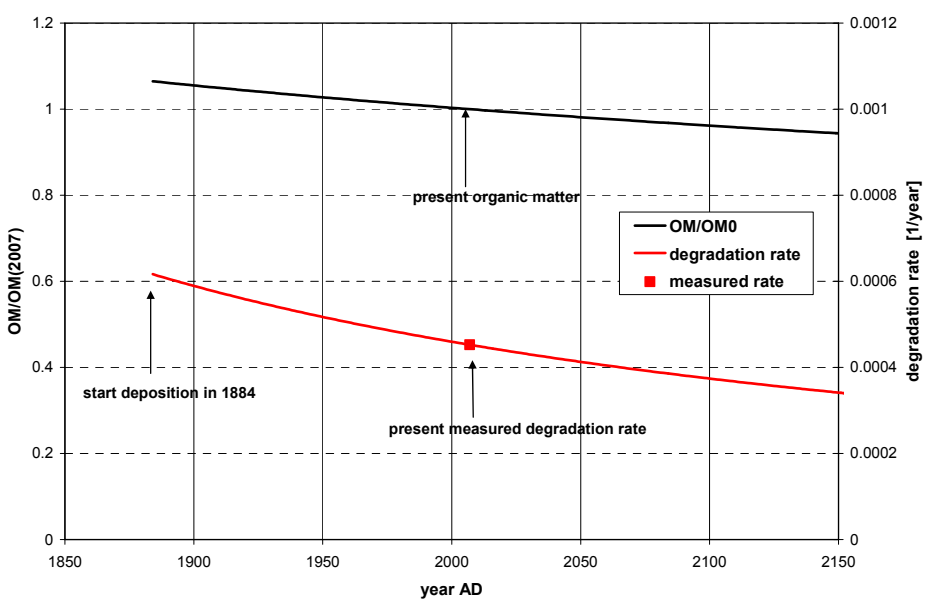


Figure 6.3 Decay of organic matter in time

6.4 Simulation Results Alternative #2

The DELCON simulations with variable cap thicknesses were done for the hydraulic dredging option. It was expected that mechanical dredging with a deposition solid content of 40% (see section 6.1) will result in a surface level that is somewhat lower than deposition of hydraulically dredged slurry. Therefore the mechanical dredging is compared with hydraulic dredging after consolidation including creep.

As indicated with the timeline (Fig.6.1) the DELCON simulations started in 1650 AD. For all boxes 1 to 5 the simulations were done until May 2007, just before deposition of dredged material starts. The dredged in-situ volume is 68,857 cy and will be dredged with a time averaged capacity of 428 cy/day (see section 6.1). With an in-situ averaged solids content of 44.9% and solid density of 1889 kg/m^3 (see Table 5.3) the total dredged solids is 20803 cyds or 15905 m^3 and the solids production rate is 0.001146 m^3/s. The solids deposition flux in the CDF is equal to the solids production rate. However the total discharge into the CDF is determined by dilution during hydraulic dredging. As discussed in section 5.4.5 the solid content of 18% for the hydraulically dredged slurry will result in segregation with relative high settling velocities; the minimum solid content for a non-segregated slurry is 28% or maximum void ratio of 4.867 (see Table 5.3). This yields a total discharge of 0.00672 m^3/s.

It is assumed that the dredged material is pumped in with a sub-aqueous tremie at the deepest area box B5 (see Fig.5.5). The deposition rate is then determined by the surface area of B5. When the top level of the slurry reaches the level of box B4, this area is flooded with the slurry and the deposition rate is than determined by the surface area of B5 and B4. The same procedure is followed until Box 1 is flooded also. The times that each subsequent box is flooded depends on the consolidation that takes place during deposition. After box B1 flooded the simulation is continued until a maximum level is reached. The most shallow area box B1 is reaching that level first. For the remaining boxes the deposition rate will increase, because the area of box B1 is not available anymore. During this last stage of filling the boxes B2 through B5 are subsequently filled up to the maximum level and with increasing deposition rate. The times of flooding, reaching the maximum and deposition rates in meter solids per second are listed in Table 6.1. The above sequence of filling the CDF means in practice that the decanting box for the effluent should be located at the deepest point near the sheet pile wall.

In order to determine the maximum level that can store the total dredged solids of 20803 cyds (15905 m^3), three maximum levels were applied resulting in three total dredged solids volumes (see Fig.6.4): starting with 602 ft, than 604 ft and in between 603.6 ft. By interpolation the final level of 603.69 ft was obtained, which has been used for the final computations.

Table 6.1 Times and deposition rates used in DELCON, alternative #2

box	time flooded [days]	time max level [days]	deposition rate solids [m/s]
#1	73.75	147.57	3.921E-08
#2	30.04	154.06	4.924E-08
#3	12.70	157.67	6.964E-08
#4	4.72	159.69	9.915E-08
#5	0.00	160.51	1.955E-07

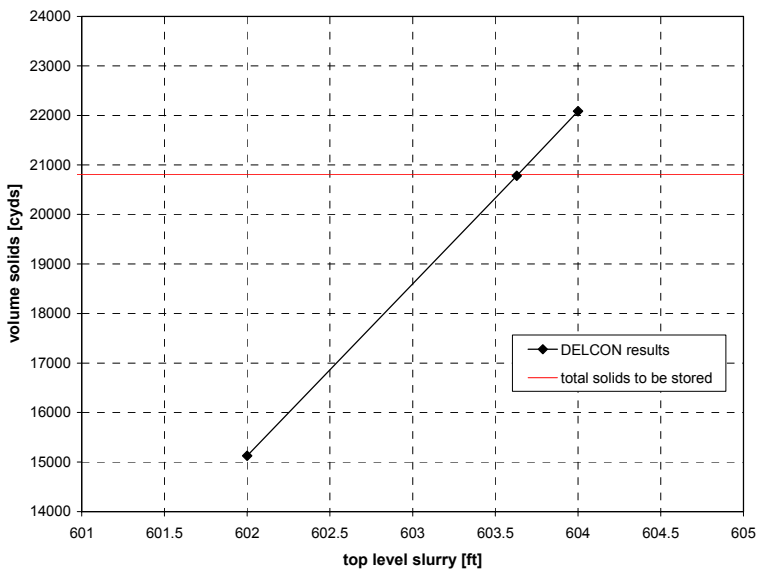


Figure 6.4 Determination of maximum deposition level in CDF

For capping with sand the same dredging capacity of 428 cy/day is assumed. The practical density range for hydraulic sand transport is about 1200 kg/m^3 to maximum 1600 kg/m^3. For the deposition rate a density of 1400 kg/m^3 was used. This yields an averaged solids deposition flux of 0.003097 m^3/s. With a total surface area of 29255 m^2 or 314575 ft^2 a deposition rate of 1.0596E-07 m/s results for all boxes and all cap layer thicknesses.

Typical results of the DELCON simulations are shown in Fig.6.5a through Fig.6.5d in which for box B4 profiles of void ratio, excess pore water pressure, discharge of pore water and methane concentrations are shown for different times: just before capping, during capping (after 20 days) and when capping is finished. The results are shown for 2 ft cap.

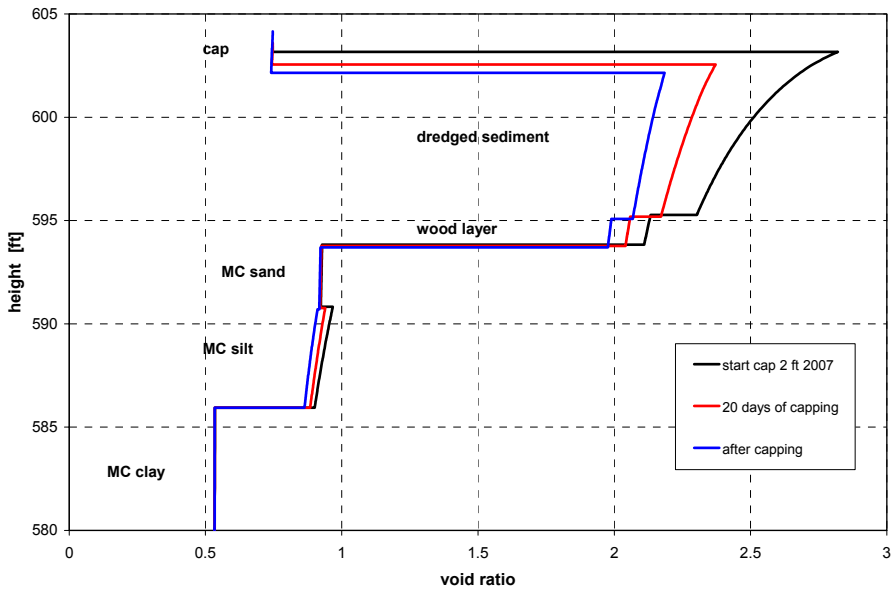


Figure 6.5a Profiles void ratio in box B4

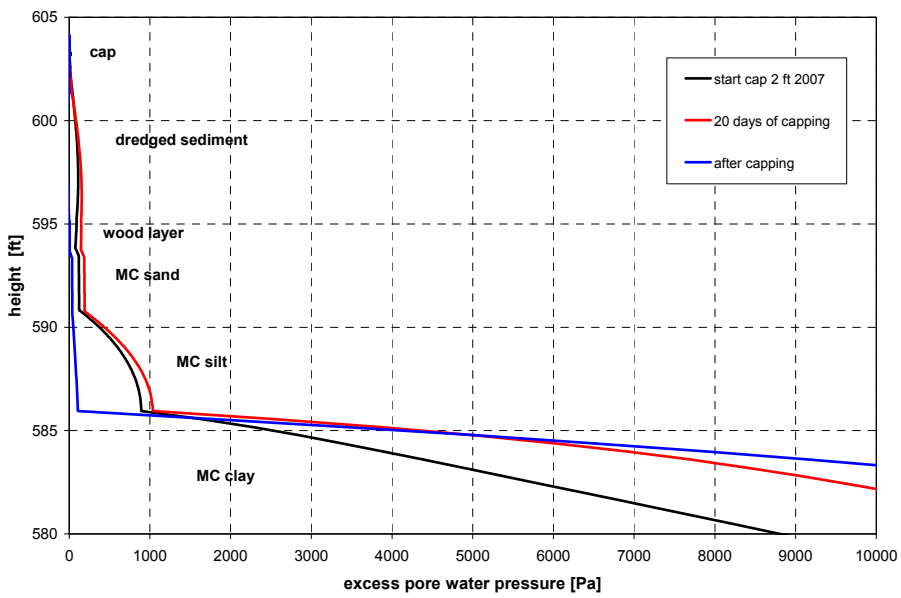


Figure 6.5b Profiles excess pore water pressure in box B4

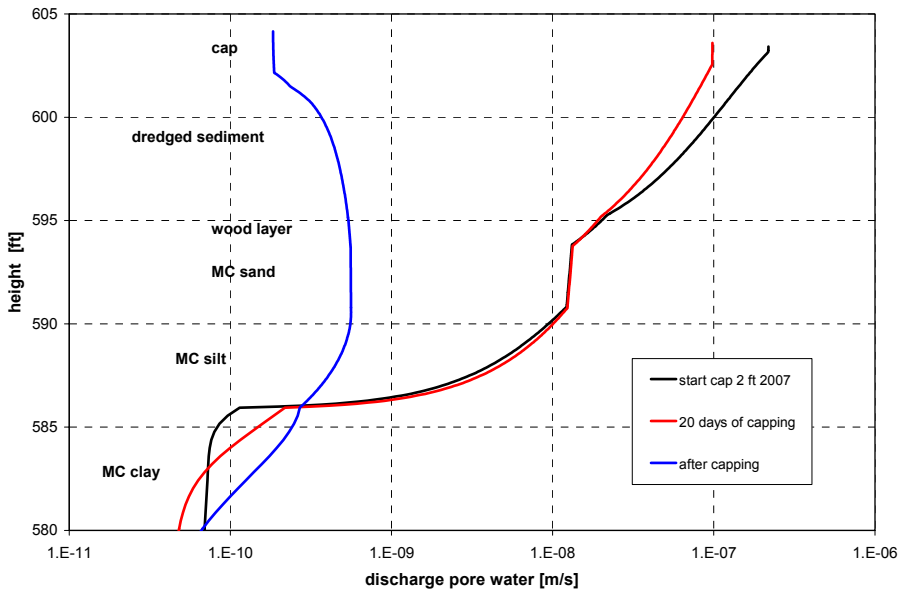


Figure 6.5c Profiles specific discharge in box B4

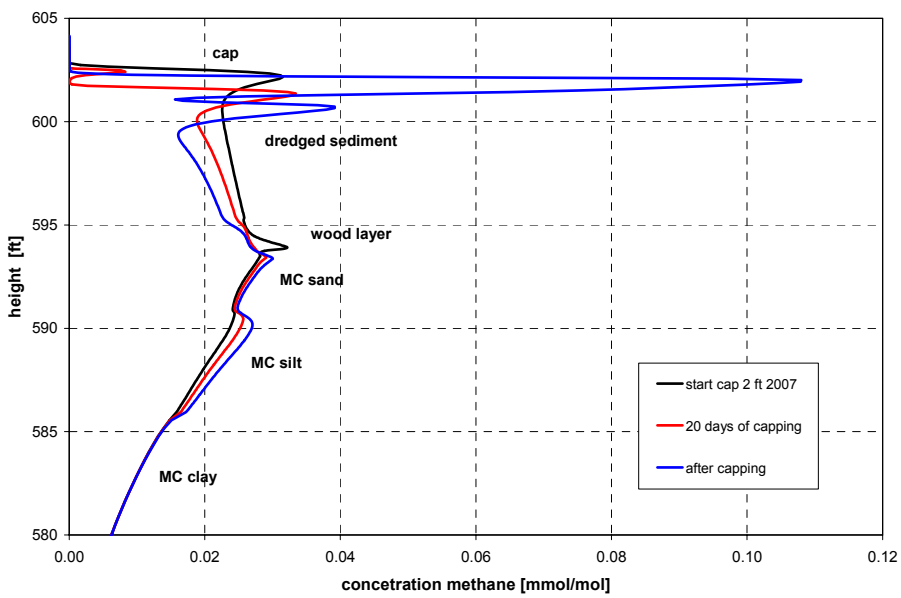


Figure 6.5d Profiles methane concentration in box B4

It can be observed in Fig.6.5b that the generated excess pore water pressures in the wood layer and deposited dredged sediment consolidate very rapidly and actually can follow the deposition and capping. This can be explained by the time scale of consolidation. Eq.(3.5) and a layer thickness of wood layer plus dredged sediment of maximal 10 ft (3 m) with only drainage on top, yields a time scale of 17 days, which is much shorter than the time of slurry depositing and capping. After capping only excess pore pressure remain in the Miller Creek clay for a period of 5 years (see section 5.4.1). The drop in discharge after capping in Fig.6.5c also shows the rapid

consolidation of the wood layer and dredged sediment. Given the rapid consolidation during deposition there will be no advantage to splitting up the deposition of the dredged material into two years.

The methane concentration in Fig.6.5d shows an increase in peak concentration during capping. Although capping insulates the sediment and should reduce methane concentrations, the capping is done during summertime and therefore gas production, which is temperature dependent, will be maximal.

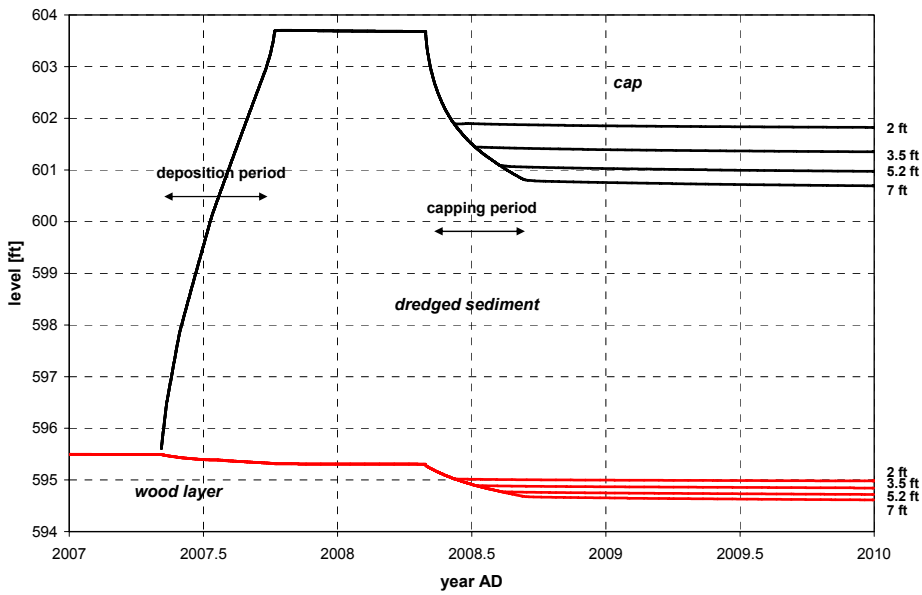


Figure 6.6a Time series levels of wood layer and dredged sediment (B4)

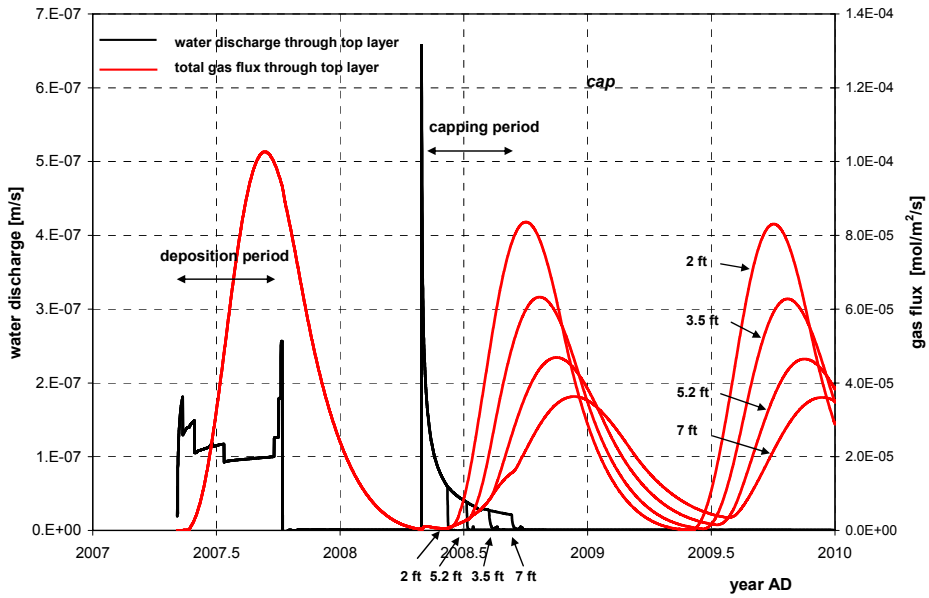


Figure 6.6b Time series water discharge and gas flux through top dredged sediment (B4)

In Fig.6.6a and Fig.6.6b time series are given for top level of layers, specific water discharge, gas flux through lake bed and through top of deposited slurry. In Fig.6.6a the rapid consolidation during deposition and capping can be observed as well. The settling after capping is creep of the wood layer and deposited slurry.

The water discharge through the top of the slurry layer (black lines in Fig.6.6b) is maximal at the start of capping. Because the deposition rate for all cap layer thicknesses is the same the discharge is independent of cap layer thickness. In Table 6.2 the maximum values are given together with the surface areas and total discharge. These discharges are much smaller than the discharge necessary to mobilize NAPL: 0.75 m/day (see section 3.3.2). Therefore no NAPL displacement is expected, but NAPL will be redistributed in the pore system.

The gas flux through the top of the sediment layer (red lines in Fig.6.6b) is affected by the cap layer thickness due to the heat insulating effect. A thicker cap results in less gas release.

Table 6.2 Maximum water discharges during capping

box	surface area [ft^2]	specific discharge [m/day]	discharge [m^3/hr]
#1	64098	0.0446	11.07
#2	73379	0.0516	14.66
#3	52716	0.0522	10.65
#4	61291	0.0568	13.48
#5	63091	0.0583	14.24
sum	314575		64.09

In Fig.6.7 the time series and profile results are combined in a colored plot with contours for void ratio (Fig.6.7a), temperature in ^{o}C (Fig.6.7b) and methane concentration in mmol/mol (Fig.6.7c). These figures are given for box B4 with a 2 ft cap and have the same time frame as Fig.6.6: 2007 until 2010. The void ratio plot (Fig.6.7a) shows a rapid consolidation during deposition. After the sand cap is deposited the void ratio is still changes in time due to creep. Note that the top level of the cap is almost the same as the level of the dredged sediment before capping. In Fig.6.7b the temperature variation with depth and time is given. After capping it shows that the temperatures in the dredged sediment are reduced due to the insulating effect of the cap. In Fig.6.7c the methane concentration is depicted. The highest concentrations occur in areas with highest temperatures (Fig.6.7b). During the placement of the sand cap very low concentrations appear (brown area) in the dredged sediment. This is a result of the increased upward advective transport due to local consolidation. After the cap is placed diffusive transport into the cap layer can be observed. In case of a membrane in between the sand cap and top of dredged sediment (see Fig.6.2) gas will be trapped below the membrane.

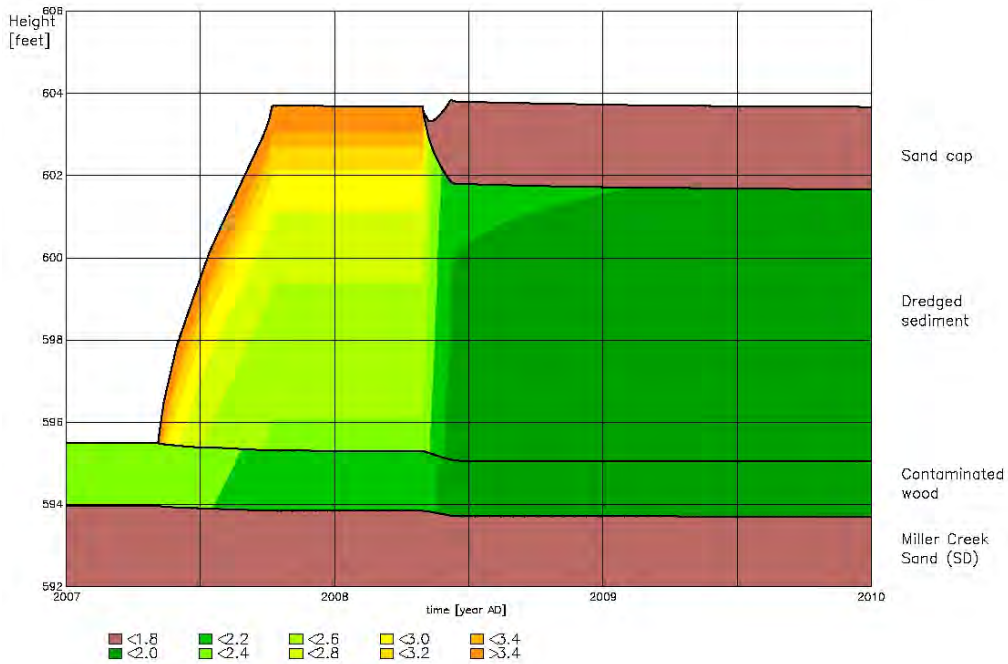


Figure 6.7a Void ratio as function of time and depth in box B4

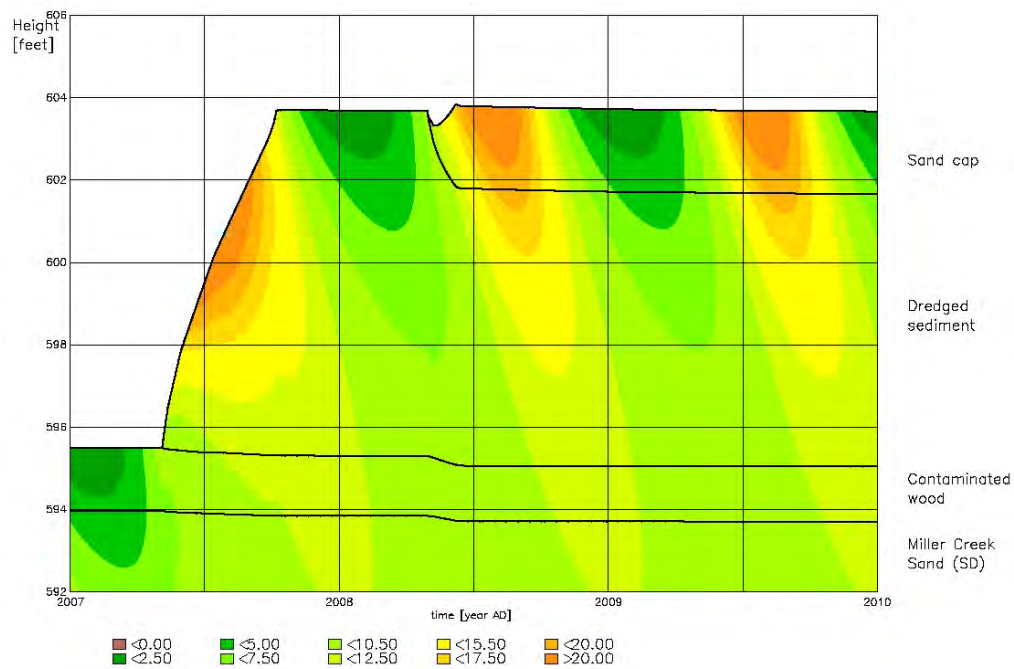


Figure 6.7b Temperature in ^{o}C as function of time and depth in box B4

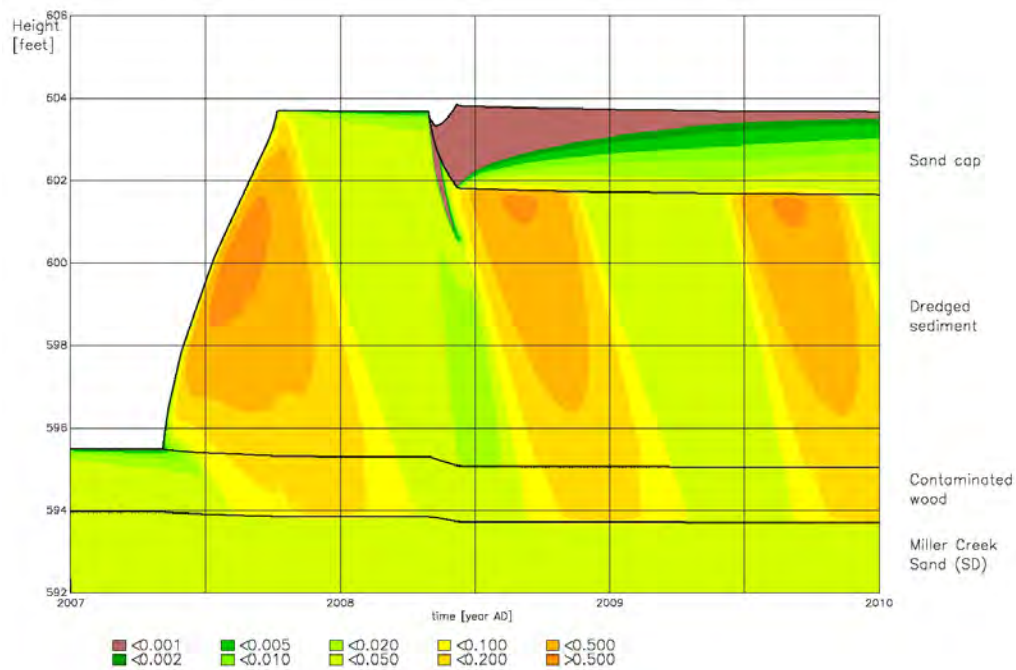


Figure 6.7c Methane concentrations in mmol/mol as function of time and depth in box B4

In Fig.6.8 the settling of layers are shown for all 5 boxes, by plotting the settlements as function of the cumulative surface area. Depicted are the top of Miller Creek sand, contaminated wood layer, dredged sediment deposit and cap layer (3.5 ft) for 4 times: just before deposition of dredged sediment (2007), after deposition (2008), after capping (2010) and long term settlement (2100). The settlement in box B4 and B5 are maximal. This is caused by the combination of large amount of dredged sediment and a thick wood layer. Near the sheet pile (box B5) settlement is somewhat less, because the wood layer is very thin and deposition was continuing until the end, while the other boxes stopped earlier (see Table 6.1). Near the shoreline (box B1) the final level is maximal due to the shallow height of the dredged material. The final top level of the dredged sediment (2100 AD) in each box is listed in Table 6.3 for all 4 cap layer thicknesses. In Table 6.4 the settlements are given for the top of the dredged sediment in each box and for all cap layer thickness. The averaged final height (in 2100 AD) is depicted in Fig.6.9 together with the averaged level of the top of dredged sediment. From this graph it can be concluded that a cap of 1.5 ft is sufficient to get the averaged top level of the dredged sediment below 602 ft. Further increase of the cap layer thickness gives less settlement. In Fig.6.9 also the final top levels are shown for mechanical dredging. It is assumed that mechanical dredging does not dilute the dredged sediment. The effect however on the final level in 2100 is less than 0.18 ft with respect to hydraulic dredging assuming no segregation, which can be achieved at a solid content above 28%.

In the event the solid content of the dredge material is less than 28%, segregation of the coarse fraction (mainly sand 63% by weight) will result in less consolidation of the fines and wood fibers in the CDF. Under these conditions the sand fraction

builds its own "skeleton", i.e. sand particles rest on other sand particles, and as a result the full weight of the particulate portion of the dredge slurry is not effectively consolidating the fines and wood fibers. This will result in a much higher final layer thickness of the dredge material, perhaps by a factor of 2.

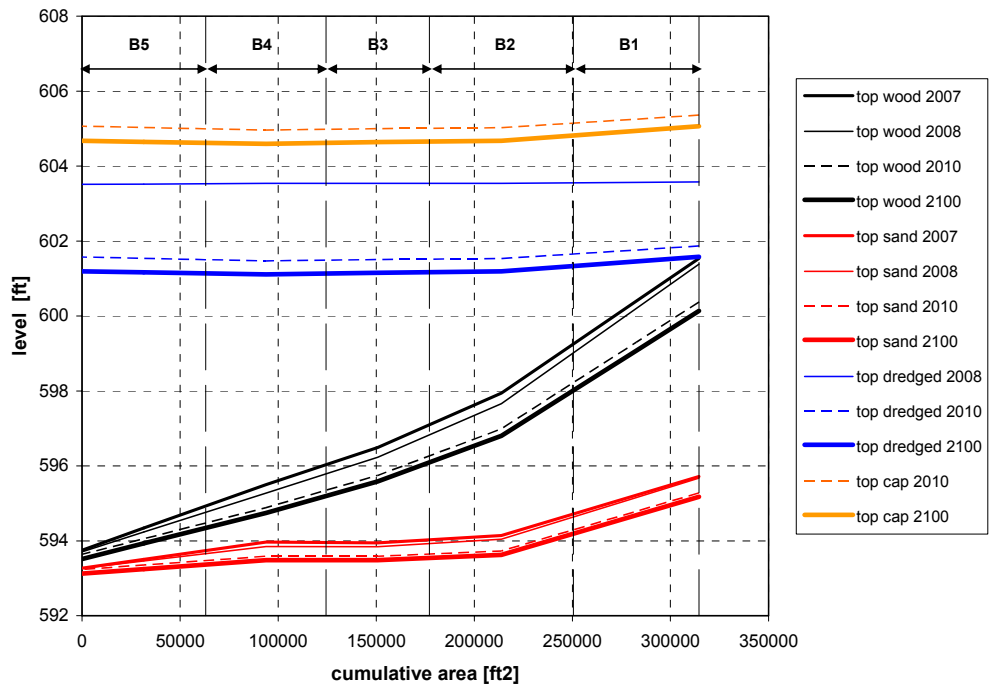


Figure 6.8 Settling profiles cap 3.5 ft

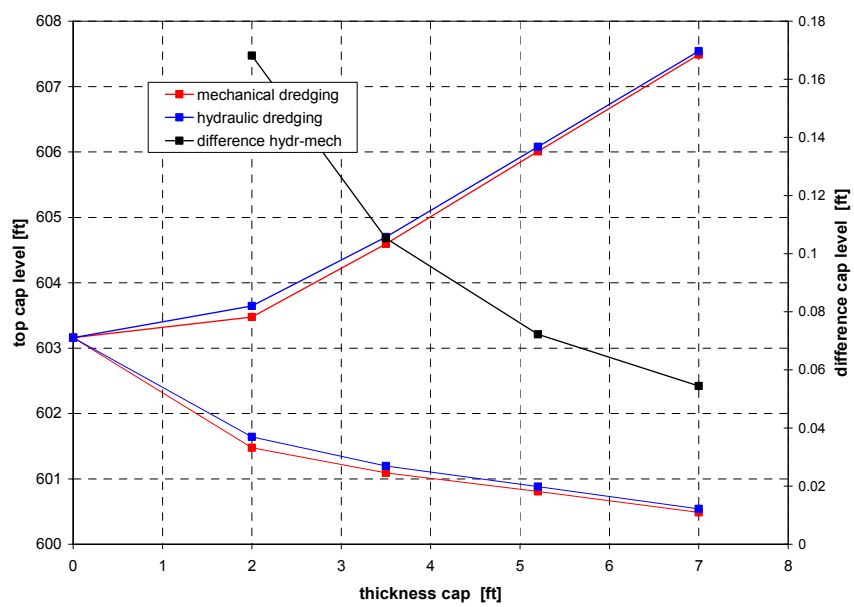


Figure 6.9 Averaged top level of dredged sediment and cap for hydraulic and mechanical dredging

Table 6.3 Final top level dredged sediment in 2100 AD

cap thickness [ft]	B 1 [ft]	B 2 [ft]	B3 [ft]	B4 [ft]	B5 [ft]
2	601.87	601.63	601.59	601.55	601.57
3.5	601.45	601.19	601.15	601.11	601.16
5.2	601.10	600.82	600.79	600.75	600.83
7	600.83	600.55	600.52	600.48	600.58

Table 6.4 Final settlement top level dredged sediment in 2100 AD

cap thickness [ft]	B 1 [ft]	B 2 [ft]	B3 [ft]	B4 [ft]	B5 [ft]
2	-1.69	-1.91	-1.95	-1.99	-1.95
3.5	-2.11	-2.35	-2.39	-2.43	-2.36
5.2	-2.46	-2.72	-2.74	-2.79	-2.69
7	-2.73	-3.00	-3.01	-3.06	-2.94

6.5 Simulation Results - Alternative #3

Alternative #3 (see section 6.1) considers two dredging depths: 4ft (#3a) and 2 ft (#3b). In order to determine the final height of the lakebed, different cap layer thicknesses were simulated with DELCON in each box. Given the layer thickness of the wood layer in each box as depicted in Fig.5.5, a 4 ft dredging depth will remove the whole contaminated wood layer in box B2, B3, B4 and B5. In case of 3 ft dredge depth only in box B3, B4 and B5 the wood layer is completely removed. For a 2 ft dredging depth this holds only for box B4 and B5. The DELCON simulations were done for the boxes where a compressible wood layer is still present. In the other boxes, the compressibility of the remaining soil layers are very low which will always result in a higher seabed level. In Table 6.5 the computed cap layer thickness are given that result in the same seabed level. Also in this alternative the discharges of pore water during capping are below the threshold for NAPL movement.

Table 6.5 Cap layer thickness for constant sea bed level

dredging depth [ft]	B 1 [ft]	B 2 [ft]	B3 [ft]	B4 [ft]	B5 [ft]
2	2.34	2.32	2.17		
3	3.22	3.32			
4	4.29				

7. Conclusions and Recommendations

7.1 Conclusions

The permeability of the wood layer according to the SIC test show that a solids content less than 28% will be in the hindered settling regime. In the hindered settling regime there is no contact beween particles, but the settling velocity of each fraction is reduced by the volume concentration of solids. In this regime, segregation of fraction can occur during deposition in the CDF. In general, segregation yields a larger volume in the CDF after consolidation with the same total amount of solids. Therefore the DELCON simulations for hydraulically dredged contaminated wood layer were performed at a solid content above 28%.

In the event the solid content of the dredge material is less than 28%, segregation of the coarse fraction (mainly sand 63% by weight) will result in less consolidation of the fines and wood fibers in the CDF. The final layer thickness of the dredge material could be greater by up to a factor of 2 compared to consolidation of dredge material with a solid content greater than 28%.

The permeability of the contaminated wood layer under the CDF and the dredged contaminated sediment is such that consolidation times are less than 17 days, which is much less than the slurry deposition time and capping time of maximum 180 days. The drainage of these layers is almost instantaneously when loaded in a rate that corresponds to the capacity of the dredging equipment (428 cyds/day). The remaining settlement is mainly due to creep of the wood layer and dredged contaminated sediment in the CDF. There will also be some contribution to consolidation by the Miller Creek clay layer, but that will end after the time scale of about 5 years.

Given the rapid consolidation there will be no advantage to phasing deposition of the dredged sediment over two years.

The compressibility of the wood layer is mainly determined by the organic fibers and much less by the mineral fraction, which is mainly silt and sand. The clay fraction is only 3.4% of the mineral fraction and is only able to reduce permeability.

For bubble formation in the wood layer sediment, the air entry value of the wood layer is important. With the measured air entry value of 2.69 kPa the strength of the sediment must be smaller than 360 Pa in order to get bubble formation. A larger strength will result in de-saturation of the pore system. The in-situ strength is about 200 Pa. After consolidation this strength increases above 360 Pa and therefore it is expected that production of methane and carbon dioxide will de-saturate the largest pores and create pathways for gas releases.

The specific discharges through the top layer of the dredged sediment in the CDF during capping with sand are much smaller than the discharge necessary to mobilize NAPL (0.75 m/day). Therefore no NAPL displacement is expected. That holds also for alternative #3.

In order to store the total amount of dredged solids (20,803 cyds) in the CDF, the level of the hydraulically dredged slurry must be maximum 603.64 ft. A cap thickness of 1.5 ft is sufficient to get the averaged top level of the dredged sediment below 602 ft.

The effect of mechanical dredging is almost the same as hydraulic dredging, due to the rapid consolidation of the wood layer material. Mechanical dredging will result in a lower final level than with hydraulic dredging, however the difference in final level is less than 0.18 ft.

The required cap layer thickness in Alternative #3 to get the same lake bed level after capping is slightly more than the dredging depth.

7.2 Recommendations

The permeability of the wood layer according to the SIC test show that a solids content of 28% or lower will be in the hindered settling regime and therefore result in a lot of segregation in pipeline transport and deposition in the CDF. It is recommended to perform settling test at different diluted concentration in order to determine segregation levels.

If hydraulic dredging is anticipated and it appears that the solids content of he dredge material will be less than 28%, then these conditions should be modeled as part of remedial design.

Given the sequence of filling in the CDF, where the deepest point in the CDF gets the last solids at the end of filling, it is recommended to locate the decanting box for the effluent at the deepest point near the sheet pile wall.

In the present study no information was available about the volume concentration and size characteristics of the large logs present in the contaminated wood layer. The structure of these logs is unknown and could hamper consolidation of the existing wood layer. The percent of large logs by volume will reduce settlement by at least 10%, but could be more if the sediment in between the logs remains under-consolidated.

8. References

Marle, C.M. 1981 Multiphase flow in porous media, Gulf Publishing Company Houston Texas.

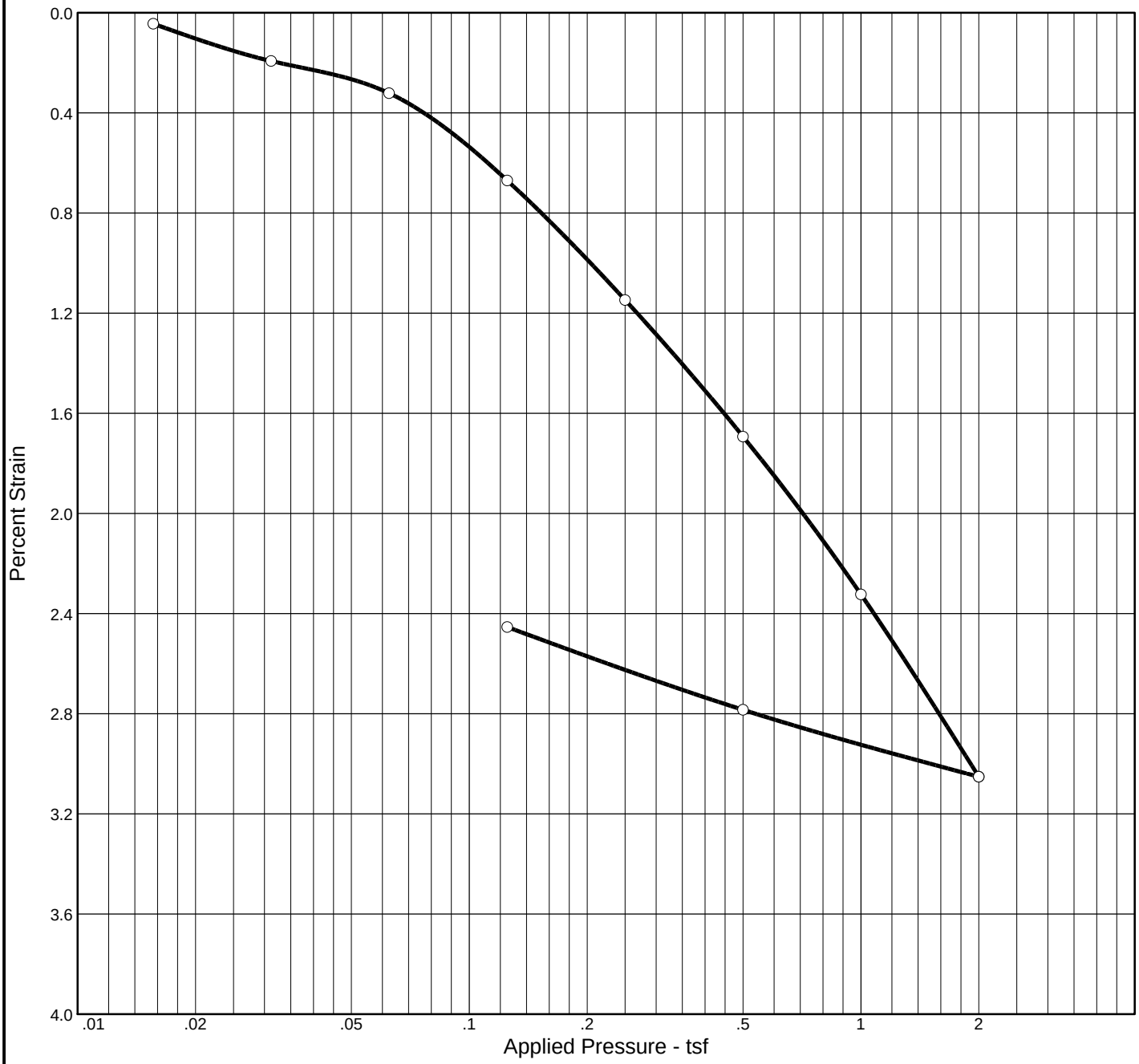
URS. 2007. Remedial Investigation Report. Ashland/Northern States Power Lakefront Superfund Site.

Winterwerp, J.C. and W.G.M. van Kesteren. 2004. Introduction to the Physics of Cohesive Sediment in the Marine Environment, in Development in Sedimentology 56, Elsevier.

Appendix A

Soil Engineering Testing

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
100.0 %	29.3 %	96.4	----	----	2.82	0.13	0.18	0.04	0.01			0.827

MATERIAL DESCRIPTION	USCS	AASHTO
Medium dense,wet,tan, silty fine Sand SM	SM	----

Project No. 07-2183 **Client:** URS Corp.

Project: Ashland Superfund, WI.
Project No. 25688375

Location: Flux Column 2G Sediment at Bottom

Remarks:
Bottom 1- 3 cm sediment after flux w/ 2.9 ft. sand cap

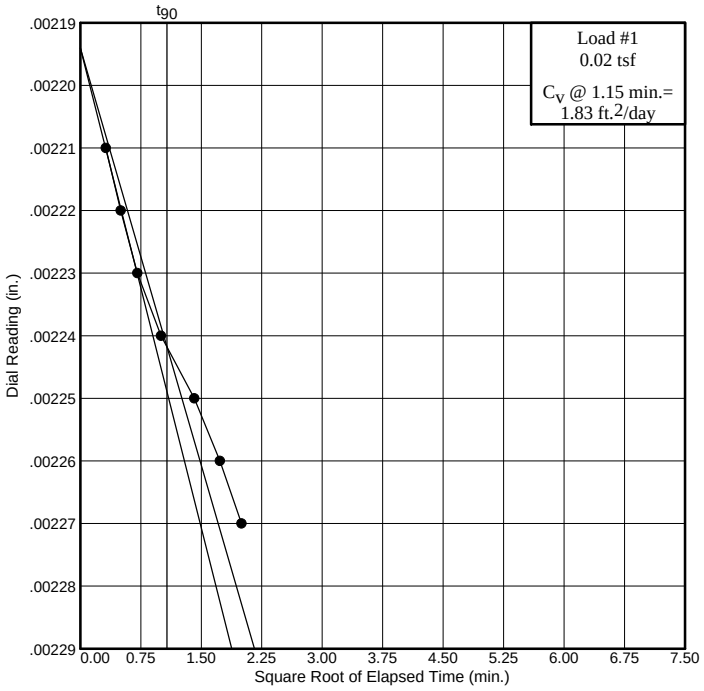
SOIL TECHNOLOGY

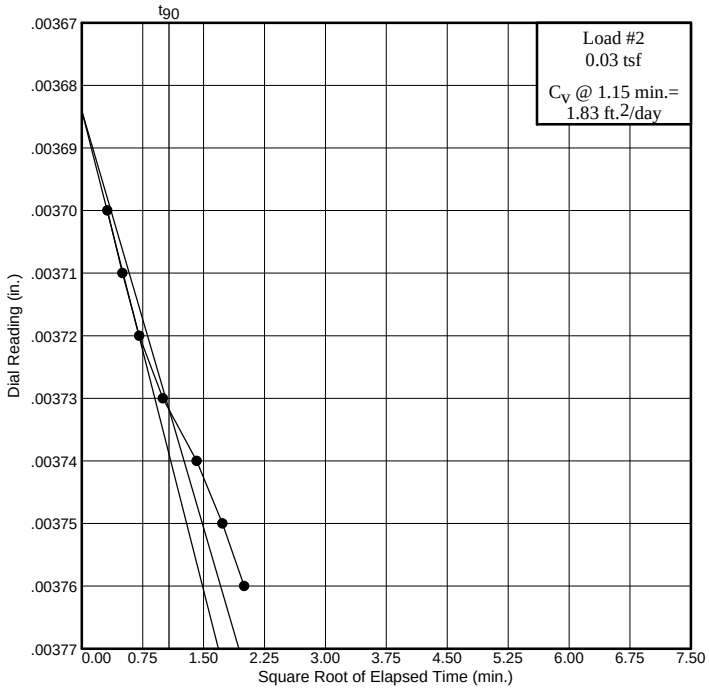
Bainbridge Island, WA

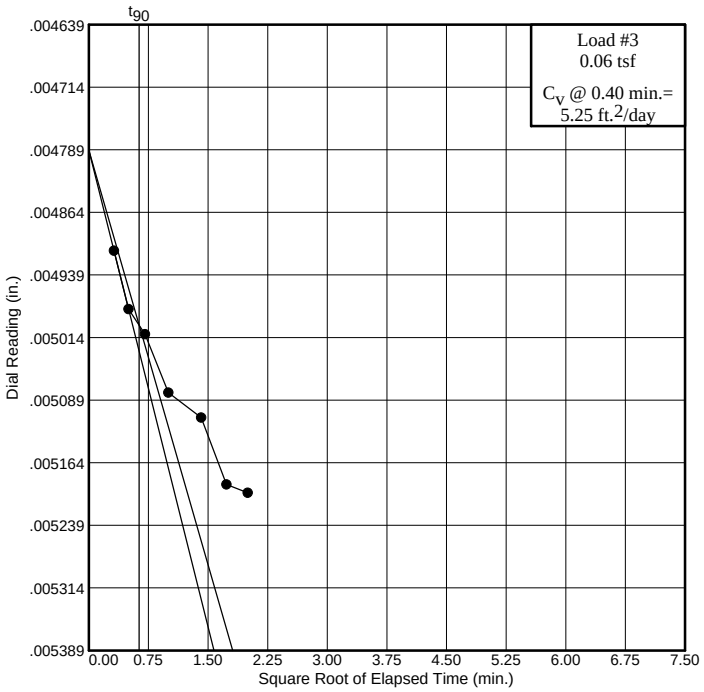
Figure 1

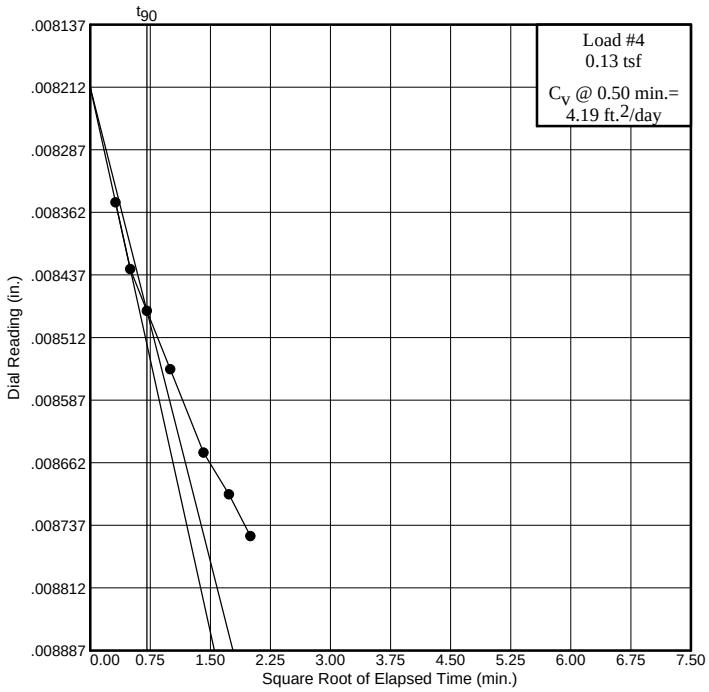
Dial Reading vs. Time

Project No.: 07-2183
Project: Ashland Superfund, WI.
Project No. 25688375
Location: Flux Column 2G Sediment at Bottom









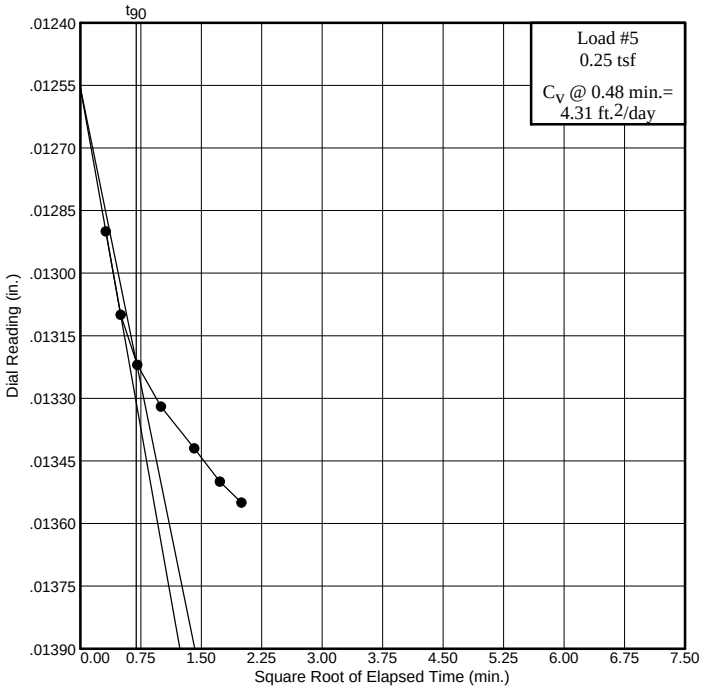
SOIL TECHNOLOGY

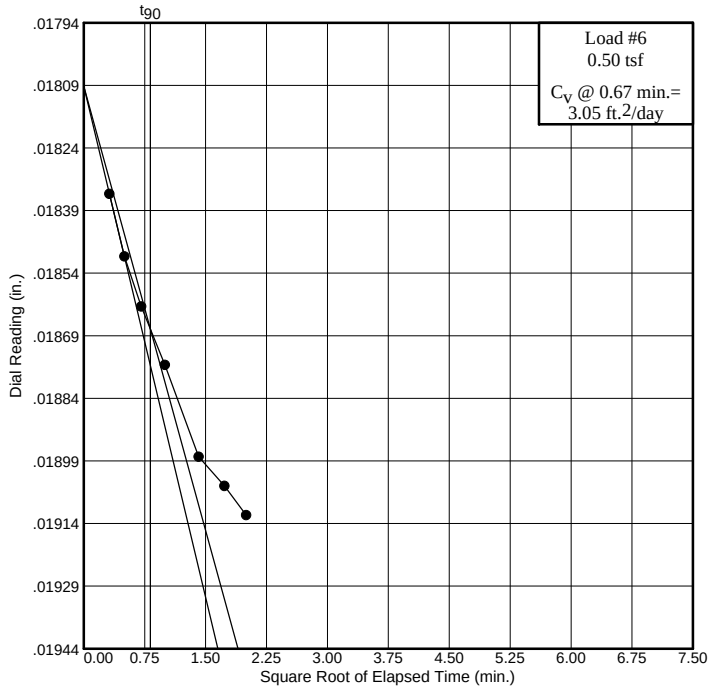
Bainbridge Island, WA

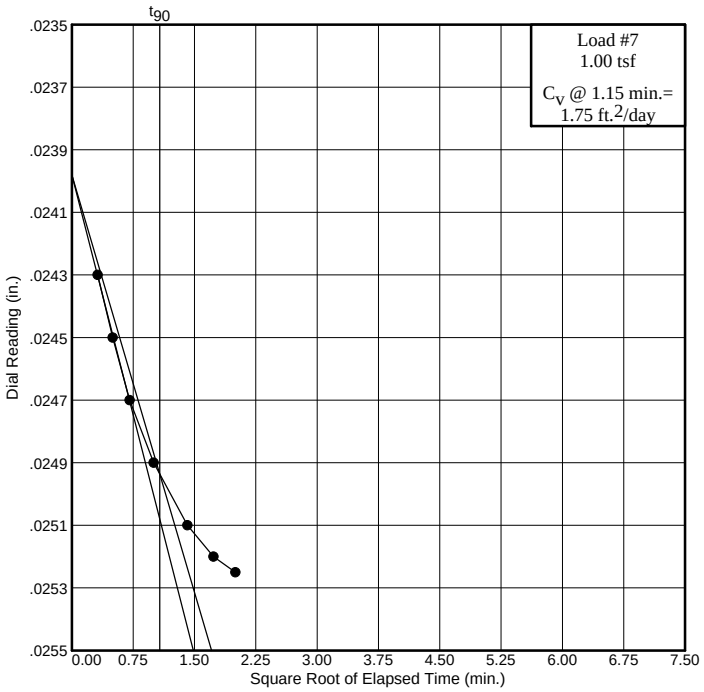
Figure 2

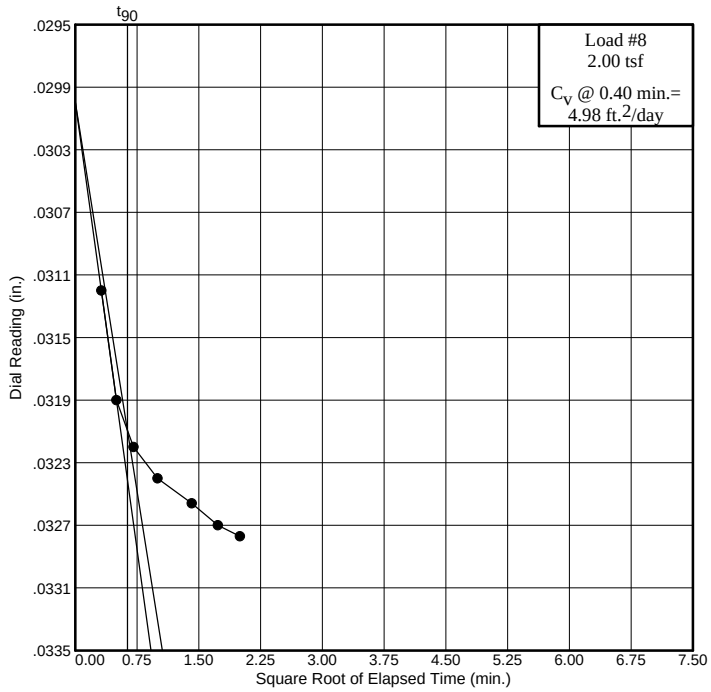
Dial Reading vs. Time

Project No.: 07-2183
Project: Ashland Superfund, WI.
Project No. 25688375
Location: Flux Column 2G Sediment at Bottom









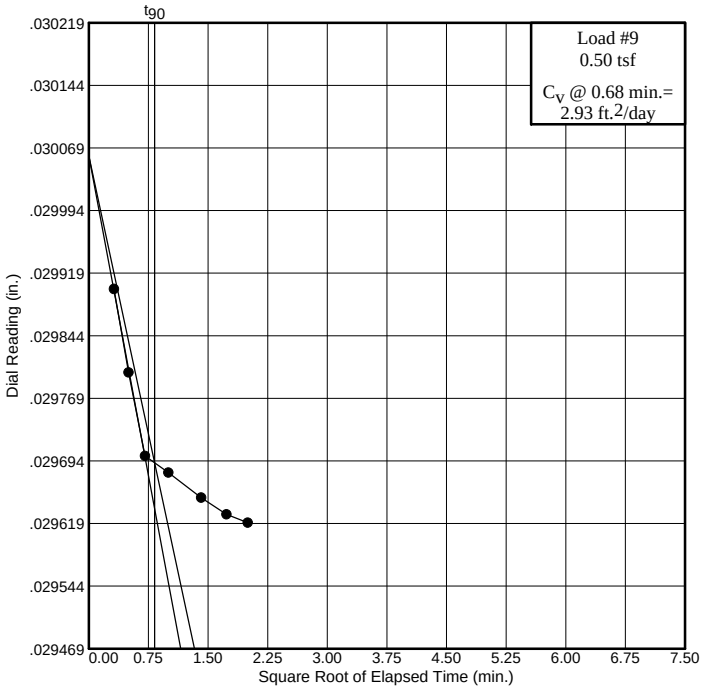
SOIL TECHNOLOGY

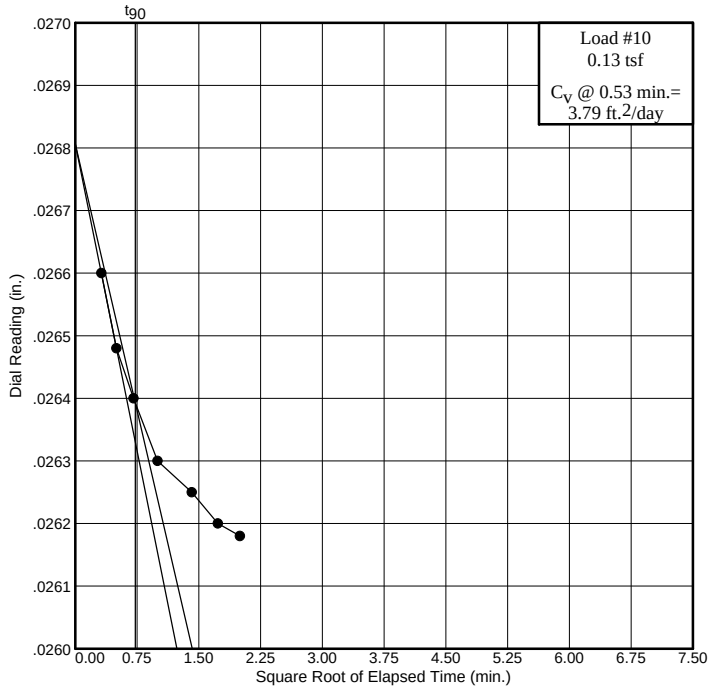
Bainbridge Island, WA

Figure 3

Dial Reading vs. Time

Project No.: 07-2183
Project: Ashland Superfund, WI.
Project No. 25688375
Location: Flux Column 2G Sediment at Bottom



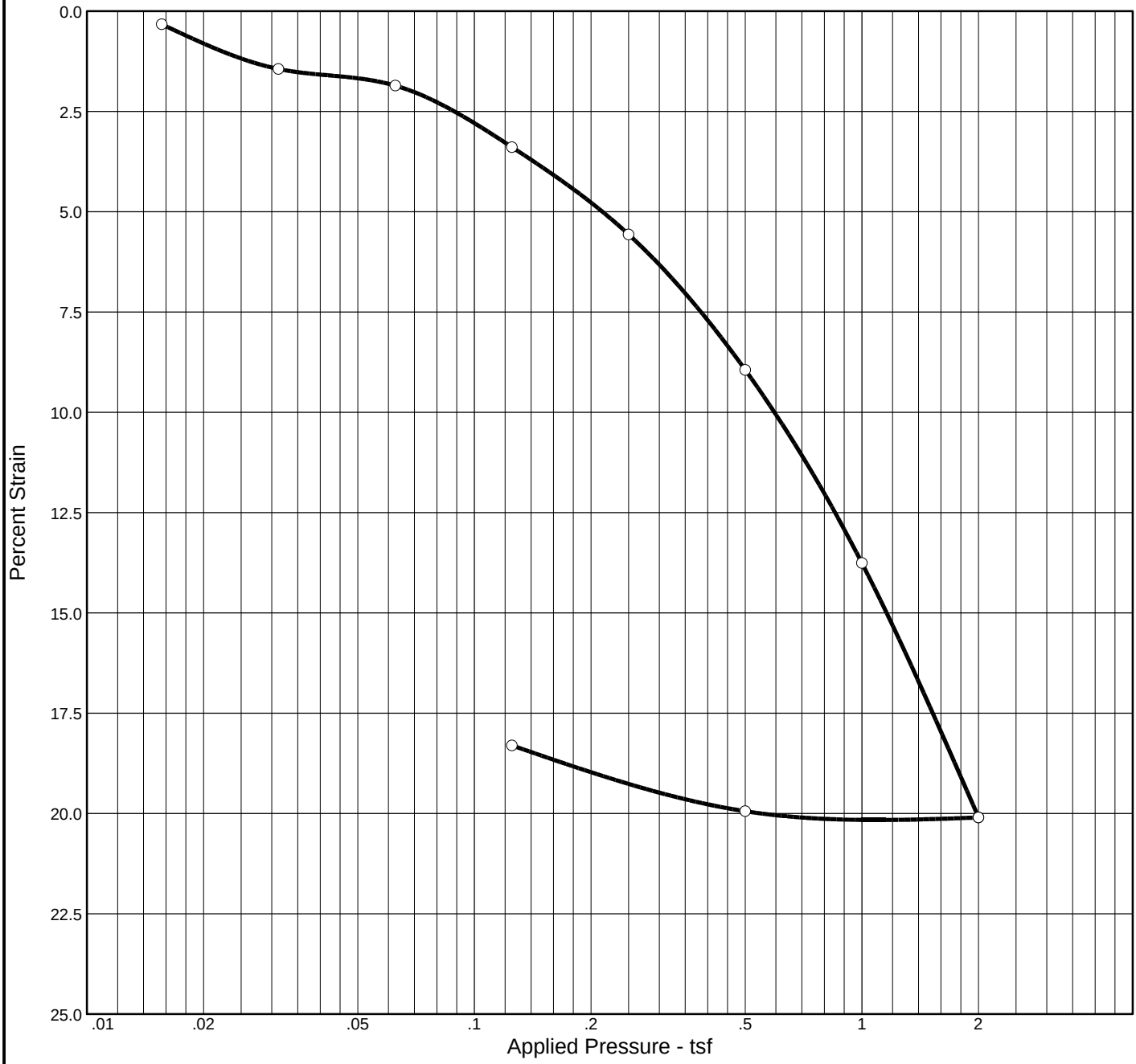


SOIL TECHNOLOGY

Bainbridge Island, WA

Figure 4

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
98.8 %	205.3 %	21.9	----	----	1.3	.15 est.	0.46	0.79	0.06			2.700

MATERIAL DESCRIPTION	USCS	AASHTO
Soft to m-stiff,wet,grey-black, wood debris	PT	----

Project No. 07-2183 **Client:** URS Corp.

Project: Ashland Superfund, WI.
Project No. 25688375

Location: Flux Column 2D Wood Debris Layer

Remarks:
Wood fiber/debris layer after flux w/ 4.2 ft. sand cap

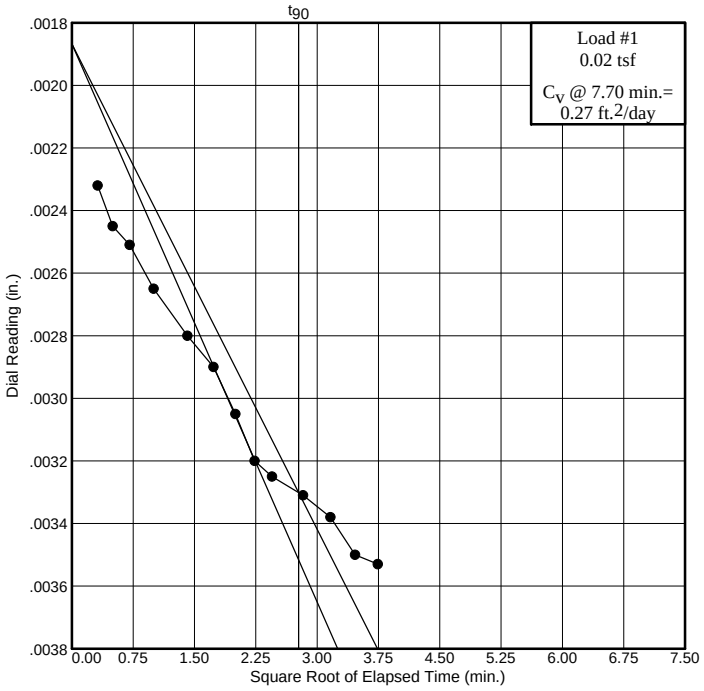
SOIL TECHNOLOGY

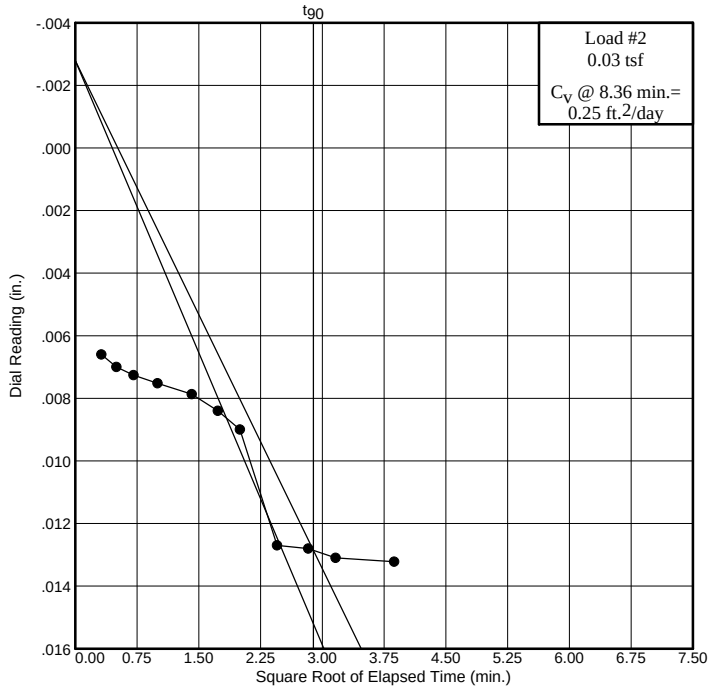
Bainbridge Island, WA

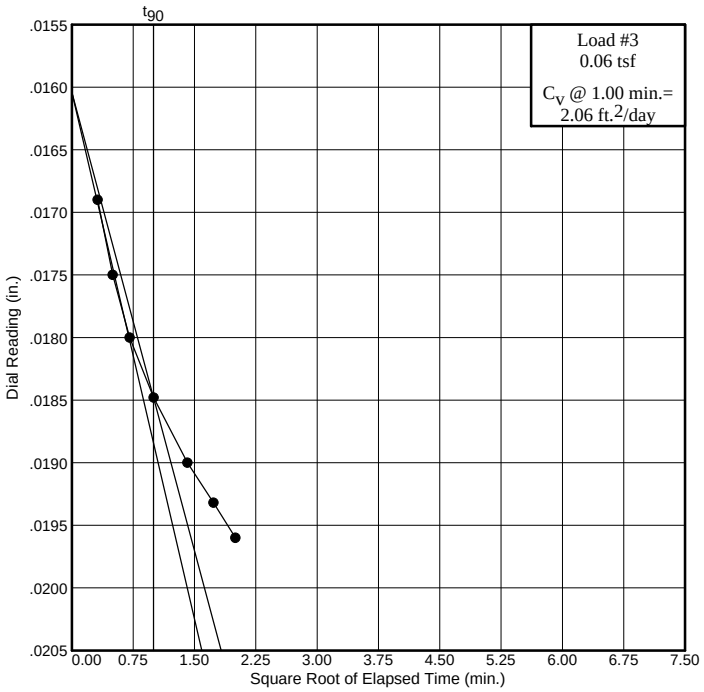
Figure 2

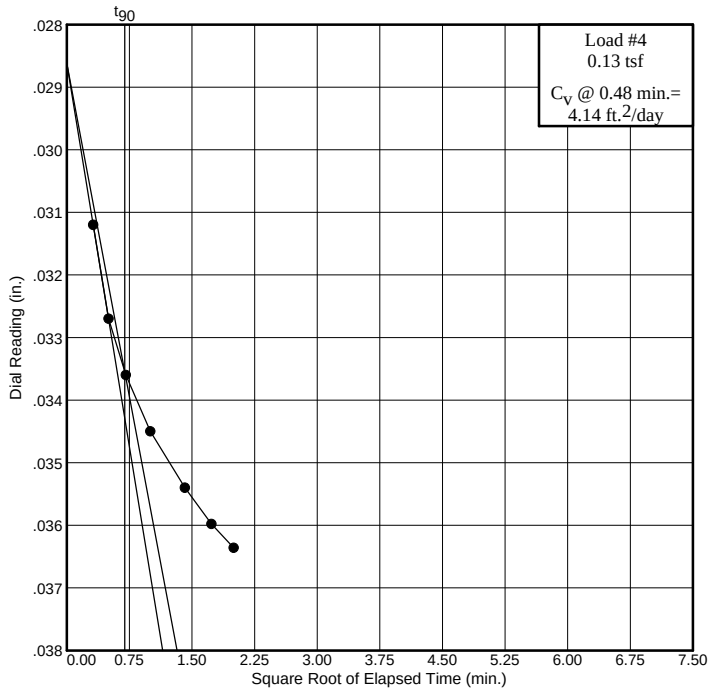
Dial Reading vs. Time

Project No.: 07-2183
Project: Ashland Superfund, WI.
Project No. 25688375
Location: Flux Column 2D Wood Debris Layer









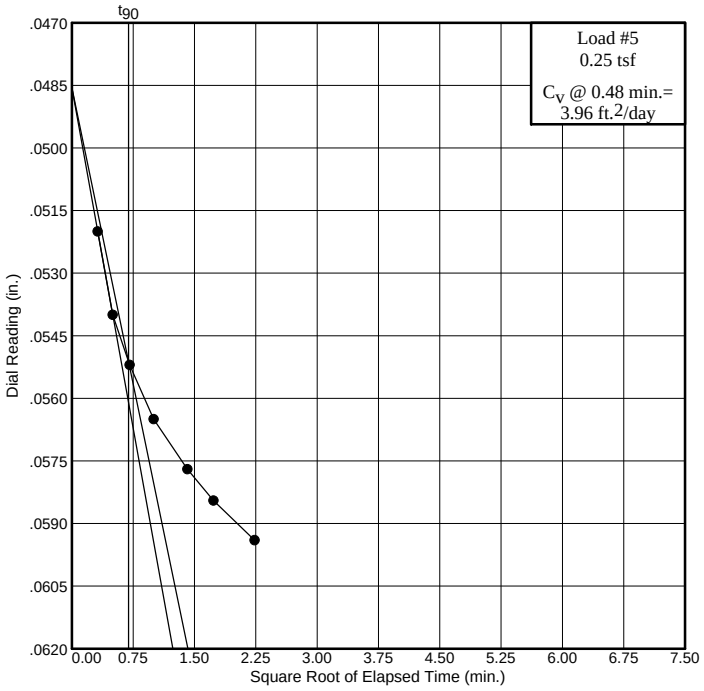
SOIL TECHNOLOGY

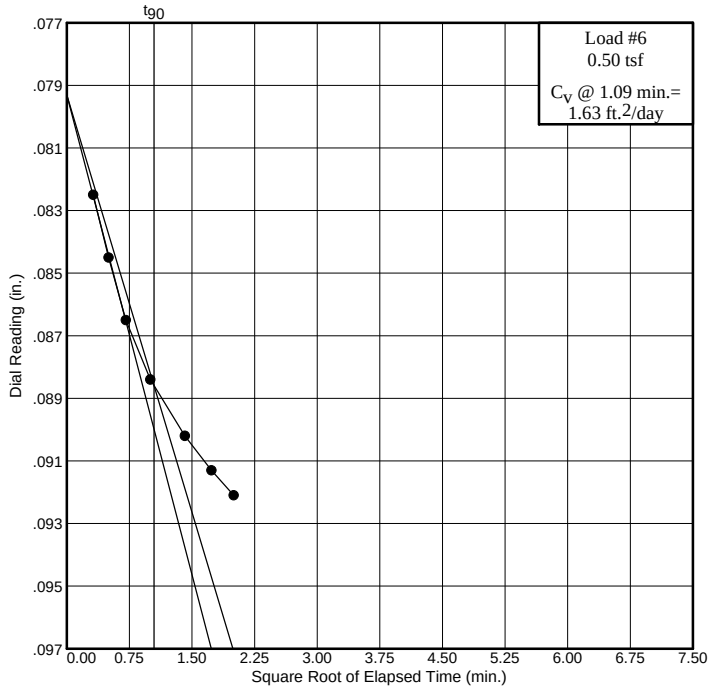
Bainbridge Island, WA

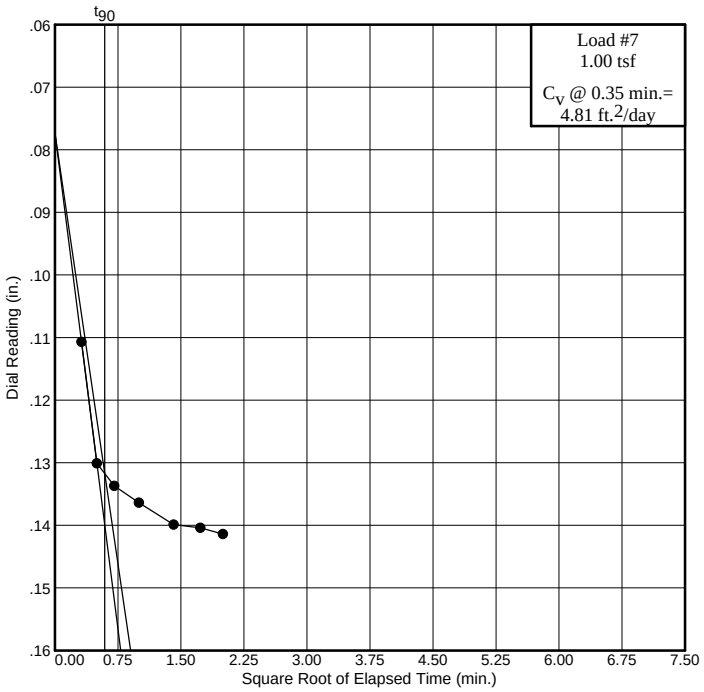
Figure 3

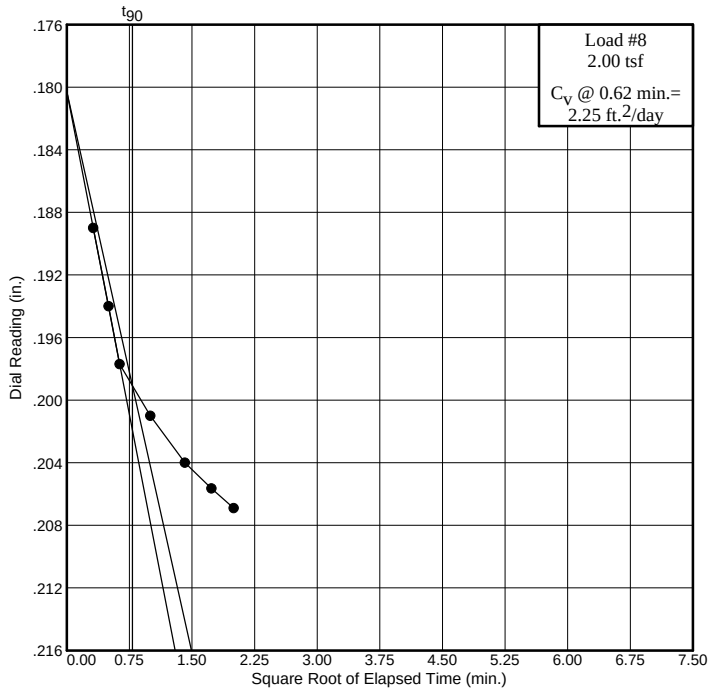
Dial Reading vs. Time

Project No.: 07-2183
Project: Ashland Superfund, WI.
Project No. 25688375
Location: Flux Column 2D Wood Debris Layer









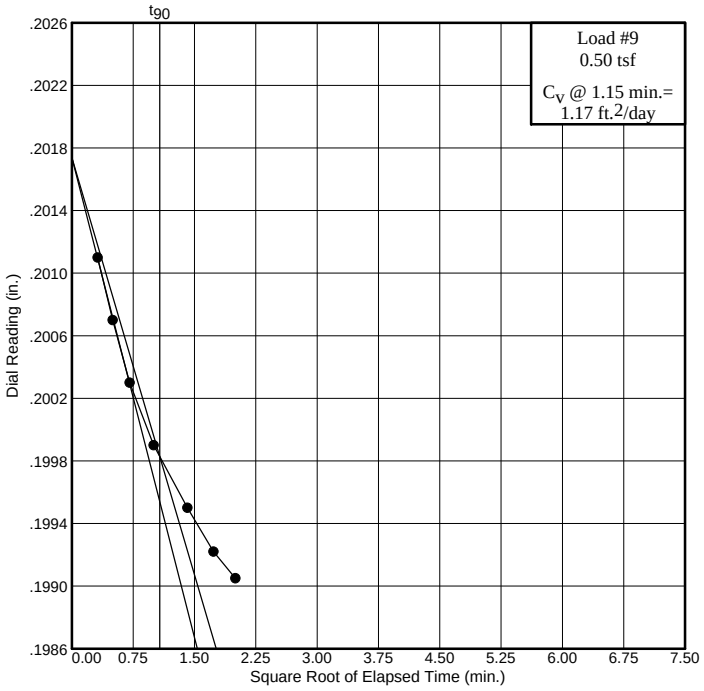
SOIL TECHNOLOGY

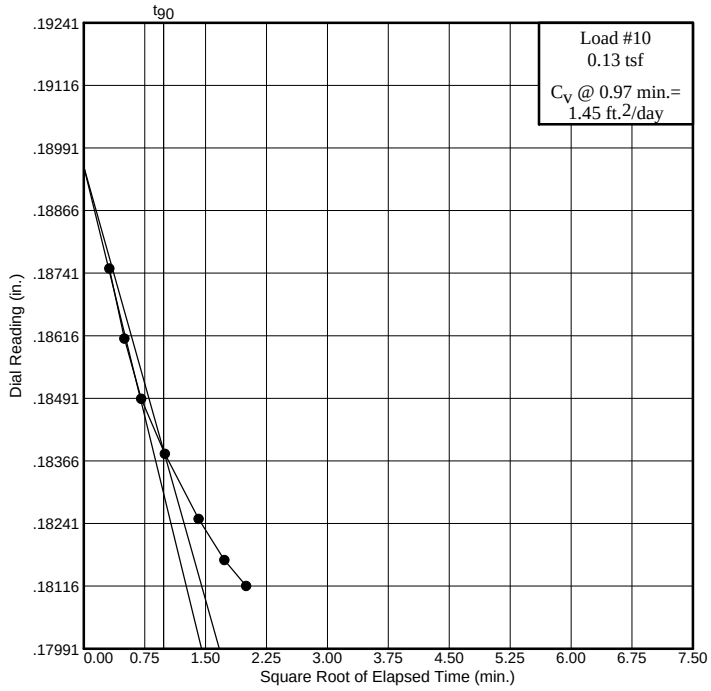
Bainbridge Island, WA

Figure 4

Dial Reading vs. Time

Project No.: 07-2183
Project: Ashland Superfund, WI.
Project No. 25688375
Location: Flux Column 2D Wood Debris Layer





SOIL TECHNOLOGY

Bainbridge Island, WA

Figure 5

APPENDIX C

OCTOBER 25, 2007
WORKSHOP SUMMARY REPORT

February 14, 2008

Summary
Community Workshop

Ashland/Northern States Power Lakefront Site
October 25, 2007

Residents of the Chequamegon Bay area gathered in Ashland, Wisconsin on October 25, 2007 to identify the characteristics of clean-up options for the Ashland/NSP Lakefront site that would make a remedy(s) most acceptable to the community. "Community acceptability" is one of nine criteria Superfund managers are required to consider when choosing clean-up methods.[1] Early in the investigation process, area residents and others asked U.S. Environmental Protection Agency and Department of Natural Resources to provide such input prior to the ranking of potential clean-up options for this site.[2] The federal Superfund program encourages project staff to seek such early community input about clean-up remedies and future use of sites before a feasibility study is conducted.[3]

The community workshop followed a public meeting one week prior where EPA and DNR project managers presented the results of the remedial investigation, the study that described the degree and extent of contamination. A state health specialist explained health risks posed by site contaminants. The city administrator summarized the goals and recommendations of the city's waterfront development plan. The city's plan was developed as part of a comprehensive plan that included extensive public involvement of both city and area residents. The project team also described the purpose and process for the community workshop to give people an opportunity to prepare. This information was also explained in an informational mailer prepared by the Agencies and in a front page article in Ashland's *Daily Press*.

Notices of the community workshop were sent to the Agencies' site mailing list and in several notices published in the Ashland *Daily Press* and the *Evergreen Press*. Meeting announcements were posted in local stores, at Northland College and in public buildings. Such local organizations as the League of Women Voters and the Chamber of Commerce also included notices of the meeting in their newsletters or e-mail alerts.

Workshop Format

The community workshop followed the format recommended in the "Visioning" section of EPA's Superfund *Community Involvement Toolkit* [4]and in other guides cited in the *Toolkit*.[5]
Superfund project managers gave a brief overview of the types of methods typically used for cleaning up sediment, soil and ground water containing manufactured gas plant wastes. Then they explained how the nine Superfund criteria are used to evaluate potential remedies for a site.

The workshop's facilitator, a University of Wisconsin-Extension water resources educator, asked community members to identify the outcomes or characteristics of a cleanup remedy that would make it most acceptable to them. Participants were asked to avoid identifying characteristics associated with the other eight criteria already defined in Superfund guidance (e.g., reduces risk). Participants divided into small groups at separate tables, each with a facilitator and an easel. Each participant was provided a marker and a set of 4"x6" Post-It Notes. They each took five minutes to write down the characteristics or outcomes they would like to see addressed, one per note sheet. They then described their recommendations, one at a time in round-robin fashion, and handed their note sheet to the facilitator to post on the easel for the group to see. Research shows that people think most creatively while working in silence, but in the presence of others. The method also provides an opportunity for all present to express their ideas.[6] The facilitators asked the group to identify whether their suggestions might be organized around common themes.

After all participants submitted and explained their recommendations to their small groups, the facilitators brought all the notes to the front of the room, and transferred them to one large 5'x15' paper sheet on the wall. The meeting facilitator organized the notes into groups sharing a common theme. For example, the suggestions "return site to its original beauty – most natural looking" and "preserve aesthetics of waterfront/park area" were grouped under the theme "beauty and aesthetics." In all, 105 suggested outcomes or characteristics were organized around 15 themes. The themes were grouped into three categories: 1) characteristics during implementation of the remedy, 2) outcomes of the clean-up and 3) characteristics of the overall process for clean-up.

The last step at the meeting was the assignment of weights to the recommended characteristics. Each participant was provided five self-sticking colored dots. They were asked to place their dots on the recommendations they felt were most important. They could distribute their five dots as they wished. They could put from one to five dots on any suggested characteristic or on the overall theme for a group of characteristics. The table at the back of this summary lists the recommended characteristics and the number of dots assigned to each. The brainstorming technique used for this meeting is effective at reflecting a wide range of community concerns, but the assignment of dots is not an effective method to assign formal weights to particular characteristics. Instead, it simply gave the participants a general sense of the strength of their interest in each characteristic they recommended.

EPA and DNR intend to work with NSP Wisconsin, the company potentially responsible for the cleanup, to identify ways to incorporate the results of the workshop into the feasibility study, currently under development by NSP Wisconsin. This report will identify potential options and evaluate the effects of each remedy relative to eight of the nine Superfund criteria, including the "community acceptance" criterion.

Next Steps

Once the feasibility study is complete and recommended cleanup options developed, EPA will hold a formal public comments period and hearing for residents to weigh in on proposed cleanup options.

Table: Participants' point scores for recommended characteristics of remedies they would find most acceptable.

	Theme Points	Points	
			During Clean-up Concerns
	16	8	Time
1		3	Be quick
2		3	Fastest speed of clean-up
3		1	The clean-up process is completed as quickly as possible
4		1	Most efficient timeline
5			Identify the timeframe for clean-up
6			Set and keep to schedule
7			Fastest speed of clean-up -- natural processes too slow
8			Restoration sooner rather than later
	11	1	Disruption
9		4	Marina operations and boat storage not affected during clean-up
10		3	Be as unintrusive as possible during clean-up to Ashland and lake
11		2	Least disruption to residents
12		1	Expedite short-term objectives to put area back into development
13			Stage clean-up for access
14			Maintain local access for recreational activities
15			Tourism protected
16			Maintain tourism during clean-up
17			Best focus on clean-up process -- not in a vacuum
18			Protect tourism: "orange suits" negative impact
19			Not disturbing waterfront activity
20			No effect on wildlife during clean-up
21			Least environmental impact during clean-up
22			During construction maintain use of swimming beach and waterfront trail
	7		Sustainability
23		3	Minimize waste generated by clean-up method
24		3	Re-use/recycle coal tar as fuel product
25		1	Use most local services and most local materials for clean-up
26			Most sustainable clean-up re: location, etc
			Odors
27			Most reduce vapors below perception
28			Minimize particulate and odor issues
	13		Cost & Who Pays
29		10	Identify the total cost of the project
30		2	Local taxes least affected by clean-up
31		1	Least impact of Xcel Energy customer
32			Where does payment come from?
33			Cost
			After Clean-up Outcomes
	33	5	Maximum Future Use Opportunities
34		18	(Most) compliance with waterfront plan, i.e., most future use opportunities
35		1	(Most) consistent with waterfront development plan
36		6	Total clean-up for most future use for tourism, business development & future generations
37		1	Most options for future use
38		1	Allow long-term public use
39		1	Property can be used by the public (most) safely
40			Most waterfront plan opportunities

	Theme Points	Points	
41			At a minimum - consistent with waterfront plan
42			Be able to use the area
43			Option most flexible to future use
44			The land can be used in some way by the public
45			Make area as useful as possible for the greatest variety of future uses
46			Re-use
47			End use theme and remedy selection
48			Feasible re-use of wastewater treatment plant
49			Re-use treatment plant for marina-related activities
50			Get rid of sewer plant
	13	4	Recreational Use
51		3	Make site most available for future use: marina expansion, etc.
52		1	Maintain existing space for boat storage and parking
53		1	Best improve RV campground
54		4	Be able to swim there
55			Be able to fish and swim in the area
56			Re-use the bay area for fishing, wading, boating
57			Provides the most deep, useable space
58			Most maintains navigation
59			Best maintains beach
60			Best personal recreation
	15	3	Beauty & Aesthetics
61		9	Return site to its original beauty -- most natural looking
62		1	Natural looking shoreline after clean-up
63		1	A "show piece" development location facility -- the most desirable location
64		1	Created ravine as a gateway to the lake
65			Attractive gathering place
66			Most aesthetically pleasing
67			Re-use of the "Kreher Park" area as a natural area
68			Preserve aesthetics of the waterfront/park area
	8	5	Shoreline Location
69		2	No further encroaching on Lake Superior
70		1	Restore quality and keep same footprint
71			Removal of contamination without removing lakefront
	7	1	Fish & Natural Habitat
72		3	Lake ecosystem protected
73		1	Optimum maintenance of healthy fishery
74		1	Fish (smelt) safe to eat
75		1	(Least) affect waters flowing to sacred rice beds
76			Most healthy fishery and natural habitat
77			Local fisheries (most) restored
78			Most improve coastal habitat and aesthetics
	6	6	Groundwater/Artesian Wells
79			Artesian wells remain unaffected -- clean aquifers
80			Use of artesian wells restored
81			Use of artesian wells for clean, safe drinking water
82			Artesians and aquifer restored
83			(Most) clean-up of Copper Falls aquifer
84			(Most) clean-up of free product from aquifer
			Toxic effects
85			Most protect human health & environment

	Theme Points	Points	
			Clean-up Process
	41		Least Risk of Re-visiting Clean-up
86		18	Do it right the first time
87		12	Most permanent remedy
88		3	Most complete clean-up
89		3	Clean-up needs to be complete, not just covered up
90		2	Most prevent continued/future degradation
91		1	(Most) Long-term solution
92		1	Reputation of Ashland restored, i.e., no more Superfund
93		1	Stop erosion of pollutants by whatever means necessary
94			Best account for natural disturbance processes, e.g., erosion
95			Least likely to create contaminant problem elsewhere
	8	4	Education & Community Involvement
96		1	Site interpretation for awareness building
97		1	Prevent this from happening again: education, incentives
98		1	Education, public awareness and involvement
99		1	Public relations initiative to keep project moving in a positive direction
100			Good explanation for tourists of what is going on and why
101			Community involvement during and after implementation
	2		**Remedies**
102		2	Dry-dredged
103			Complete contaminant removal
104			Least preferable: capping and leaving in place
105			Cap it and go home

References

[1] U. S. Code of Federal Regulations. 40 CFR §300.430(e)(9). The nine criteria are: 1) protection of public health and the environment, 2) compliance with state, federal & local laws, 3) reduction of toxicity, mobility or volume of contaminants, 4) long-term effectiveness or permanence, 5) short-term effectiveness or time required for implementation, 6) implementability or ease of accomplishing the remedy, 7) financial cost, 8) acceptability to state government and 9) community acceptability.

[2] Wisconsin Department of Natural Resources. 2005. Community involvement plan: Ashland/NSP Lakefront Site (EPA ID# WISFN0507952). Publication No. RR-726. Madison, Wisconsin. pp. 12-13.

[3] U. S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response. 2001. Early and meaningful community involvement. OSWER Directive 9230.0-99. Washington, D.C.

[4] EPA, Office of Solid Waste and Emergency Response. 2002. Superfund community involvement toolkit. Publication No. EPA 540-K-01-004. Washington, D.C.

[5] EPA, Office of Sustainable Ecosystems and Communities. 1997. Community-based environmental protection: a resource book for protecting ecosystems and communities. Publication No. EPA 230-B-96-003. Washington, D.C. See also: National Association for City and County Health Officials. 2000. A step-by-step process for visioning. Available at http://mapp.naccho.org/visioning/visioning_approach_to_visioning.asp; accessed 18 Dec 2007.

[6] Delbecq, A.L., Van de Ven, A.H. and Gustufson, D.A. 1975. Group techniques for program planning: a guide to the nominal group technique and delphi processes. Glenview, IL: Scott, Foresman and Co.

APPENDIX D

VOLUME AND WATER BUDGETCALCULATIONS USED FOR EVALUATING REMEDIAL ALTERNATIVES

APPENDIX D1

VOLUMES AND AREAL EXTENT OF CONTAMINATED MEDIA

Appendix D1
Volumes and Areal Extent of Contaminated Media - Computations

Soil

Upper Bluff Area	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Volume1	Assumptions
Lateral Extent of Soil Contamination - Unsatuarted Zone						
Lateral Extent - Upland Area	88,000	2.02	10	32,593	32,600	Lateral extent (2.02 acres) where benzene exceeded RCL. Average thickness of plume is 10 feet.
Entire Filled Ravine Area	55,900	1.28	10	20,704	20,700	Lateral extent of filled ravine where benzne exceeded RCL. Average thickness is 10 feet.
Unlimited Removal Volume - Unsaturated and Satuarated Zones						
Filled Ravine	47,300	1.09	20	35,037	35,000	Lateral extent of filled ravine north of alley. Average thickness is 20 feet.
Limited Removal Volume - Unsatuarted and Satuzred Zones						
Former Gas Holder Area	16,900	0.39	15	9,389	9,400	Area south of St. Claire Street is 130 by 130 feet. Average depth is 15 feet.
Former Clay Pipe Area	750		5	139	150	Area north of St. Claire Street is 10 by 75 feet at base of ravine, and 5 feet thick.

Kreher Park	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Volume1	Assumptions
Lateral Extent - Kreher Park	505,296	11.60	12	224,576	224,600	Lateral extent (11.6 acres) of all fill in Kreher Park
Lateral Extent - Kreher Park	452,153	10.38	5	83,732	83,700	Lateral extent (10.38 acres) where benzene exceeded RCL. Average thickness is 5 feet.
Former Coal Tar Dump Area	26,000	0.60	5	4,815	4,800	Area is 260 by 100 feet. Thickness above wood waste layer is 5 feet. (Includes saturated and unsaturated zone soil.)

Groundwater and Saturated Soil Media

Upper Bluff Area	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Volume1	Assumptions
Lateral Extent - Upland Area	118,000	2.71	15	65,556	65,600	Lateral extent (2.71 acres) where benzene exceeds ES. Average thickness of plume is 15 feet.

Kreher Park	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Volume1	Assumptions
Lateral Extent - Kreher Park	452,153	10.38	7	117,225	117,200	Lateral extent (10.38 acres) where benzene exceeds ES. Average thickness of plume is 7 feet.

Copper Falls Aquifer	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Volume1	Assumptions
Lateral Extent - Upland Area	198,000	4.55	50	366,667	366,700	Lateral extent (4.55 acres) where benzene exceeds ES. Average thickness of plume is 50 feet.
Lateral Extent - Kreher Park	103,000	2.36	35	133,519	133,500	Lateral extent (2.36 acres) where benzene exceeds ES. Average thickness of plume is 35 feet.
	301,000	6.91		500,185	500,200	Sum of Kreher Park and Upland Area plume volumes.

Sediment

	Area (sq. ft.)	Area (acres)	Thickness (ft)	Volume (cubic yds)	Approximate Volume1	Assumptions 2
Lateral Extent - Total PAH > 10 ppm	436,471	10.0	0 - 10	73,771	73,800	Lateral extent (10.02 acres) where total PAH > 10 ppm. Removal of all contaminated media up to 10 feet.
Lateral Extent - Total PAH > 10 ppm	527,076	12.1	0 - 4	78,085	78,000	Lateral extent (12.1 acres) where total PAH > 10 ppm. Removal of all contaminated media up to 4 feet.
Lateral Extent - Total PAH > 10 ppm	696,960	16.0	0 - 10	133,906	133,900	Lateral extent (16 acres) where total PAH > 10 ppm. Removal of all contaminated media up to 10 feet.

1 Rounded to nearest 100 cubic yards.
2 Not all sediment between 0 and 10 feet has total PAH exceedanaces above 10 ppm.
Wood waste layer included in all volume calculations.
See Section 4.3 of Alternative Screening Technical Memorandum for further explanation.

APPENDIX D2

WATER BUDGET CALCULATIONS FOR KREHER PARK

Appendix D2
Kreher Park Water Budget Calculations

Water Budget For Kreher Park - Existing Conditions

Recharge at Kreher Park

RE = (P-ET-RO)A

RE =	Groundwater Recharge		
P =	Precipitation (ft/yr)	32	in/yr
ET =	Evapotranpiration (ft/yr)		
RO =	Runoff (ft/yr)		
A =	Drainage Area (sq. ft.)	11.6	acres

Precipitation for Ashland County

normal	31.91	
		year
high	52.04	1890
low	19.96	1956

Marina Parking Lot **Gravel Covered**

						Percentage of Precipitatic	From	To
RE 1 =	106,867	cubic ft.				100.00%		
	799,901	gallons	P =	2.67	ft./yr.			
			ET =	1.33	ft./yr.	50%	50%	65%
			RO =	0.27	ft./yr.	10%	10%	25%
			A =	100,188	sq. ft.	2.3 acres		

Remainder of Park **Grass Covered**

						Percentage of Precipitatic	From	To
RE 2 =	378,101	cubic ft.						
	2,830,084	gallons	P =	2.67	ft./yr.	100.00%		
			ET =	1.47	ft./yr.	55%	50%	65%
			RO =	0.27	ft./yr.	10%	10%	25%
			A =	405,108	sq. ft.	9.3 acres		

Total Recharge at Kreher Park

RE park = 484,968 cubic ft.
3,629,985 gallons

Filled Ravine Recharge (from gravel covered area north of St. Claire Street)

						Percentage of		
RE3 =	27,878	cubic ft.	P =	2.67	ft./yr.	100.00%		
	208,670	gallons	Ev =	1.33	ft./yr.	50%	50%	65%
			Ro =	0.27	ft./yr.	10%	10%	25%
			A =	26,136	sq. ft.	0.6 acres		

Groundwater Flow Along Bluff

Q = -KiA

Q = Groundwater discharge
- K = Hydraulic conductivity of the Miller Creek Formation
i = Hydraulic gradient of the Miller Creek Formation
A = Cross section area of bluff.

Q =	3,520	cubic feet per year	
	26,349	gallons per year	
- K =	8.80E-01	cu ft/year	8.50E-07 cm/sec
i =	0.20	ft/ft	
A =	20,000	square feet	
	1,000	length of bluff (ft)	
	20	saturated thickness of Miller Creek at bluff (ft)	

Total Contribution from Upper Bluff

RE bluff = 31,399 cubic ft.
235,019 gallons

Recharge at Kreher Park and from Upper Bluff

RE total =	516,367	cubic ft.	322,084	gal/month
	3,865,004	gallons	10,589	gal/day
			7.35	gal/min

NOTES:

32	in/yr	average precipitation
17.7	in/yr	average evapotranspiration rate
55.3%		average evapotranspiration percent

Source:
USGS Hydrologic Investigation Atlas HA-524, 1974
Lake Superior Basin
Young & Skinner

Appendix D2
Kreher Park Water Budget Calculations

Water Budget For Kreher Park - Partial Caps

Recharge at Kreher Park

RE = (P-Ev-Ro)A

RE =	Groundwater Recharge		
P =	Precipitation (ft/yr)	32	
Ev =	Evapotranpiration (ft/yr)		
Ro =	Runoff (ft/yr)		
A =	Drainage Area (sq. ft.)	10.5	acres

Precipitation for Ashland County

normal	31.91	
		year
high	52.04	1890
low	19.96	1956

Marina Parking Lot **Asphalt Pavement**

RE1 =	26,717	cubic ft.					**Percentage of Precipitation**	**From**	**To**
	199,975	gallons	P =	2.67	ft./yr.		100.00%		
			Ev =	0.00	ft./yr.		0%	0%	10%
			Ro =	2.40	ft./yr.		90%	80%	95%
			A =	100,188	sq. ft.	2.3	acres		

Clay Cap - Former Coal Tar Dump Area

RE2 =	11,616	cubic ft.					**Percentage of Precipitation**	**From**	**To**
	86,946	gallons	P =	2.67	ft./yr.		100.00%		
			Ev =	0.13	ft./yr.		5%	1%	10%
			Ro =	2.27	ft./yr.		85%	70%	90%
			A =	43,560	sq. ft.	1	acres		

Remainder of Park - Grass Covered

							Percentage of Precipitation	**From**	**To**
RE3 =	248,292	cubic ft.							
	1,858,466	gallons	P =	2.67	ft./yr.		100.00%		
			Ev =	1.48	ft./yr.		55%	50%	65%
			Ro =	0.40	ft./yr.		15%	10%	25%
			A =	313,632	sq. ft.	7.2	acres		

Total Recharge at Kreher Park

RE park =	286,625	cubic ft.
	2,145,387	gallons

Contribution to Kreher Park from Filled Ravine **Filled Ravine - Asphalt Pavement**

Recharge from Upper Bluff

							Percentage of Precipitation	**From**	**To**
			P =	2.67	ft./yr.		100.00%		
RE bluff =	13,358	cubic ft.	Ev =	0.13	ft./yr.		5%	1%	10%
	99,988	gallons	Ro =	2.40	ft./yr.		90%	80%	95%
			A =	100,188	sq. ft.	2.3	acres		

Recharge at Kreher Park and from Upper Bluff

RE total =	299,983	cubic ft.	187,115	gal/month
	2,245,374	gallons	6,152	gal/day
			4.27	gal/min

NOTES:	32	in/yr	average precipitation
	17.7	in/yr	average evapotranspiration rate
	55.3%		average evapotranspiration percent

Source:
USGS Hydrologic Investigation Atlas HA-524, 1974
Lake Superior Basin
Young & Skinner

Appendix D2
Kreher Park Water Budget Calculations

Water Budget For Kreher Park - Cap for Entire Park

RE = (P-Ev-Ro)A

RE =	Groundwater Recharge	
P =	Precipitation (ft/yr)	32 inches per year
Ev =	Evapotranpiration (ft/yr)	
Ro =	Runoff (ft/yr)	
A =	Drainage Area (sq. ft.)	10.5 acres

Marina Parking Lot

					Percentage of Precipitation	From	To
RE1 =	10,687	cubic ft.					
	79,990	gallons	P =	2.67 ft./yr.	100.00%		
			Ev =	0.03 ft./yr.	1%	1%	10%
			Ro =	2.53 ft./yr.	95%	80%	95%
			A =	100,188 sq. ft.	2.3 acres		

Clay Cap - Entire Kreher Park

					Percentage of Precipitation	From	To
RE2 =	95,251	cubic ft.					
	712,955	gallons	P =	2.67 ft./yr.	100.00%		
			Ev =	0.13 ft./yr.	5%	1%	10%
			Ro =	2.27 ft./yr.	85%	70%	90%
			A =	357,192 sq. ft.	8.2 acres		

Remainder of Park

					Percentage of Precipitation	From	To
RE3 =	0	cubic ft.					
	0	gallons	P =	2.67 ft./yr.	100.00%		
			Ev =	1.48 ft./yr.	55%	50%	65%
			Ro =	0.40 ft./yr.	15%	10%	25%
			A =	0 sq. ft.	0 acres		

RE park =	105,938	cubic ft.
	792,945	gallons

Contribution to Kreher Park for Filled Ravine

Filled Ravine - Asphalt Pavement

					Percentage of Precipitation	From	To
RE bluff =	13,358	cubic ft.	P =	2.67 ft./yr.	100.00%		
	99,988	gallons	Ev =	0.13 ft./yr.	5%	1%	10%
			Ro =	2.40 ft./yr.	90%	80%	95%
			A =	100,188 sq. ft.	2.3 acres		

REt =	119,296	cubic ft.	74,411	gal/month
	892,933	gallons	2,446	gal/day
			1.70	gal/min

NOTES:	32	in/yr	average precipitation
	17.7	in/yr	average evapotranspiration rate
	55.3%		average evapotranspiration percent

Source:
USGS Hydrologic Investigation Atlas HA-524, 1974
Lake Superior Basin
Young & Skinner

APPENDIX E

ARARS AND TBCS FOR THE ASHLAND/NSP LAKEFRONT SITE

Table E-1 – ARAR Summary
For Potential Soil Remedial Alternatives

ARAR / TBC	Alternative S-2		Alternative S-3A and 3B		Alternative S-4A and S-4B		Alternative S-5A and 5B		Alternative S-6	
	Containment Using Surface Barriers		Limited and Unlimited Removal and Off-site Disposal		Limited Removal and On-site Disposal		Limited Removal and Ex-situ Thermal Treatment		Limited Removal and Ex-situ Soil Washing	
	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply
Chemical Specific										
RCRA – Definition of Hazardous Waste 40 CFR 261	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Primary and Secondary Ambient Air Quality Standards (NAAQS) 40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR Part 61	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Hazardous Substance Spill Law and Soil Cleanup Standards Ch. 292.11, NR 720	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Groundwater Quality –WAC NR140	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Pollutant Discharge Elimination Systems - WAC NR 200	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations – WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Soil Cleanup Standards – WAC NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Guidance for Generic Soil PAH Cleanup Levels (WDNR PUBL-RR-519-97, April 1997)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Lab Certif. – WAC NR 149	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Action Specific										
CERCLA - Procedures for Planning and Implementing Off-site Response Actions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Subtitle D Non-hazardous Waste Standards 40 CFR 257	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Manifesting, Transport, and Record keeping Requirements 40 CFR 262	Yes	Yes	Yes	Yes	Yes	Yes	No	NA	No	NA
RCRA - Wastewater Treatment System Standards 40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Excavation and Fugitive Dust	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-1 – ARAR Summary
For Potential Soil Remedial Alternatives

ARAR / TBC	Alternative S-2		Alternative S-3A and 3B		Alternative S-4A and S-4B		Alternative S-5A and 5B		Alternative S-6	
	Containment Using Surface Barriers		Limited and Unlimited Removal and Off-site Disposal		Limited Removal and On-site Disposal		Limited Removal and Ex-situ Thermal Treatment		Limited Removal and Ex-situ Soil Washing	
	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply
Requirements 40 CFR 264										
RCRA - Storage Requirements 40 CFR 264, 265	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations NR 400	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Solid Waste Management Regs NR 500	Yes	Yes	Yes	Yes	Yes	Yes	No	NA	No	NA
WI Hazardous Waste Regulations – NR 600	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Invest. & Remed. of Env. Contamination – NR 700	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Cover Systems (Cover Systems as Soil Performance Standard Remedies (WDNR PUBL-RR-709, Jan. 2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Management of Investigation Derived Waste (Interim Guidelines for the Management of Investigation – Derived Waste (WDNR PUBL-RR- 556-93, May 1993)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Groundwater Discharge Requirements (Informational Document for Wisconsin Discharge Permit; Contaminated Groundwater from Remedial Action Operations (WDNR PUBL- RR-583-01, May 2001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Management of Waste from Remediation of Manufactured Gas Plants (Draft Management of Waste from Remediation of Manufactured Gas Plants (WDNR PUBL – RR – 768, Feb 2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OSHA Occupational Safety and Health Standards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DOT Haz Mat Transport	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI SPCC – NR 216	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-1 – ARAR Summary
For Potential Soil Remedial Alternatives

ARAR / TBC	Alternative S-2		Alternative S-3A and 3B		Alternative S-4A and S-4B		Alternative S-5A and 5B		Alternative S-6	
	Containment Using Surface Barriers		Limited and Unlimited Removal and Off-site Disposal		Limited Removal and On-site Disposal		Limited Removal and Ex-situ Thermal Treatment		Limited Removal and Ex-situ Soil Washing	
	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply	Apply	Comply
Location Specific										
Landfill Siting and Approval Processes WI Statutes Ch. 289	No	NA	No	NA	Yes	Yes	No	NA	No	NA
Solid Waste Management Regs – NR 500	Yes	Yes	Yes	Yes	Yes	Yes	No	NA	No	NA
To Be Considered										
WI Water Quality Regs – NR 300	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Safe Drinking Water Act	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Great Lakes Water Quality Agreement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act 303(d)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Strategy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Guidance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Great Lakes Water Quality Initiative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local Permits	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparge**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Chemical Specific																
RCRA – Definition of Hazardous Waste 40 CFR 261	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Primary and Secondary Ambient Air Quality Standards (NAAQS) 40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR Part 61	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Hazardous Substance Spill Law and Soil Cleanup Standards – Ch. 292.11, NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Groundwater Quality –WAC NR140	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Pollutant Discharge Elimination Systems - WAC NR 200	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations – WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Soil Cleanup Standards – WAC NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Soil Cleanup Standards – WAC NR 720	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Guidance for	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparge**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Generic Soil PAH Cleanup Levels (WDNR PUBL-RR-519-97, April 1997)																
WI Lab Certif. – WAC NR 149	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Action Specific																
CERCLA - Procedures for Planning and Implementing Off-site Response Actions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Subtitle D Non-hazardous Waste Standards 40 CFR 257	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Manifesting, Transport, and Record keeping Requirements 40 CFR 262	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Wastewater Treatment System Standards 40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Excavation and Fugitive Dust Requirements 40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RCRA - Storage Requirements 40 CFR 264, 265	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Air Pollution Control Regulations – NR 400	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Solid Waste Management Regs –	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparge**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
NR 500																
WI Hazardous Waste Regulations – NR 600	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI Invest. & Remed. of Env. Contamination – NR 700	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Cover Systems (Cover Systems as Soil Performance Standard Remedies; WDNR PUBL-RR-709, Jan. 2007)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Management of Investigation Derived Waste (Interim Guidelines for the Management of Investigation – Derived Waste; WDNR PUBL-RR- 556-93, May 1993	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Groundwater Discharge Requirements (Informational Document for Wisconsin Discharge Permit; Contaminated Groundwater from Remedial Action Operations; WDNR PUBL- RR-583-01, May 2001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Management of Waste from	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparge**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Remediation of Manufactured Gas Plants (Draft Management of Waste from Remediation of Manufactured Gas Plants; WDNR PUBL – RR – 768, Feb 2007)																
OSHA – Occupational Safety and Health Standards	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DOT Haz Mat Transport	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI SPCC – NR 216	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location Specific																
Landfill Siting and Approval Process WI Statutes Ch. 289	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Solid Waste Management Regs – NR 500	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
To Be Considered																
WI Water Quality Regs – NR 300	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Safe Drinking Water Act	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Great Lakes Water Quality Agreement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act 303(d)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Strategy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPA Contaminated Management Guidance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-2 – ARAR Summary for Potential Groundwater Remedial Alternatives																
ARAR / TBC	**Alt. GW-2**		**Alt. GW-3**		**Alt. GW-4**		**Alt. GW-5**		**Alt. GW-6**		**Alt. GW-7**		**Alt. GW-8**		**Alt. GW-9**	
	Containment using Surface and Vertical Barriers		**In-situ Treatment using Ozone Sparge**		**In-situ Treatment using Surfactant Injection**		**In-situ Treatment using Permeable Reactive Barrier Walls**		**In-situ Treatment using Chemical Oxidation**		**In-situ Treatment using Electrical Resistance Heating**		**In-situ Treatment using Dynamic Underground Stripping/Steam Injection**		**Removal using Groundwater Extraction Wells**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**						
Great Lakes Water Quality Initiative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local Permits	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table E-3 – ARAR Summary for Potential Sediment Remedial Alternatives						
ARAR/TBC	**Alt. SED-2**		**Alt. SED-3**		**Alt. SED-4 and SED-5**	
	Dredge, place in CDF		**Dredge, Cap**		**Dredge-All**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**
Chemical Specific						
Clean Water Act Section 304, Ambient Water Quality Criteria, US EPA 1986	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act Section 303, Water Quality Standards, 40 CFR 131	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act Section 304, Sediment Quality Criteria, US EPA 1991	No	NA	No	NA	No	NA
RCRA - Definition of Hazardous Waste, 40 CFR 261	No	NA	No	NA	No	NA
Clean Air Act, National Primary and Secondary Ambient Air Quality Standards (NAAQS), 40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act, National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61	No	NA	No	NA	No	NA
WDNR Water Quality Standards for Wisconsin Surface Waters, WAC NR 102-105	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Wisconsin Groundwater Quality, WAC NR 140	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Wisconsin State Air Pollutant Control Regulations, WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Wisconsin State Soil Cleanup Standards, WAC NR 720	No	NA	No	NA	No	NA
WDNR Soil Cleanup Levels for PAHs Interim Guidance, WDNR PUBL RR519-97, April 1997	No	NA	No	NA	No	NA
Location Specific						
Rivers and Harbors Act, 33 CFR 320	Yes	Yes	Yes	Yes	Yes	Yes

Table E-3 – ARAR Summary for Potential Sediment Remedial Alternatives						
ARAR/TBC	**Alt. SED-2**		**Alt. SED-3**		**Alt. SED-4 and SED-5**	
	Dredge, place in CDF		**Dredge, Cap**		**Dredge-All**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**
WDNR Designated Waters Special Natural Resources Interest, WAC NR 1.05(4) and Wisconsin Statutes 30.01(1 am)	No	NA	No	NA	No	NA
WDNR Landfill Siting and Approval Process, Wisconsin Statutes 289	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
WDNR Permits in Navigable Waters, Wisconsin Statutes 30	Yes	Yes	Yes	Yes	Yes	Yes
Local Permits (building, zoning, other)	TBD	TBD	TBD	TBD	TBD	TBD
Action Specific						
Clean Water Act Section 401, National Pollutant Discharge Elimination System	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
Clean Water Act Section 301(b), Effluent Standards- Technology Based Discharge Requirements	No	NA	No	NA	No	NA
CERCLA Procedures for Planning and Implementing Off-site Response Actions, 40 CFR 300.440	No	NA	Yes	Yes	Yes	Yes
RCRA- Manifesting, Transport and Recordkeeping Requirements, 40 CFR 262	No	NA	No	NA	No	NA
RCRA- Wastewater Treatment System Standards, 40 CFR 264	No	NA	No	NA	No	NA
RCRA- Storage Requirements, 40 CFR 264 and 265	No	NA	No	NA	No	NA
RCRA- Subtitle D Non-hazardous Waste Standards, 40 CFR 257	Yes	Yes	Yes	Yes	Yes	Yes
RCRA- Excavation and Fugitive Dust Requirements, 40 CFR 264	Yes	Yes	Yes	Yes	Yes	Yes
DOT Rules for Hazardous Materials Transport, 49 CFR 107-171	No	NA	Yes	Yes	Yes	Yes
OSHA Occupational Safety and Health Standards, 29 CFR 1910.120, 1910.132, 1910.134 and 1910.138	Yes	Yes	Yes	Yes	Yes	Yes
Clean Air Act National Primary and Secondary Ambient Air Quality Standards (NAAQS), 40 CFR Part 50	Yes	Yes	Yes	Yes	Yes	Yes

Table E-3 – ARAR Summary for Potential Sediment Remedial Alternatives						
ARAR/TBC	**Alt. SED-2**		**Alt. SED-3**		**Alt. SED-4 and SED-5**	
	Dredge, place in CDF		**Dredge, Cap**		**Dredge-All**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**
Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NEHSHAP), 40 CFR 61	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Designated Waters of Special Natural Resources Interest, WAC NR 1.05(4) and Wisconsin Statutes 30.01(1am)	No	NA	No	NA	No	NA
WDNR Plans and Specifications Review of Projects and Operations, WAC NR 108	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Environmental Analysis and Review Procedures, WAC NR 150	No	NA	No	NA	No	NA
WDNR Laboratory Certification and Registration, WAC NR 149	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Wisconsin Pollutant Discharge Elimination System, WAC NR 200	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
WDNR Water Quality Antidegradation, WAC NR 207	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Water Quality Antidegradation: Waste Load Allocated, Water Quality-Related Effluent Standards and Limitations, WAC NR 212-220	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Lining of Industrial Lagoons and Design of Storage Structures, WAC NR 213	No	NA	No	NA	No	NA
WDNR Wisconsin's General Permit Program for Certain Water Regulatory Permits, WAC NR 322	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
WDNR Shoreline Protection, WAC NR 328	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Dredging Contract Fees, WAC NR 346	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Sediment Sampling and Analysis, Monitoring Protocol and Disposal Criteria for Dredging Projects, WAC NR 347	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Wisconsin State Air Pollutant Control Regulations, WAC NR 400-499	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Solid Waste Management, WAC NR 500-520	Yes	Yes	Yes	Yes	Yes	Yes

Table E-3 – ARAR Summary for Potential Sediment Remedial Alternatives						
ARAR/TBC	**Alt. SED-2**		**Alt. SED-3**		**Alt. SED-4 and SED-5**	
	Dredge, place in CDF		**Dredge, Cap**		**Dredge-All**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**
WDNR Hazardous Waste Management, WAC NR 600-685	No	NA	No	NA	No	NA
WDNR Investigation of Remediation of Environmental Contamination, WAC NR 700	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Notification of the Discharge of Hazardous Substances, WAC NR 706	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Public Information and Participation, WAC NR 714	No	NA	No	NA	No	NA
WDNR Standard for Selecting Remedial Actions, WAC NR 722	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Remedial and Interim Action design, Implementation, Operation, Maintenance and Monitoring Requirements, WAC NR 724	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Great Lakes Water Quality Initiative WAC 102 and 106 USEPA Great Lakes Water Quality Initiative, 1995	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Assessing Sediment Quality in Water Bodies Associated with Manufactured Gas Plant Sites, WDNR PUBL-WR-447-96, March 1996	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Guidance for Cover Systems as Soil Performance Standard Remedies, WDNR-PUBL-RR-709, April 2004	No	NA	No	NA	No	NA
WDNR Consensus-Based Sediment Quality Guidelines: Recommendations for Use and Application Interim Guidance, WDNR-PUBL-WT-732, 2003.	Yes	Yes	Yes	Yes	Yes	Yes
WDHFS Health-Based Guidelines for Air Management, Public Participation and Risk Communication During the Excavation of Former Manufactured Gas Plants, 2004	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Sediment Remediation Implementation Guidance Strategic Directions Report, 1995	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Low-Hazard Solid Waste Exemption, Wisconsin Statutes 289.43	Yes	Yes	Yes	Yes	Yes	Yes

Table E-3 – ARAR Summary for Potential Sediment Remedial Alternatives						
ARAR/TBC	**Alt. SED-2**		**Alt. SED-3**		**Alt. SED-4 and SED-5**	
	Dredge, place in CDF		**Dredge, Cap**		**Dredge-All**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**
WDNR Interim Guidelines for the Management of Investigation-Derived Waste, WDNR-PUBL_RR-556-93, May 1993	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Informational Document for Wisconsin Discharge Permit; Contaminated Groundwater from Remedial Action Operations, WDNR-PUBL-RR-583-01 May 2001	No	NA	No	NA	No	NA
WDNR Draft Management of Wastes from Remediation of Manufactured Gas Plants, WDNR-PUBL-RR-768, February 2007	Yes	Yes	Yes	Yes	Yes	Yes
To Be Considered						
US EPA Contaminated Sediment Management Strategy, EPA-823-R-98-001	Yes	Yes	Yes	Yes	Yes	Yes
US EPA Contaminated Sediment Management Guidance, EPA-540-R-05-012	Yes	Yes	Yes	Yes	Yes	Yes
US Public Health Service, Agency for Toxic Substances and Disease Registry (*no citation)*	Yes	Yes	Yes	Yes	Yes	Yes
Clean Water Act Section 118(c)(7), Great Lakes Critical Program Act of 1990-Assessment of Remediation of Contaminated Sediments (ARCS) Program, 40 CFR 132 Appendix E	Yes	Yes	Yes	Yes	Yes	Yes
US EPA Contaminated Sediment Management Strategy, EPA-823-R-98-001	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Beneficial Reuse Solid Waste Exemption, WAC NR 500.08	No	NA	Yes	Yes	Yes	Yes
Clean Water Act, Section 404, Dredge and Fill Requirements-Inland Testing Manual	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
WDNR Dredge and Fill Requirements, 1985 and 1990	Yes	Yes/permit	Yes	Yes/permit	Yes	Yes/permit
WDNR Solid Waste Management, Beneficial Reuse Solid Waste Exemption, WAC NR 500.08	No	NA	Yes	Yes	Yes	Yes

Table E-3 – ARAR Summary for Potential Sediment Remedial Alternatives						
ARAR/TBC	**Alt. SED-2**		**Alt. SED-3**		**Alt. SED-4 and SED-5**	
	Dredge, place in CDF		**Dredge, Cap**		**Dredge-All**	
	Apply	**Comply**	**Apply**	**Comply**	**Apply**	**Comply**
WDNR Assessing Sediment Quality in Water Bodies Associated with Manufactured Gas Plant Sites, WDNR PUBL-WR-447-96, March 1996	Yes	Yes	Yes	Yes	Yes	Yes
WDNR Consensus-Based Sediment Quality Guidelines, Recommendations for Use & Application, Interim Guidance, WDNR PUBL-WT-732, 2003	Yes	Yes	Yes	Yes	Yes	Yes
International Joint Commission (IJC), IJC, 1992	No	NA	No	NA	No	NA

APPENDIX F

PRELIMINARY REMEDIATION COST ESTIMATES

APPENDIX F1

PRELIMNARY REMEDIATION COST ESTIMATES FOR SOIL

Table F1-1
Cost Summary of Soil Remedial Alternatives

Alternative	General Response Action	Technology	Soil Volume	Capital Costs	Mob/Demob	Engineering	Construction Oversight	Contingency	Post Construction Maintenance	Total
			cy							
S1	No Action	No Action	na	$0	$0	$0	$0		$0	$0
S2	Containment - Eng. Surface Barriers	Upper Bluff Area	na	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
		Kreher Park	na	$1,118,563	$55,928	$167,784	$167,784	$223,713	$21,716	$1,755,488
		Total		$1,224,118	$61,206	$183,618	$183,618	$244,824	$21,716	$1,919,099
S3A	Removal - limited removal & offsite disposal	Upper Bluff Area	9,550	$2,203,435	$110,172	$330,515	$330,515	$440,687	$0	$3,415,324
		Kreher Park	4,800	$973,848	$48,692	$146,077	$146,077	$194,770	$0	$1,509,464
		Total	14,350	$3,177,283	$158,864	$476,592	$476,592	$635,457	$0	$4,924,788
S3B	Removal - unlimited removal & offsite disposal	Upper Bluff Area	35,000	$5,103,860	$255,193	$765,579	$765,579	$1,020,772	$0	$7,910,983
		Kreher Park	225,000	$22,591,722	$1,129,586	$3,388,758	$3,388,758	$4,518,344	$0	$35,017,169
		Total	260,000	$27,695,582	$1,384,779	$4,154,337	$4,154,337	$5,539,116	$0	$42,928,152
S4A	Removal - limited removal & onsite disposal (one acre disposal cell)	Upper Bluff Area	9,550	$1,451,850	$72,593	$217,778	$217,778	$290,370	$0	$2,250,368
		Kreher Park	4,800	$1,054,203	$52,710	$158,130	$158,130	$210,841	$0	$1,634,014
		Total	14,350	$2,506,053	$125,303	$375,908	$375,908	$501,211	$0	$3,884,382
S4B	Removal - unlimited limited removal & onsite disposal (four acre disposal cell)	Upper Bluff Area	35,000	$1,788,580	$89,429	$268,287	$268,287	$357,716	$0	$2,772,299
		Kreher Park	4,800	$2,364,788	$118,239	$354,718	$354,718	$472,958	$0	$3,665,421
		Total	39,800	$4,153,368	$207,668	$623,005	$623,005	$830,674	$0	$6,437,720
S5A	Ex-situ Thermal Treatment (Onsite thermal desorption)	Upper Bluff Area	9,550	$3,036,291	$151,815	$455,444	$455,444	$607,258	$0	$4,706,250
		Kreher Park	4,800	$1,392,456	$69,623	$208,868	$208,868	$278,491	$0	$2,158,306
		Total	14,350	$4,428,746	$221,437	$664,312	$664,312	$885,749	$0	$6,864,557
S5B	Ex-situ Thermal Treatment (Offsite incineration)	Upper Bluff Area	9,550	$5,228,016	$261,401	$784,202	$784,202	$1,045,603	$0	$8,103,424
		Kreher Park	4,800	$2,436,468	$121,823	$365,470	$365,470	$487,294	$0	$3,776,525
		Total	14,350	$7,664,483	$383,224	$1,149,672	$1,149,672	$1,532,897	$0	$11,879,949
S6	Ex-situ Physical/Biological Treatment (onsite soil washing)	Upper Bluff Area	9,550	$3,671,748	$183,587	$550,762	$550,762	$734,350	$0	$5,691,209
		Kreher Park	4,800	$1,711,848	$85,592	$256,777	$256,777	$342,370	$0	$2,653,364
		Total	14,350	$5,383,595	$269,180	$807,539	$807,539	$1,076,719	$0	$8,344,573

Table F1-2
Summary of Wastewater Treatment Volumes for Potential Groundwater Remedial Alternatives

Soil Remedial Alternatives		Waster Generation	Wastewater Volume Copper Falls	Wastewater Volume Filled Ravine	Wastewater Volume Kreher Park
S-1	No Action	none	none	none	none
S-2	Containment - surface barrier (partial cap)	none	none	none	none
S-3A	Removal - limited removal & off-site disposal	construction dewatering	none	5 gpm for 20 days	5 gpm for 20 days
S-3B	Removal - unlimited removal & off-site disposal	construction dewatering	none	5 gpm for 60 days	20 gpm for 180 days
S-4A	Removal - limited removal & on-site disposal	construction dewatering	none	5 gpm for 20 days	5 gpm for 20 days
S-4B	Removal - unlimited limited removal & on-site disposal	construction dewatering	none	5 gpm for 60 days	5 gpm for 20 days
S-5A	Ex-situ Thermal Treatment (On-site thermal desorption)	construction dewatering	none	5 gpm for 20 days	5 gpm for 20 days
S-5B	Ex-situ Thermal Treatment (Off-site incineration)	construction dewatering	none	5 gpm for 20 days	5 gpm for 20 days
S-6	Ex-situ Physical/Biological Treatment	construction dewatering	none	5 gpm for 20 days	5 gpm for 20 days

Table F1-3
Alternate S2A Containment Using Engineered Surface Barriers (Partial Surface Barriers at Kreher Park)

Containment: **Surface Barriers**

	Total Area:	
1 ***Asphalt Pavement -***	16,000 sq ft	NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000 sq ft	NSPW Property North of St. Claire Street
	98,000 sq ft	Marina Parking Lot Area
2 ***Low Permeability Cap -***		
Includes 3 feet of clay.	42,500 sq ft	Former Coal Tar Dump Area
	72,000 sq ft	WWTP Area (includes TW-11 Area)

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Installation of new asphalt pavement	sq. yd.	1,778	$25	$44,444	NSPW Property South of St. Claire Street (includes grading)
2	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$105,556**	
	Mobilization/Demobilization @	5%	of	$105,556	$5,278	
	Engineering @	15%	of	$105,556	$15,833	
	Construction Oversight @	15%	of	$105,556	$15,833	
				Subtotal	**$142,500**	
	Contingency	20%	of	$105,556	$21,111	
				Total	**$163,611**	

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
2	Clear & Grub	est.	1	$10,000	$10,000	
3	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
4	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
5	Vegetation	acre	1	$3,500	$3,500	Seeding
6	WWTP Building Demolition	est.	1	$250,000	$250,000	
7	Installation of low permeability cap	cy	8,000	$25	$200,000	3 ft. of clay over former coal tar dump area
8	Top Soil	sq. yd.	8,000	$18	$144,000	0.5 ft. topsoil cover over clay cap
9	Vegetation	acre	1.7	$3,500	$5,785	Seeding
10	Storm water Drainage System	est.	1	$30,000	$30,000	For post-remediation storm water management
				Subtotal	**$1,118,563**	
	Mobilization/Demobilization @	5%	of	$1,118,563	$55,928	
	Engineering @	15%	of	$1,118,563	$167,784	
	Construction Oversight @	15%	of	$1,118,563	$167,784	
				Subtotal	**$1,510,060**	
	Contingency	20%	of	$1,118,563	$223,713	
				Total	**$1,733,772**	

Table F1-3
Alternate S2A Containment Using Engineered Surface Barriers (Partial Surface Barriers at Kreher Park)

Post Construction

Item No.	Item	Unit	Quantity	Unit Costs	Total
1	Annual Inspections	yr	30	$250	$7,500
2	Post-Closure Reporting/Record Keeping	yr	30	$500	$15,000
3	Cap Maintenance	yr	30	$1,000	$30,000
			Subtotal	**$1,750**	**$52,500**
	Present worth @7% Discount				**$21,716**

GRAND TOTAL $1,919,099

Summary	Capital Cost	Mod / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
Upper Bluff Area							
Installation of asphalt pavement - upper bluff area	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
Kreher Park							
Installation of asphalt pavement - Kreher Park (marina parking lot)	$272,222	$13,611	$40,833	$40,833	$54,444	$21,716	$443,660
Installation of a clay cap - Kreher Park (former coal tar dump area)	$216,556	$10,828	$32,483	$32,483	$43,311		$335,661
WWTP Building Demo and Clay Cap (includes TW-11 Area)	$629,785	$31,489	$94,468	$94,468	$125,957		$976,167
Estimated Cost	$1,118,563	$55,928	$167,784	$167,784	$223,713	$21,716	$1,755,488
Total Estimated Cost	$1,224,118	$61,206	$183,618	$183,618	$244,824	$21,716	$1,919,099

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

Table F1- 4
Alternate S3A: Limited Removal and Off-site Disposal

Containment:

Excavation - Limited Removal		Volume to Remove		
Remove NAPL contaminated soil	1.7 ton/cubic yard	9,400	cy	NSPW Property South of St. Claire Street
		150	cy	NSPW Property North of St. Claire Street
		4,800	cy	Former Coal Tar Dump Area
Surface Barriers		Total Area:		
Asphalt Pavement -		26,000	sq ft	NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.		22,000	sq ft	NSPW Property North of St. Claire Street
		98,000	sq ft	Marina Parking Lot Area
Low Permeability Cap -				
Includes 3 feet of clay.		42,500	sq ft	Former Coal Tar Dump Area

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Gas Holder Removal	Est.	1	$30,000	$30,000	Removal/demolition of buried gas holders.
3	Excavation	cy	9,550	$5	$47,750	
4	Transportation	ton	16,235	$25	$405,875	
5	Disposal	ton	16,235	$18	$292,230	
6	Backfill	cy	9,550	$12	$114,600	
7	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
8	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
9	Installation of new asphalt pavement	sq. yd.	48,000	$25	$1,200,000	NSPW Property North of St. Claire Street (includes grading)
10	Move/Abandon Existing Utilities and Wells	ls	1	$10,000	$10,000	Includes move/abandon existing buried sanitary and gas utilities
11	24 hr. Security of Site	weekly	4	$2,695	$10,780	$15/hr X 24 hr X 7 days + $25/day (expenses)
12	Perimeter Fence	ln ft	500	$20	$10,000	Fence around excavation area
				Subtotal	**$2,203,435**	
	Mobilization/Demobilization @	5%	of	$2,203,435	$110,172	
	Engineering @	15%	of	$2,203,435	$330,515	
	Construction Oversight @	15%	of	$2,203,435	$330,515	
				Subtotal	**$2,974,637**	
	Contingency @	20%	of	$2,203,435	$440,687	
				Total	**$3,415,324**	

Table F1- 4
Alternate S3A: Limited Removal and Off-site Disposal

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear & Grub	est.	1	$10,000	$10,000	
2	Excavation	cy	4,800	$5	$24,000	Former coal tar dump area to 5 feet.
3	Transportation	ton	8,160	$25	$204,000	
4	Perimeter Fence	ton	8,160	$18	$146,880	
5	Backfill	cy	4,800	$12	$57,600	Former coal tar dump area
7	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
8	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
9	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
10	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
11	Vegetation	acre	1	$3,500	$3,500	Seeding
12	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
13	24 hr. Security of Site	weekly	2	$2,695	$5,390	$15/hr X 24 hr X 7 days + $25/day (expenses)
14	Perimeter Fence	ln ft	750	$20	$15,000	Fence around excavation area
				Subtotal	**$973,848**	
	Mobilization/Demobilization @	5%	of	$973,848	$48,692	
	Engineering @	15%	of	$973,848	$146,077	
	Construction Oversight @	15%	of	$973,848	$146,077	
				Subtotal	**$1,314,695**	
	Contingency @	20%	of	$973,848	$194,770	
				Total	**$1,509,464**	

GRAND TOTAL $4,924,788

Summary

	Capital Costs	Mod / Demob	Engineering	Construction Oversight	Contingency	Estimated Cost
Limited removal and off-site disposal - upper bluff area	$2,203,435	$110,172	$330,515	$330,515	$440,687	$3,415,324
Limited removal and off-site disposal - Kreher Park	$973,848	$48,692	$146,077	$146,077	$194,770	$1,509,464
Total Estimated Cost	$3,177,283	$158,864	$476,592	$476,592	$635,457	$4,924,788

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

Table F1-5
Alternate S3B: Unlimited Removal and Off-site Disposal

Containment:

Excavation - Unlimited Removal		Volume to Remove		
Remove all fill material	1.7 ton/cubic yard	35,000 cy		Fill material in filled ravine volume
		12,000 cy		Fly ash within filled ravine (not contaminated with NAPL)
		225,000 cy		Fill material in Kreher Park
Surface Barriers		Total Area:		
Asphalt Pavement -		26,000 sq ft		NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.		22,000 sq ft		NSPW Property North of St. Claire Street
		98,000 sq ft		Marina Parking Lot Area

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Gas Holder Removal	Est.	1	$30,000	$30,000	Removal/demolition of buried gas holders.
3	Excavation	cy	35,000	$5	$175,000	All fill material
4	Transportation - off-site landfill	ton	59,500	$25	$1,487,500	NAPL contaminated soil and non fly ash debris
5	Disposal - off-site landfill	ton	59,500	$18	$1,071,000	NAPL contaminated soil and non fly ash debris
4	Transportation - NSPW landfill	ton	20,400	$25	$510,000	Fly ash material
5	Disposal - NSPW landfill	ton	20,400	$18	$367,200	Fly ash material
6	Backfill - salvaged from Kreher Park	cy	35,000	$3	$105,000	Clean fill salvaged from Kreher Park
7	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
8	Waste water treatment	Gallon	432,000	$0.05	$21,600	Existing treatment system (5 gpm for 60 days)
9	Installation of new asphalt pavement	sq. yd.	48,000	$25	$1,200,000	NSPW Property North of St. Claire Street (includes grading)
10	Move/abandon existing utilities and wells	ls	1	$10,000	$10,000	Includes move/abandon existing buried sanitary and gas utilities
11	24 hr. Security of Site	weekly	8	$2,695	$21,560	$15/hr X 24 hr X 7 days + $25/day (expenses)
12	Perimeter Fence	ln ft	1,500	$20	$30,000	Fence around excavation area
				Subtotal	**$5,103,860**	
	Mobilization/Demobilization @	5%	of	$5,103,860	$255,193	
	Engineering @	15%	of	$5,103,860	$765,579	
	Construction Oversight @	15%	of	$5,103,860	$765,579	
				Subtotal	**$6,890,211**	
	Contingency @	20%	of	$5,103,860	$1,020,772	
	Total			**Total**	**$7,910,983**	

Table F1-5
Alternate S3B: Unlimited Removal and Off-site Disposal

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear & Grub	est.	1	$10,000	$10,000	
2	WWTP Building Demolition	est.	1	$250,000	$250,000	
3	Vertical barrier wall	sf	32,000	$35	$1,120,000	Sheet pile wall 2,000 linear feet 16 feet deep along shoreline.
4	Excavation	cy	225,000	$5	$1,125,000	Fill material in Park, less volume used as backfill in upper bluff
5	Transportation to off-site landfill	ton	382,500	$25	$9,562,500	
6	Disposal	ton	382,500	$18	$6,885,000	
7	Backfill	cy	225,000	$12	$2,700,000	
8	Excavation de-watering equipment	Est.	1	$250,000	$250,000	Pumps and holding tanks
9	Waste water treatment	Gallon	5,184,000	$0.05	$259,200	Existing treatment system (20 gpm for 180 days)
10	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
11	24 hr. Security of Site	weekly	40	$2,695	$107,800	$15/hr X 24 hr X 7 days + $25/day (expenses)
12	Perimeter Fence	ln ft	2500	$20	$50,000	Fence around excavation area
	subtotal				$22,591,722	
	Mobilization/Demobilization @	5%	of	$22,591,722	$1,129,586	
	Engineering @	15%	of	$22,591,722	$3,388,758	
	Construction Oversight @	15%	of	$22,591,722	$3,388,758	
				Subtotal	**$30,498,825**	
	Contingency @	20%	of	$22,591,722	$4,518,344	
				Total	**$35,017,169**	

GRAND TOTAL $42,928,152

Summary

	Capital Costs	Mod / Demob	Engineering	Construction Oversight	Contingency	Estimated Cost
Limited removal and off-site disposal - upper bluff area	$5,103,860	$255,193	$765,579	$765,579	$1,020,772	$7,910,983
Limited removal and off-site disposal - Kreher Park	$22,591,722	$1,129,586	$3,388,758	$3,388,758	$4,518,344	$35,017,169
Total Estimated Cost	$27,695,582	$1,384,779	$4,154,337	$4,154,337	$5,539,116	$42,928,152

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

Table F1-6
Alternate S4A: Limited Removal and On-site Disposal (One Acre Disposal Cell)

Containment:

Excavation - Limited Removal		Volume to Remove		
Remove NAPL contaminated soil	1.7 ton/cubic yard	9,400	cy	NSPW Property South of St. Claire Street
		150	cy	NSPW Property North of St. Claire Street
		4,800	cy	Former Coal Tar Dump Area
Surface Barriers		Total Area:		
Asphalt Pavement -		26,000	sq ft	NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.		22,000	sq ft	NSPW Property North of St. Claire Street
		98,000	sq ft	Marina Parking Lot Area
Low Permeability Cap -				
Includes 3 feet of clay.		42,500	sq ft	Former Coal Tar Dump Area

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Gas Holder Removal	Est.	1	$30,000	$30,000	Removal/demolition of buried gas holders.
3	Excavation	cy	9,550	$5	$47,750	
4	Transportation (on-site)	ton	16,235	$2	$32,470	Transport to disposal cell in Kreher Park
6	Backfill	cy	9,550	$3	$28,650	Will utilize salvaged clean fill from Kreher Park
7	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
8	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
9	Installation of new asphalt pavement	sq. yd.	48,000	$25	$1,200,000	NSPW Property North of St. Claire Street (includes grading)
10	Move/Abandon Existing Utilities	ls	1	$10,000	$10,000	Includes move/abandon existing buried sanitary and gas utilities
11	24 hr. Security of Site	weekly	4	$2,695	$10,780	$15/hr X 24 hr X 7 days + $25/day (expenses)
12	Perimeter Fence	ln ft	500	$20	$10,000	Fence around excavation area
				Subtotal	**$1,451,850**	
	Mobilization/Demobilization @	5%	of	$1,451,850	$72,593	
	Engineering @	15%	of	$1,451,850	$217,778	
	Construction Oversight @	15%	of	$1,451,850	$217,778	
				Subtotal	**$1,959,998**	
	Contingency @	20%	of	$1,451,850	$290,370	
				Total	**$2,250,368**	

Table F1-6
Alternate S4A: Limited Removal and On-site Disposal (One Acre Disposal Cell)

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear & Grub	est.	1	$10,000	$10,000	
2	Excavation	cy	4,800	$5	$24,000	Former coal tar dump area to 5 feet.
3	Transportation (on-site)	ton	8,160	$2	$16,320	Transport to disposal cell in Kreher Park
4	Backfill	cy	4,800	$12	$57,600	Former coal tar dump area.
5	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
6	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
7	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
8	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
9	Vegetation	acre	1	$3,500	$3,415	Seeding
10	Disposal cell permit and sitting	Est.	1	$35,000	$35,000	
11	Disposal cell liner and cap	Acre	1	$350,000	$350,000	
12	Storm water Drainage System	Basin	1	$30,000	$30,000	For water runoff during storm post-remediation
13	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
14	24 hr. Security of Site	weekly	2	$2,695	$5,390	$15/hr X 24 hr X 7 days + $25/day (expenses)
15	Perimeter Fence	ln ft	750	$20	$15,000	Fence around excavation area
	subtotal			**Subtotal**	**$1,054,203**	
	Mobilization/Demobilization @	5%	of	$1,054,203	$52,710	
	Engineering @	15%	of	$1,054,203	$158,130	
	Construction Oversight @	15%	of	$1,054,203	$158,130	
				Subtotal	**$1,423,174**	
	Contingency @	20%	of	$1,054,203	$210,841	
				Total	$1,634,014	

GRAND TOTAL $3,884,382

Summary

	Capital Costs	Mod / Demob	Engineering	Construction Oversight	Contingency	Estimated Cost
Limited removal and off-site disposal - upper bluff area	$1,451,850	$72,593	$217,778	$217,778	$290,370	$2,250,368
Limited removal and off-site disposal - Kreher Park	$1,054,203	$52,710	$158,130	$158,130	$210,841	$1,634,014
Total Estimated Cost	$2,506,053	$125,303	$375,908	$375,908	$501,211	$3,884,382

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

Table F1-7
Alternate S4B: Unlimited Removal and On-site Disposal (Four Acre Disposal Cell)

Containment:

Excavation - Limited Removal		Volume to Remove		
Remove NAPL contaminated soil	1.7 ton/cubic yard	35,000 cy		Filled Ravine Volume
		4,800 cy		Former Coal Tar Dump Area
Surface Barriers		Total Area:		
Asphalt Pavement -		26,000 sq ft		NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.		22,000 sq ft		NSPW Property North of St. Claire Street
		98,000 sq ft		Marina Parking Lot Area
Low Permeability Cap -				
Includes 3 feet of clay.		42,500 sq ft		Former Coal Tar Dump Area

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Gas Holder Removal	Est.	1	$30,000	$30,000	Removal/demolition of buried gas holders.
3	Excavation	cy	35,000	$5	$175,000	
4	Transportation	ton	59,500	$2	$119,000	Transport to disposal cell in Kreher Park
6	Backfill	cy	35,000	$3	$105,000	Will utilize salvaged clean fill from Kreher Park
7	Excavation de-watering equipment	Est.	1	$50,000	$50,000	Pumps and holding tanks
8	Waste water treatment	Gallon	576,000	$0.05	$28,800	Existing treatment system (10 gpm for 40 days)
9	Installation of new asphalt pavement	sq. yd.	48,000	$25	$1,200,000	NSPW Property North of St. Claire Street (includes grading)
10	Move/Abandon Existing Utilities	ls	1	$10,000	$10,000	Includes move/abandon existing buried sanitary and gas utilities
11	24 hr. Security of Site	weekly	4	$2,695	$10,780	$15/hr X 24 hr X 7 days + $25/day (expenses)
12	Perimeter Fence	ln ft	500	$20	$10,000	Fence around excavation area
				Subtotal	**$1,788,580**	
	Mobilization/Demobilization @	5%	of	$1,788,580	$89,429	
	Engineering @	15%	of	$1,788,580	$268,287	
	Construction Oversight @	15%	of	$1,788,580	$268,287	
				Subtotal	**$2,414,583**	
	Contingency @	20%	of	$1,788,580	$357,716	
				Total	**$2,772,299**	

Table F1-7
Alternate S4B: Unlimited Removal and On-site Disposal (Four Acre Disposal Cell)

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear & Grub	est.	1	$10,000	$10,000	
2	WWTP Building Demolition	est.	1	$250,000	$250,000	
3	Excavation	cy	4,800	$5	$24,000	Former coal tar dump area to 5 feet.
4	Transportation (on-site)	ton	8,160	$2	$16,320	Transport to disposal cell in Kreher Park
5	Backfill	cy	4,800	$12	$57,600	Former coal tar dump area.
6	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
7	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
8	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
9	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
10	Vegetation	acre	4	$3,500	$14,000	Seeding
11	Disposal cell permit and sitting	Est.	1	$35,000	$35,000	
12	Disposal cell liner and cap	Acre	4	$350,000	$1,400,000	
13	Storm water Drainage System	Basin	1	$30,000	$30,000	For water runoff during storm post-remediation
14	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
15	24 hr. Security of Site	weekly	2	$2,695	$5,390	$15/hr X 24 hr X 7 days + $25/day (expenses)
16	Perimeter Fence	ln ft	750	$20	$15,000	Fence around excavation area
	subtotal				$2,364,788	
	Mobilization/Demobilization @	5%	of	$2,364,788	$118,239	
	Engineering @	15%	of	$2,364,788	$354,718	
	Construction Oversight @	15%	of	$2,364,788	$354,718	
				Subtotal	**$3,192,464**	
	Contingency @	20%	of	$2,364,788	$472,958	
	Total				$3,665,421	

GRAND TOTAL $6,437,720

Summary

	Capital Costs	Mod / Demob	Engineering	Construction Oversight	Contingency	Estimated Cost
Limited removal and off-site disposal - upper bluff area	$1,788,580	$89,429	$268,287	$268,287	$357,716	$2,772,299
Limited removal and off-site disposal - Kreher Park	$2,364,788	$118,239	$354,718	$354,718	$472,958	$3,665,421
Total Estimated Cost	$4,153,368	$207,668	$623,005	$623,005	$830,674	$6,437,720

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

Table F1-8
Alternate S5A: Limited Removal and On-site Thermal Treatment

Containment:

Excavation - Limited Removal		Volume to Remove		
Remove NAPL contaminated soil	1.7 ton/cubic yard	9,400	cy	NSPW Property South of St. Claire Street
		150	cy	NSPW Property North of St. Claire Street
		4,800	cy	Former Coal Tar Dump Area
Surface Barriers		Total Area:		
Asphalt Pavement -		26,000	sq ft	NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.		22,000	sq ft	NSPW Property North of St. Claire Street
		98,000	sq ft	Marina Parking Lot Area
Low Permeability Cap -				
Includes 3 feet of clay.		42,500	sq ft	Former Coal Tar Dump Area

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Gas Holder Removal	Est.	1	$30,000	$30,000	Removal/demolition of buried gas holders.
3	Excavation	cy	9,550	$5	$47,750	
4	Transportation for off-site landfill	ton	1,624	$25	$40,588	Assumes 10% of fill not suitable for thermal treatment
5	Sorting and Disposal (unsuitable material)	ton	1,624	$18	$29,223	
6	Thermal Treatment	ton	14,612	$100	$1,461,150	Thermal desorption and on-site placement of treated soil.
7	Backfill	cy	9,550	$12	$114,600	
8	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
9	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
10	Installation of new asphalt pavement	sq. yd.	48,000	$25	$1,200,000	NSPW Property North of St. Claire Street (includes grading)
11	Move/Abandon Existing Utilities	ls	1	$10,000	$10,000	Includes move/abandon existing buried sanitary and gas utilities
12	24 hr. Security of Site	weekly	4	$2,695	$10,780	$15/hr X 24 hr X 7 days + $25/day (expenses)
13	Perimeter Fence	ln ft	500	$20	$10,000	Fence around excavation area
				Subtotal	$3,036,291	
	Mobilization/Demobilization @	5%	of	$3,036,291	$151,815	
	Engineering @	15%	of	$3,036,291	$455,444	
	Construction Oversight @	15%	of	$3,036,291	$455,444	
				Subtotal	**$4,098,992**	
	Contingency @	20%	of	$3,036,291	$607,258	
				Total	**$4,706,250**	

Table F1-8
Alternate S5A: Limited Removal and On-site Thermal Treatment

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear & Grub	est.	1	$10,000	$10,000	
2	Excavation	cy	4,800	$5	$24,000	Former coal tar dump area to 5 feet.
3	Transportation	ton	816	$25	$20,400	
4	Sorting and Disposal (unsuitable material)	ton	816	$18	$14,688	Assumes 10% of fill not suitable for thermal treatment
5	Thermal Treatment	ton	7,344	$100	$734,400	
6	Backfill	cy	4,800	$12	$57,600	
7	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
8	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
9	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
10	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
11	Vegetation	acre	1	$3,500	$3,500	Seeding
12	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
13	24 hr. Security of Site	weekly	2	$2,695	$5,390	$15/hr X 24 hr X 7 days + $25/day (expenses)
14	Perimeter Fence	ln ft	750	$20	$15,000	Fence around excavation area
	subtotal			**Subtotal**	$1,392,456	
	Mobilization/Demobilization @	5%	of	$1,392,456	$69,623	
	Engineering @	15%	of	$1,392,456	$208,868	
	Construction Oversight @	15%	of	$1,392,456	$208,868	
				Subtotal	**$1,879,815**	
	Contingency @	20%	of	$1,392,456	$278,491	
				Total	**$2,158,306**	

GRAND TOTAL $6,864,557

Summary

	Capital Costs	Mod / Demob	Engineering	Construction Oversight	Contingency	Estimated Cost
Limited removal and off-site disposal - upper bluff area	$3,036,291	$151,815	$455,444	$455,444	$607,258	$4,706,250
Limited removal and off-site disposal - Kreher Park	$1,392,456	$69,623	$208,868	$208,868	$278,491	$2,158,306
Total Estimated Cost	$4,428,746	$221,437	$664,312	$664,312	$885,749	$6,864,557

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

Table F1-9
Alternate S5B: Limited Removal and Off-site Incineration

Containment:

Excavation - Limited Removal		Volume to Remove		
Remove NAPL contaminated soil	1.7 ton/cubic yard	9,400	cy	NSPW Property South of St. Claire Street
		150	cy	NSPW Property North of St. Claire Street
		4,800	cy	Former Coal Tar Dump Area
Surface Barriers		Total Area:		
Asphalt Pavement -		26,000	sq ft	NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.		22,000	sq ft	NSPW Property North of St. Claire Street
		98,000	sq ft	Marina Parking Lot Area
Low Permeability Cap -				
Includes 3 feet of clay.		42,500	sq ft	Former Coal Tar Dump Area

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Gas Holder Removal	Est.	1	$30,000	$30,000	Removal/demolition of buried gas holders.
3	Excavation	cy	9,550	$5	$47,750	
4	Transportation for off-site landfill	ton	1,624	$25	$40,588	Assumes 10% of fill not suitable for thermal treatment
5	Sorting and Disposal (unsuitable material)	ton	1,624	$18	$29,223	
7	Transportation for off-site incineration	ton	14,612	$50	$730,575	
8	Incineration	ton	14,612	$200	$2,922,300	
9	Backfill	cy	9,550	$12	$114,600	
10	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
11	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
12	Installation of new asphalt pavement	sq. yd.	48,000	$25	$1,200,000	NSPW Property North of St. Claire Street (includes grading)
13	Move/Abandon Existing Utilities	ls	1	$10,000	$10,000	Includes move/abandon existing buried sanitary and gas utilities
14	24 hr. Security of Site	weekly	4	$2,695	$10,780	$15/hr X 24 hr X 7 days + $25/day (expenses)
15	Perimeter Fence	ln ft	500	$20	$10,000	Fence around excavation area
	subtotal			**Subtotal**	**$5,228,016**	
	Mobilization/Demobilization @	5%	of	$5,228,016	$261,401	
	Engineering @	15%	of	$5,228,016	$784,202	
	Construction Oversight @	15%	of	$5,228,016	$784,202	
				Subtotal	**$7,057,821**	
	Contingency @	20%	of	$5,228,016	$1,045,603	
				Total	**$8,103,424**	

Table F1-9
Alternate S5B: Limited Removal and Off-site Incineration

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear & Grub	est.	1	$10,000	$10,000	Former coal tar dump area to 5 feet.
2	Excavation	cy	4,800	$5	$24,000	Former coal tar dump area to 5 feet.
3	Transportation for off-site landfill	ton	816	$25	$20,400	
4	Sorting and Disposal (unsuitable material)	ton	816	$18	$14,688	Assumes 10% of fill not suitable for thermal treatment
5	Transportation for off-site incineration	ton	7,344	$50	$367,200	
6	Incineration	ton	7,344	$200	$1,468,800	
7	Backfill	cy	1	$12	$12	
8	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
9	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
10	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
11	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
12	Vegetation	acre	1	$3,500	$3,500	Seeding
13	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
14	24 hr. Security of Site	weekly	2	$2,695	$5,390	$15/hr X 24 hr X 7 days + $25/day (expenses)
15	Perimeter Fence	ln ft	750	$20	$15,000	Fence around excavation area
	subtotal			**Subtotal**	$2,436,468	
	Mobilization/Demobilization @	5%	of	$2,436,468	$121,823	
	Engineering @	15%	of	$2,436,468	$365,470	
	Construction Oversight @	15%	of	$2,436,468	$365,470	
				Subtotal	**$3,289,232**	
	Contingency @	20%	of	$2,436,468	$487,294	
				Total	**$3,776,525**	

GRAND TOTAL $11,879,949

Summary

	Capital Costs	Mod / Demob	Engineering	Construction Oversight	Contingency	Estimated Cost
Limited removal and off-site disposal - upper bluff area	$5,228,016	$261,401	$784,202	$784,202	$1,045,603	$8,103,424
Limited removal and off-site disposal - Kreher Park	$2,436,468	$121,823	$365,470	$365,470	$487,294	$3,776,525
Total Estimated Cost	$7,664,483	$383,224	$1,149,672	$1,149,672	$1,532,897	$11,879,949

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

Table F1-10
Alternate S6: Limited Removal and On-site Soil Washing

Containment:

Excavation - Limited Removal		Volume to Remove		
Remove NAPL contaminated soil	1.7 ton/cubic yard	9,400	cy	NSPW Property South of St. Claire Street
		150	cy	NSPW Property North of St. Claire Street
		4,800	cy	Former Coal Tar Dump Area
Surface Barriers		Total Area:		
Asphalt Pavement -		26,000	sq ft	NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.		22,000	sq ft	NSPW Property North of St. Claire Street
		98,000	sq ft	Marina Parking Lot Area
Low Permeability Cap -				
Includes 3 feet of clay.		42,500	sq ft	Former Coal Tar Dump Area

Upper Bluff Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Gas Holder Removal	Est.	1	$30,000	$30,000	Removal/demolition of buried gas holders.
3	Excavation	cy	9,550	$5	$47,750	
4	Transportation for off-site landfill	ton	1,624	$25	$40,588	Assumes 10% of fill not suitable for thermal treatment
5	Disposal	ton	1,624	$18	$29,223	
6	Soil Wash	ton	14,612	$150	$2,191,725	Thermal desorption and on-site placement of treated soil.
7	Backfill	cy	1,624	$12	$19,482	
8	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
9	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
10	Installation of new asphalt pavement	sq. yd.	48,000	$25	$1,200,000	NSPW Property North of St. Claire Street (includes grading)
11	Move/Abandon Existing Utilities	ls	1	$10,000	$10,000	Includes move/abandon existing buried sanitary and gas utilities
12	24 hr. Security of Site	weekly	4	$2,695	$10,780	$15/hr X 24 hr X 7 days + $25/day (expenses)
13	Perimeter Fence	ln ft	500	$20	$10,000	Fence around excavation area
				Subtotal	$3,671,748	
	Mobilization/Demobilization @	5%	of	$3,671,748	$183,587	
	Engineering @	15%	of	$3,671,748	$550,762	
	Construction Oversight @	15%	of	$3,671,748	$550,762	
				Subtotal	**$4,956,859**	
	Contingency @	20%	of	$3,671,748	$734,350	
				Total	$5,691,209	

Table F1-10
Alternate S6: Limited Removal and On-site Soil Washing

Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear & Grub	est.	1	$10,000	$10,000	
2	Excavation	cy	4,800	$5	$24,000	Former coal tar dump area to 5 feet.
3	Transportation	ton	816	$25	$20,400	
4	Disposal	ton	816	$18	$14,688	Assumes 10% of fill not suitable for thermal treatment
5	Soil Wash	ton	7,344	$150	$1,101,600	
6	Backfill	cy	816	$12	$9,792	
7	Excavation de-watering equipment	Est.	1	$25,000	$25,000	Pumps and holding tanks
8	Waste water treatment	Gallon	144,000	$0.05	$7,200	Existing treatment system (5 gpm for 20 days)
9	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
10	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
11	Vegetation	acre	1	$3,500	$3,500	Seeding
12	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
13	24 hr. Security of Site	weekly	2	$2,695	$5,390	$15/hr X 24 hr X 7 days + $25/day (expenses)
14	Perimeter Fence	ln ft	750	$20	$15,000	Fence around excavation area
				Subtotal	$1,711,848	
	Mobilization/Demobilization @	5%	of	$1,711,848	$85,592	
	Engineering @	15%	of	$1,711,848	$256,777	
	Construction Oversight @	15%	of	$1,711,848	$256,777	
				Subtotal	**$2,310,995**	
	Contingency @	20%	of	$1,711,848	$342,370	
				Total	$2,653,364	

GRAND TOTAL $8,344,573

Summary

	Capital Costs	Mod / Demob	Engineering	Construction Oversight	Contingency	Estimated Cost
Limited removal and off-site disposal - upper bluff area	$3,671,748	$183,587.38	$550,762	$550,762	$734,350	$5,691,209
Limited removal and off-site disposal - Kreher Park	$1,711,848	$85,592.39	$256,777	$256,777	$342,370	$2,653,364
Total Estimated Cost	$5,383,595	$269,180	$807,539	$807,539	$1,076,719	$8,344,573

Long term groundwater monitoring costs are included with groundwater remedial alternatives.

APPENDIX F2

PRELIMNARY REMEDIATION
COST ESTIMATES FOR GROUNDWATER

Table F2-1
Cost Summary of Groundwater Remedial Alternatives

Alternative	General Response Action	Technology	Capital Costs	Mob/Demob	Engineering	Construction Oversight	Contingency	Post Construction OM&M	Total
GW1	**No Action**	**No Action**	$0	$0	$0	$0	$0	$0	$0
GW2A	**Containment**	**Engineered Surface & Vertical Barriers**							
		Copper Falls Aquifer	$0	$0	$0	$0	$0	$0	$0
		Shallow Groundwater - Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
		Shallow Groundwater - Kreher Park (partial cap)	$4,237,768	$211,888	$635,665	$635,665	$847,554	$2,504,757	$9,073,298
		Total	***$4,343,324***	***$217,166***	***$651,499***	***$651,499***	***$868,665***	***$2,504,757***	***$9,236,909***
GW2B	**Containment**	**Engineered Surface & Vertical Barriers**							
		Copper Falls Aquifer	$0	$0	$0	$0	$0	$0	$0
		Shallow Groundwater - Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
		Shallow Groundwater - Kreher Park (cap entire Park)	$6,030,852	$301,543	$904,628	$904,628	$1,206,170	$1,469,226	$10,817,047
		Total	***$6,136,408***	***$306,820***	***$920,461***	***$920,461***	***$1,227,282***	***$1,469,226***	***$10,980,658***
GW3	**In-situ Treatment**	**Ozone sparge**							
		Copper Falls Aquifer	$763,000	$38,150	$114,450	$114,450	$152,600	$694,704	$1,877,354
		Shallow Groundwater - Filled Ravine	$133,000	$6,650	$19,950	$19,950	$26,600	$63,550	$269,700
		Shallow Groundwater - Kreher Park	$1,009,000	$50,450	$151,350	$151,350	$201,800	$84,050	$1,648,000
		Total	***$1,905,000***	***$95,250***	***$285,750***	***$285,750***	***$381,000***	***$842,304***	***$3,795,054***
GW4	**In-situ Treatment**	**Surfactant Injection/Dual Phase Recovery**							
		Copper Falls Aquifer	$479,800	$23,990	$71,970	$71,970	$95,960	$682,404	$1,426,094
		Shallow Groundwater - Filled Ravine	$0	$0	$0	$0	$0	$0	$0
		Shallow Groundwater - Kreher Park	$0	$0	$0	$0	$0	$0	$0
		Total	***$479,800***	***$23,990***	***$71,970***	***$71,970***	***$95,960***	***$682,404***	***$1,426,094***
GW5	**In-situ Treatment**	**Permeable Reactive Barrier Well**							
		Copper Falls Aquifer	$0	$0	$0	$0	$0	$0	$0
		Shallow Groundwater - Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
		Shallow Groundwater - Kreher Park	$3,650,174	$182,509	$547,526	$547,526	$730,035	$397,088	$6,054,858
		Total	***$3,755,730***	***$187,786***	***$563,359***	***$563,359***	***$751,146***	***$397,088***	***$6,218,469***
GW6	**In-situ Treatment**	**Chemical Oxidation**							
		Copper Falls Aquifer	$2,017,500	$100,875	$302,625	$302,625	$403,500	$2,596,420	$5,723,545
		Shallow Groundwater - Filled Ravine	$1,333,333	$66,667	$200,000	$200,000	$266,667	$67,363	$2,134,029
		Shallow Groundwater - Kreher Park	$1,352,389	$67,619	$202,858	$202,858	$270,478	$94,308	$2,190,510
		Total	***$4,703,222***	***$235,161***	***$705,483***	***$705,483***	***$940,644***	***$2,758,090***	***$10,048,085***
GW7	**In-situ Treatment**	**Electrical Resistance Heating**							
		Copper Falls Aquifer	$4,439,200	$221,960	$665,880	$665,880	$887,840	$123,000	$7,003,760
		Shallow Groundwater - Filled Ravine	$2,852,633	$142,632	$427,895	$427,895	$570,527	$51,250	$4,472,832
		Shallow Groundwater - Kreher Park	$2,949,628	$147,481	$442,444	$442,444	$589,926	$71,750	$4,643,673
		Total	***$10,241,461***	***$512,073***	***$1,536,219***	***$1,536,219***	***$2,048,292***	***$246,000***	***$16,120,265***
GW8	**In-situ Treatment**	**Dynamic Underground Stripping / CROW**							
		Copper Falls Aquifer (DUS)	$4,637,200	$231,860	$695,580	$695,580	$927,440	$123,000	$7,310,660
		Shallow Groundwater - Filled Ravine (CROW)	$1,698,333	$84,917	$254,750	$254,750	$339,667	$51,250	$2,683,667
		Shallow Groundwater - Kreher Park (CROW)	$1,581,111	$79,056	$237,167	$237,167	$316,222	$71,750	$2,522,472
		Total	***$7,916,644***	***$395,832***	***$1,187,497***	***$1,187,497***	***$1,583,329***	***$246,000***	***$12,516,799***
GW9A	**Removal**	**Groundwater Extraction - Existing System**							
		Copper Falls Aquifer	$0	$0	$0	$0	$0	$2,220,466	$2,220,466
		Shallow Groundwater - Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
		Shallow Groundwater - Kreher Park	$0	$0	$0	$0	$0	$0	$0
		Total	***$105,556***	***$5,278***	***$15,833***	***$15,833***	***$21,111***	***$2,220,466***	***$2,384,078***
GW9B	**Removal**	**Groundwater Extraction - Enhanced System**							
		Copper Falls Aquifer	$284,500	$14,225	$42,675	$42,675	$56,900	$5,978,656	$6,419,631
		Shallow Groundwater - Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
		Shallow Groundwater - Kreher Park	$966,278	$48,314	$144,942	$144,942	$193,256	$17,392,454	$18,890,185
		Total	***$1,356,333***	***$67,817***	***$203,450***	***$203,450***	***$271,267***	***$23,371,111***	***$25,473,427***

Table F2-2
Summary of Wastewater Treatment Volumes for Potential Groundwater Remedial Alternatives

GW-1	No Action	none	none	none	none
GW-2A	Containment - surface (partial cap) & vertical barriers	from infiltration	none	discharge to Park	2,250,000 gal per year
GW-2B	Containment - surface (cap entire Park) & vertical barriers	from infiltration	none	discharge to Park	893,000 gal per year
GW-3	Ozone Sparge	existing system	3 gpm for 5 years	included w/Copper Falls	none
GW-4	Surfactant/Dual Phase Recovery	existing system	3 gpm for 5 years	included w/Copper Falls	none
GW-5	Permeable Reactive Barrier Wall	from infiltration	none	discharge to Park	discharge thru PRB
GW-6	In-situ Chemical Oxidation	enhanced system	15 gpm for 7 years	none	none
GW-7	Electrical Resistance Heating	enhanced system	20 gpm for 12 months	10 gpm for 12 months	20 gpm for 12 months
GW-8	Steam Injection (DUS and CROW)	enhanced system	20 gpm for 6 months	10 gpm for 6 months	20 gpm for 6 months
GW-9A	Groundwater Extraction - Existing System	existing system	3 gpm for 5 years	included w/Copper Falls	none
GW-9B	Groundwater Extraction - Enhanced System	enhanced system	15 gpm for 30+ years	included w/Copper Falls	50 gpm for 30+ years

Table F2-3
Alternate GW2A: Containment Using Engineered Surface and Vertical Barriers (Partial Cap for Kreher Park)

Containment: **Surface Barriers**

		Total Area:	
1	***Asphalt Pavement -***	16,000 sq ft	NSPW Property South of St. Claire Street
	Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000 sq ft	NSPW Property North of St. Claire Street
		98,000 sq ft	Marina Parking Lot Area
2	***Low Permeability Cap -***		
	Includes 3 feet of clay.	42,500 sq ft	Former Coal Tar Dump Area
		5,000 sq ft	TW-11 Area
		72,000 sq ft	WWTP Area

Upland Area ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Installation of new asphalt pavement	sq. yd.	1,778	$25	$44,444	NSPW Property South of St. Claire Street (includes grading)
2	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$105,556**	
	Mobilization/Demobilization @	5%	of	$105,556	$5,278	
	Engineering @	15%	of	$105,556	$15,833	
	Construction Oversight @	15%	of	$105,556	$15,833	
				Subtotal	**$142,500**	
	Contingency @	20%	of	$105,556	$21,111	
				Total	**$163,611**	

Kreher Park ***Shallow Groundwater - Kreher Park***
Former Coal Tar Dump and TW-11 Areas

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear and Grub	est.	1	$10,000	$10,000	
2	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
3	Installation of low permeability cap	cy	5,278	$25	$131,944	3 ft. of clay over former coal tar dump area
4	Top Soil	sq. yd.	5,278	$18	$95,000	0.5 ft. topsoil cover over clay cap
5	Vegetation	acre	1.1	$3,500	$3,817	Seeding
6	Storm water Drainage System	est.	1	$30,000	$30,000	For water runoff during storm post-remediation
7	Vertical barrier wall - along shoreline	sf	38,750	$35	$1,356,250	Sheet pile wall (1,550 linear feet and 25 feet deep).
8	Vertical barrier wall - perimeter	sf	32,000	$35	$1,120,000	Sheet pile wall (2,000 linear feet and 16 feet deep).
9	Groundwater Diversion Trench	ln ft	1,525	$50	$76,250	Divert groundwater from upper bluff area around Kreher Park
10	Groundwater Extraction Wells	each	15	$2,500	$37,500	
11	Well Pumps	each	15	$2,500	$37,500	
12	Extraction Well Lateral Piping	ln ft	2,500	$100	$250,000	
13	Discharge Lateral Piping	ln ft	1,500	$75	$112,500	
14	Treatment equipment	each	1	$30,000	$30,000	
15	Building	each	1	$25,000	$25,000	
16	UST/OWS System	Est.	1	$15,000	$15,000	
17	Institutional Control Implementation	est.	1	$5,000	$5,000	Groundwater use and deed restrictions.
	subtotal			**Subtotal**	**$3,607,983**	
	Mobilization/Demobilization @	5%	of	$3,607,983	$180,399	
	Engineering @	15%	of	$3,607,983	$541,197	Includes WPDES permit application.
	Construction Oversight @	15%	of	$3,607,983	$541,197	
				Subtotal	**$4,870,777**	
	Contingency @	20%	of	$3,607,983	$721,597	
				Total	**$5,592,374**	

Table F2-3
Alternate GW2A: Containment Using Engineered Surface and Vertical Barriers (Partial Cap for Kreher Park)

Shallow Groundwater - Kreher Park
WWTP Area

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	WWTP Building Demolition	est.	1	$250,000	$250,000	
2	Installation of low permeability cap	cy	8,000	$25	$200,000	3 ft. of clay at WWTP area (post demolition)
3	Top Soil	sq. yd.	8,000	$18	$144,000	0.5 ft. topsoil cover over clay cap
4	Vegetation	acre	1.7	$3,500	$5,785	Seeding
5	Storm water Drainage System	est.	1	$30,000	$30,000	For water runoff during storm post-remediation
				Subtotal	$629,785	
	Mobilization/Demobilization @	5%	of	$629,785	$31,489	
	Engineering @	15%	of	$629,785	$94,468	
	Construction Oversight @	15%	of	$629,785	$94,468	
				Subtotal	**$850,210**	
	Contingency @	20%	of	$629,785	$125,957	
				Total	**$976,167**	

Post Construction

Item No.	Item	Unit	Quantity	Unit Costs	Total	
1	Annual Inspections	yr	30	$250	$7,500	
2	Post-Closure Reporting/Record Keeping	yr	30	$500	$15,000	
3	Cap Maintenance	yr	30	$1,000	$30,000	
4	Groundwater Extraction System O & M	yr	30	$57,600	$1,728,000	$4,800 per month
5	Groundwater monitoring	yr	30	$25,000	$750,000	shallow groundwater monitoring
6	Annual cap inspection and reporting	yr	30	$5,000	$150,000	
7	Groundwater treatment & disposal	yr	30	$112,500	$3,375,000	2,250,000 gallons per year (from infiltration)
			Subtotal	**$201,850**	**$6,055,500**	
	Present worth @7% Discount				**$2,504,757**	

GRAND TOTAL $9,236,909

Summary

	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
Installation of surface barrier - upper bluff area	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
Installation of surface & vertical barrier - Kreher Park	$3,607,983	$180,399	$541,197	$541,197	$721,597	$0	$5,592,374
WWTP Demolition and clay cap	$629,785	$31,489	$94,468	$94,468	$125,957	$0	$976,167
Post construction maintenance and monitoring (30 years)	$0	$0	$0	$0		$2,504,757	$2,504,757
Total Estimated Cost	$4,343,324	$217,166	$651,499	$651,499	$868,665	$2,504,757	$9,236,909

Includes groundwater monitoring costs for shallow groundwater

Table F2-4
Alternate GW2B: Containment Using Engineered Surface and Vertical Barriers (Cap for Kreher Park)

Containment: **Surface Barriers**

	Total Area:	
1 ***Asphalt Pavement -***	16,000 sq ft	NSPW Property South of St. Claire Street
Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000 sq ft	NSPW Property North of St. Claire Street
	98,000 sq ft	Marina Parking Lot Area
2 ***Low Permeability Cap -***		
Includes 3 feet of clay.	11.5 Acres	Kreher Park

Upland Area ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Installation of new asphalt pavement	sq. yd.	1,778	$25	$44,444	NSPW Property South of St. Claire Street (includes grading)
2	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$105,556**	
	Mobilization/Demobilization @	5%	of	$105,556	$5,278	
	Engineering @	15%	of	$105,556	$15,833	
	Construction Oversight @	15%	of	$105,556	$15,833	
				Subtotal	**$142,500**	
	Contingency @	20%	of	$105,556	$21,111	
				Total	**$163,611**	

Kreher Park ***Shallow Groundwater - Kreher Park***
Former Coal Tar Dump and TW-11 Areas

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear and Grub	est.	1	$10,000	$10,000	
2	WWTP Building Demolition	est.	1	$250,000	$250,000	
3	Installation of low permeability cap	cy	55,660	$25	$1,391,500	3 ft. of clay over former coal tar dump area
4	Top Soil	sq. yd.	55,660	$18	$1,001,880	0.5 ft. topsoil cover over clay cap
5	Vegetation	acre	11.5	$3,500	$40,250	Seeding
6	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
7	Vertical barrier wall - along shoreline	sf	38,750	$35	$1,356,250	Sheet pile wall (1,550 linear feet and 25 feet deep).
8	Vertical barrier wall - perimeter	sf	32,000	$35	$1,120,000	Sheet pile wall (2,000 linear feet and 16 feet deep).
9	Groundwater Diversion Trench	ln ft	1,525	$50	$76,250	Divert groundwater from upper bluff area around Kreher Park
10	Groundwater Extraction Wells	each	15	$2,500	$37,500	
11	Well Pumps	each	15	$2,500	$37,500	
12	Extraction Well Lateral Piping	ln ft	2,500	$100	$250,000	
13	Discharge Lateral Piping	ln ft	1,500	$75	$112,500	
14	Treatment equipment	each	1	$30,000	$30,000	
15	Building	each	1	$25,000	$25,000	
16	UST/OWS System	Est.	1	$15,000	$15,000	
17	Institutional Control Implementation	est.	1	$5,000	$5,000	Groundwater use and deed restrictions.
	subtotal			**Subtotal**	$6,030,852	
	Mobilization/Demobilization @	5%	of	$6,030,852	$301,543	
	Engineering @	15%	of	$6,030,852	$904,628	Includes WPDES permit application.
	Construction Oversight @	15%	of	$6,030,852	$904,628	
				Subtotal	**$8,141,651**	
	Contingency @	20%	of	$6,030,852	$1,206,170	
				Total	**$9,347,821**	

Table F2-4
Alternate GW2B: Containment Using Engineered Surface and Vertical Barriers (Cap for Kreher Park)

Post Construction

Item No.	Item	Unit	Quantity	Unit Costs	Total	
1	Annual Inspections	yr	30	$250	$7,500	
2	Post-Closure Reporting/Record Keeping	yr	30	$500	$15,000	
3	Cap Maintenance	yr	30	$1,000	$30,000	
4	Groundwater Extraction System O & M	yr	30	$42,000	$1,260,000	$3,500 per month
5	Groundwater monitoring	yr	30	$25,000	$750,000	shallow groundwater monitoring
6	Annual cap inspection and reporting	yr	30	$5,000	$150,000	
7	Groundwater treatment & disposal	yr	30	$44,650	$1,339,500	893,000 gallons per year (from infiltration)
			Subtotal	**$118,400**	**$3,552,000**	
		Present worth @7% Discount			**$1,469,226**	

GRAND TOTAL $10,980,658

Summary

	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
Installation of surface barrier - upper bluff area	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
Installation of surface & vertical barrier - Kreher Park	$6,030,852	$301,543	$904,628	$904,628	$1,206,170	$1,469,226	$10,817,047
Total Estimated Cost	$6,136,408	$306,820	$920,461	$920,461	$1,227,282	$1,469,226	$10,980,658

Includes groundwater monitoring costs for shallow groundwater

Table F2-5
Alternate GW3: Ozone Sparge

In-situ Treatment **Ozone Sparge**

Upland Area ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
	Pilot Test	estimate	1	$25,000	$25,000	
1	Sparge point well installation	each	72	$1,500	$108,000	12 sparge wells per control panel
2	Sparge well line installation	ln ft	10,800	$40	$432,000	150 feet per sparge well
3	Control panel	each	6	$33,000	$198,000	
				Subtotal	**$763,000**	
	Mobilization/Demobilization @	5%	of	$763,000	$38,150	
	Engineering @	15%	of	$763,000	$114,450	
	Construction Oversight @	15%	of	$763,000	$114,450	
				Subtotal	**$1,030,050**	
	Contingency @	20%	of	$763,000	$152,600	
				Total	**$1,182,650**	

Post Construction

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	O & M (ozone sparge)	year	5	$3,000	$15,000	
2	O & M (groundwater treatment)	year	5	$57,600	$288,000	Existing groundwater treatment system
3	Wastewater treatment	year	5	$78,840	$394,200	3 gpm @ $0.05 per gallon
4	Groundwater Monitoring	year	5	$25,000	$125,000	
5	Annual report	year	5	$5,000	$25,000	
			Total	$169,440	$847,200	
	Present worth @7% Discount				**$694,704**	

Shallow Groundwater - Filled Ravine

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
	Pilot Test	estimate	1	$10,000	$10,000	
1	Sparge point well installation	each	12	$1,500	$18,000	12 sparge wells per control panel
2	Sparge well line installation	ln ft	1,800	$40	$72,000	150 feet per sparge well
3	Control panel	each	1	$33,000	$33,000	
				Subtotal	**$133,000**	
	Mobilization/Demobilization @	5%	of	$133,000	$6,650	
	Engineering @	15%	of	$133,000	$19,950	
	Construction Oversight @	15%	of	$133,000	$19,950	
				Subtotal	**$179,550**	
	Contingency @	20%	of	$133,000	$26,600	
				Total	**$206,150**	

Post Construction

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	O & M (ozone sparge)	year	5	$3,000	$15,000
2	Groundwater Monitoring	year	5	$10,000	$50,000
3	Annual report	year	5	$2,500	$12,500
			Subtotal	**$15,500**	**$77,500**
	Present worth @7% Discount				**$63,550**

Table F2-5
Alternate GW3: Ozone Sparge

Kreher Park

Shallow Groundwater - Kreher Park

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
	Pilot Test	estimate	1	$25,000	$25,000	
1	Sparge point well installation	each	96	$1,500	$144,000	12 sparge wells per control panel
2	Sparge well line installation	ln ft	14,400	$40	$576,000	150 feet per sparge well
3	Control panel	each	8	$33,000	$264,000	
				Subtotal	$1,009,000	
	Mobilization/Demobilization @	5%	of	$1,009,000	$50,450	
	Engineering @	15%	of	$1,009,000	$151,350	
	Construction Oversight @	15%	of	$1,009,000	$151,350	
				Subtotal	**$1,362,150**	
	Contingency @	20%	of	$1,009,000	$201,800	
				Total	**$1,563,950**	

Post Construction

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	O & M (ozone sparge)	year	5	$3,000	$15,000
2	Groundwater Monitoring	year	5	$15,000	$75,000
3	Annual report	year	5	$2,500	$12,500
			Subtotal	**$20,500**	**$102,500**
	Present worth @7% Discount				**$84,050**

GRAND TOTAL $3,795,054

Summary	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM&M Costs	Estimated Cost
Ozone sparge - upper bluff Copper Falls Aquifer	$763,000	$38,150	$114,450	$114,450	$152,600	$694,704	$1,877,354
Ozone sparge - upper bluff shallow groundwater	$133,000	$6,650	$19,950	$19,950	$26,600	$63,550	$269,700
Ozone sparge - Kreher Park shallow groundwater	$1,009,000	$50,450	$151,350	$151,350	$201,800	$84,050	$1,648,000
Total Estimated Cost	$1,905,000	$95,250	$285,750	$285,750	$381,000	$842,304	$3,795,054

Table F2-6
Alternate GW4: Surfactant Injection and Dual Phase (Vacuum Enhanced) Recovery

In-situ Treatment **Surfactant Injection & Dual Phase Recovery**

Upland Area ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Extraction Wells	each	30	$3,000	$90,000	
2	Surfactant Injection	per gal	45,000	$5	$225,000	300 gallons per well, and 5 applications
3	Vacuum truck	hour	1,000	$100	$100,000	2 to 3 hours per month for one year
4	Wastewater treatment & disposal (vac truck)	year	3	$21,600	$64,800	300 gallons per month per well@$0.2 per gallon
				Subtotal	**$479,800**	
	Mobilization/Demobilization @	5%	of	$479,800	$23,990	
	Engineering @	15%	of	$479,800	$71,970	
	Construction Oversight @	15%	of	$479,800	$71,970	
				Subtotal	**$647,730**	
	Contingency @	20%	of	$479,800	$95,960	
				Total	**$743,690**	

Post Construction

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Operation and Maintenance	year	5	$57,600	$288,000	Maintain upgraded treatment system
2	Groundwater extraction (existing wells)	year	5	$78,840	$394,200	3 gpm @ $0.05 per gallon
3	Groundwater Monitoring	year	5	$25,000	$125,000	
4	Annual report	year	5	$5,000	$25,000	
			Subtotal	**$166,440**	**$832,200**	
		Present worth @7% Discount			**$682,404**	

GRAND TOTAL $1,426,094

Summary	Capital Costs	Mob / Demob	Oversight & Engineering	Oversight & Engineering	Contingency	OM&M Costs	Estimated Cost
Surfactant injection and dual phase recovery	$479,800	$23,990	$71,970	$71,970	$95,960	$682,404	$1,426,094

Table F2-7
Alternate GW5: Permeable Reactive Barrier Well

In-situ Treatment **Permeable Reactive Barrier Well**

		Total Area:	
1	***Asphalt Pavement -***	16,000 sq ft	NSPW Property South of St. Claire Street
	Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000 sq ft	NSPW Property North of St. Claire Street
		98,000 sq ft	Marina Parking Lot Area
2	***Low Permeability Cap -***		
	Includes 3 feet of clay.	42,500 sq ft	Former Coal Tar Dump Area
		72,000 sq ft	WWTP Area

Upland Area ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Installation of new asphalt pavement	sq. yd.	1,778	$25	$44,444	NSPW Property South of St. Claire Street (includes grading)
2	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$105,556**	
	Mobilization/Demobilization @	5%	of	$105,556	$5,278	
	Engineering @	15%	of	$105,556	$15,833	
	Construction Oversight @	15%	of	$105,556	$15,833	
				Subtotal	**$142,500**	
	Contingency @	20%	of	$105,556	$21,111	
				Total	**$163,611**	

Kreher Park ***Shallow Groundwater - Kreher Park***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear and Grub	est.	1	$10,000	$10,000	
2	WWTP Building Demolition	est.	1	$250,000	$250,000	
3	Vertical barrier wall - along shoreline	sf	38,750	$35	$1,356,250	Sheet pile wall (1,550 linear feet and 25 feet deep).
4	Vertical barrier wall - perimeter	sf	28,000	$35	$980,000	Sheet pile wall (1,750 linear feet and 16 feet deep).
5	Groundwater Diversion Trench	ln ft	1,525	$50	$76,250	Divert groundwater from upper bluff area around Kreher Park
6	PRB Excavation	cy	1,222	$10	$4,889	275 linear feet, 10 feet wide and 12 feet deep
7	Filter Sand	cy	489	$5	$1,630	275 linear feet, 6 feet wide and 8 feet deep
8	GAC cell	cy	326	$100	$32,593	275 linear feet, 4 feet wide and 8 feet deep
9	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
10	Vegetation	acre	1	$3,500	$3,500	Seeding
11	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
12	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
13	Installation of low permeability cap	cy	8,000	$25	$200,000	3 ft. of clay at WWTP area (post demolition)
14	Top Soil	sq. yd.	8,000	$18	$144,000	0.5 ft. topsoil cover over clay cap
15	Vegetation	acre	1.7	$3,500	$5,785	Seeding
16	Storm water Drainage System	Basin	2	$30,000	$105,000	For water runoff during storm post-remediation
17	Institutional Control Implementation	est.	1	$5,000	$5,000	Groundwater use and deed restrictions.
				Subtotal	**$3,650,174**	
	Mobilization/Demobilization @	5%	of	$3,650,174	$182,509	
	Engineering @	15%	of	$3,650,174	$547,526	
	Construction Oversight @	15%	of	$3,650,174	$547,526	
				Subtotal	**$4,927,735**	
	Contingency @	20%	of	$3,650,174	$730,035	
				Total	**$5,657,770**	

Table F2-7
Alternate GW5: Permeable Reactive Barrier Well

Post Construction ***Shallow Groundwater - Kreher Park***

Item No.	Item	Unit	Quantity	Unit Costs	Total	
1	Annual Inspections	yr	30	$500	$15,000	
2	Post-Closure Reporting/Record Keeping	yr	30	$500	$15,000	
3	Cap Maintenance	yr	30	$1,000	$30,000	
5	Groundwater monitoring	yr	30	$25,000	$750,000	shallow groundwater monitoring
6	Annual cap inspection and reporting	yr	30	$5,000	$150,000	
			Subtotal	**$32,000**	**$960,000**	
		Present worth @7% Discount			**$397,088**	

GRAND TOTAL $6,218,469

Summary

	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
Installation of surface barrier - upper bluff area	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
Installation of PRB wall and vertical barrier - Kreher Park	$3,650,174	$182,509	$547,526	$547,526	$730,035	$397,088	$6,054,858
Total Estimated Cost	$3,755,730	$187,786	$563,359	$563,359	$751,146	$397,088	$6,218,469

Includes groundwater monitoring costs for shallow groundwater

Table F2-8
Alternate GW6: In-situ Chemical Oxidation

In-situ Treatment **In-situ Chemical Oxidation**

		Total Area:	
1	***Asphalt Pavement -***	26,000 sq ft	NSPW Property South of St. Claire Street
	Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000 sq ft	NSPW Property North of St. Claire Street
		98,000 sq ft	Marina Parking Lot Area
2	***Low Permeability Cap -***		
	Includes 3 feet of clay.	42,500 sq ft	Former Coal Tar Dump Area

Upland Area ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Groundwater Extraction Wells	each	7	$5,000	$35,000	Additional extraction wells
2	Pumps	each	7	$2,500	$17,500	
3	Lateral piping	ln ft	1,000	$50	$50,000	
4	UST/OWS System	Est.	1	$15,000	$15,000	Upgrade existing system
5	Wastewater treatment equipment	Est.	1	$25,000	$25,000	Upgrade existing system
6	Drilling	per gal	750,000	$2	$1,500,000	500 holes, 1,500 gallons per hole @ $2 per gallon
7	Reagent Injection	per week	50	$7,500	$375,000	3,000 gallons per day
				Subtotal	**$2,017,500**	
	Mobilization/Demobilization @	5%	of	$2,017,500	$100,875	
	Engineering @	15%	of	$2,017,500	$302,625	
	Construction Oversight @	15%	of	$2,017,500	$302,625	
				Subtotal	**$2,723,625**	
	Contingency @	20%	of	$2,017,500	$403,500	
				Total	**$3,127,125**	

Post Construction ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Operation and Maintenance	year	7	$57,600	$403,200	Existing groundwater extraction system
2	Groundwater extraction (existing wells)	year	7	$394,200	$2,759,400	15 gpm @ $0.05
3	Groundwater Monitoring	year	7	$25,000	$175,000	
4	Annual report	year	7	$5,000	$35,000	
			Subtotal	**$481,800**	**$3,372,600**	
	Present worth @7% Discount				**$2,596,420**	
				Total	**$5,723,545**	

Shallow Groundwater - Filled Ravine

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Vent Well Installation	each	10	$2,500	$25,000	10 passive vent wells
3	Drilling	per gal	450,000	$2	$900,000	300 holes, 1,500 gallons per hole @ $2 per gallon
4	Reagent Injection	per week	30	$7,500	$225,000	3,000 gallons per day
5	Installation of new asphalt pavement	sq. yd.	2,889	$25	$72,222	NSPW Property South of St. Claire Street (includes grading)
6	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$1,333,333**	
	Mobilization/Demobilization @	5%	of	$1,333,333	$66,667	
	Engineering @	15%	of	$1,333,333	$200,000	
	Construction Oversight @	15%	of	$1,333,333	$200,000	
				Subtotal	**$1,800,000**	
	Contingency @	20%	of	$1,333,333	$266,667	
				Total	**$2,066,667**	

Post Construction ***Shallow Groundwater - Filled Ravine***

Item No.	Item					
1	Groundwater Monitoring	year	7	$10,000	$70,000	
2	Annual report	year	7	$2,500	$17,500	
			Subtotal	**$12,500**	**$87,500**	
	Present worth @7% Discount				**$67,363**	
				Total	**$2,134,029**	

Table F2-8
Alternate GW6: In-situ Chemical Oxidation

Kreher Park ***Shallow Groundwater - Kreher Park***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear and Grub	est.	1	$10,000	$10,000	
2	Excavation	cy	3,935	$10	$39,352	
3	Bench scale test	est.	1	$5,000	$5,000	
4	Reagent Mixing	cy	3,935	$50	$196,759	
5	Drilling	per gal	225,000	$2	$450,000	150 holes, 1,500 gallons per hole @ $2 per gallon
6	Reagent Injection	per week	15	$7,500	$112,500	3,000 gallons per day
7	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
8	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
9	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
10	Vegetation	acre	1	$3,500	$3,500	Seeding
11	Storm water Drainage System	Basin	2	$30,000	$60,000	For water runoff during storm post-remediation
				Subtotal	$1,352,389	
	Mobilization/Demobilization @	5%	of	$1,352,389	$67,619	
	Engineering @	15%	of	$1,352,389	$202,858	
	Construction Oversight @	15%	of	$1,352,389	$202,858	
				Subtotal	**$1,825,725**	
	Contingency @	20%	of	$1,352,389	$270,478	
	Total			**Total**	**$2,096,203**	

Post Construction ***Shallow Groundwater - Kreher Park***

Item No.	Item				
1	Groundwater Monitoring	year	7	$15,000	$105,000
2	Annual report	year	7	$2,500	$17,500
	subtotal		**Subtotal**	**$17,500**	**$122,500**
		Present worth @7% Discount			**$94,308**
				Total	**$2,190,510**

GRAND TOTAL $10,048,085

In-situ chemical oxidation

Summary	In-situ chemical oxidation	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
	Copper Falls Aquifer	$2,017,500	$100,875	$302,625	$302,625	$403,500	$2,596,420	$5,723,545
	Shallow Groundwater - Filled Ravine	$1,333,333	$66,667	$200,000	$200,000	$266,667	$67,363	$2,134,029
	Shallow Groundwater - Kreher Park	$1,352,389	$67,619	$202,858	$202,858	$270,478	$94,308	$2,190,510
	GRAND TOTAL	$4,703,222	$235,161	$705,483	$705,483	$940,644	$2,758,090	$10,048,085

Table F2-9
Alternate GW7: Electrical Resistance Heating

In-situ Treatment **Electrical Resistance Heating**

		Total Area:		
1	***Asphalt Pavement -***	26,000	sq ft	NSPW Property South of St. Claire Street
	Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000	sq ft	NSPW Property North of St. Claire Street
		98,000	sq ft	Marina Parking Lot Area
2	***Low Permeability Cap -***			
	Includes 3 feet of clay.	42,500	sq ft	Former Coal Tar Dump Area

Upland Area ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Electrodes - Copper Falls	each	200	$2,500	$500,000	
3	Electrode installation	each	200	$5,000	$1,000,000	
4	Lateral piping - electrodes	ln ft	2,000	$50	$100,000	
5	Six Phase Heating equipment	Est.	1	$500,000	$500,000	
6	Six Phase Heating construction and setup	Est.	1	$500,000	$500,000	
7	Temp. Monitoring Points	each	24	$1,000	$24,000	
8	Electrical costs	month	12	$50,000	$600,000	
9	Extraction wells	each	12	$7,500	$90,000	
10	Extraction well pumps	per gal	12	$3,500	$42,000	
11	Lateral piping - extraction wells	ln ft	1,500	$75	$112,500	
12	UST/OWS System	Est.	1	$15,000	$15,000	Upgrade existing system
13	Wastewater treatment equipment	Est.	1	$25,000	$25,000	Upgrade existing system
14	Vapor phase treatment equipment & GAC	Est.	1	$25,000	$25,000	Upgrade existing system
15	Operation and Maintenance	month	12	$4,800	$57,600	Existing groundwater extraction system
16	Waste-water treatment & disposal	gallons	10,512,000	$0.05	$525,600	20 gpm @ $0.05
17	Probe/well abandonment	Est.	1	$272,500	$272,500	25-percent of installation cost
				Subtotal	**$4,439,200**	
	Mobilization/Demobilization @	5%	of	$4,439,200	$221,960	
	Engineering @	15%	of	$4,439,200	$665,880	
	Construction Oversight @	15%	of	$4,439,200	$665,880	
				Subtotal	**$5,992,920**	
	Contingency @	20%	of	$4,439,200	$887,840	
				Total	**$6,880,760**	

Post Construction ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	Groundwater Monitoring	year	5	$25,000	$125,000
2	Annual report	year	5	$5,000	$25,000
			Subtotal	$30,000	$150,000
		Present worth @7% Discount			**$123,000**
				Total	**$7,003,760**

Table F2-9
Alternate GW7: Electrical Resistance Heating

Upland Area ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Electrodes - filled ravine	each	200	$2,000	$400,000	
3	Electrode installation	each	200	$2,500	$500,000	
4	Lateral piping - electrodes	ln ft	2,000	$50	$100,000	
5	Six Phase Heating equipment	Est.	1	$500,000	$500,000	
6	Six Phase Heating construction and setup	Est.	1	$500,000	$500,000	
7	Temp. Monitoring Points	each	24	$1,000	$24,000	
8	Electrical costs	month	12	$15,000	$180,000	
9	Groundwater extraction well	each	4	$2,500	$10,000	
10	Vent wells	each	10	$1,500	$15,000	
11	Vapor phase treatment equipment & GAC	Est.	1	$25,000	$25,000	Upgrade existing system
12	Storage tanks & transfer pumps and piping	Est.	1	$25,000	$25,000	
13	Waste-water treatment & disposal	gallons	5,256,000	$0.05	$262,800	10 gpm @ $0.05 for 12 months (existing treatment system)
14	Probe/well abandonment	Est.	1	$127,500	$127,500	25-percent of installation cost
15	Installation of new asphalt pavement	sq. yd.	2,889	$25	$72,222	NSPW Property South of St. Claire Street (includes grading)
16	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$2,852,633**	
	Mobilization/Demobilization @	5%	of	$2,852,633	$142,632	
	Engineering @	15%	of	$2,852,633	$427,895	
	Construction Oversight @	15%	of	$2,852,633	$427,895	
				Subtotal	**$3,851,055**	
	Contingency @	20%	of	$2,852,633	$570,527	
				Total	**$4,421,582**	

Post Construction ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	Groundwater Monitoring	year	5	$10,000	$50,000
2	Annual report	year	5	$2,500	$12,500
			Subtotal	$12,500	$62,500
	Present worth @7% Discount				**$51,250**
				Total	**$4,472,832**

Table F2-9
Alternate GW7: Electrical Resistance Heating

Kreher Park ***Shallow Groundwater - Kreher Park***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Clear and Grub	Est.	1	$10,000	$10,000	
2	Electrodes - former seep / coal tar dump and TW-11areas	each	150	$2,000	$300,000	
3	Electrode installation	each	150	$2,500	$375,000	
4	Lateral piping - electrodes	ln ft	2,000	$50	$100,000	
5	Six Phase Heating equipment	Est.	0	$500,000	$0	Will utilize same equipment for filled ravine
6	Six Phase Heating construction and setup	Est.	1	$500,000	$500,000	
7	Temp. Monitoring Points	each	24	$1,000	$24,000	
8	Electrical costs	month	12	$15,000	$180,000	Will utilize same equipment for filled ravine
9	Groundwater extraction well	each	4	$2,500	$10,000	
10	Vent wells	each	10	$1,500	$15,000	
11	Vapor phase treatment equipment & GAC	Est.	1	$25,000	$25,000	
12	Storage tanks & transfer pumps and piping	Est.	1	$250,000	$250,000	
13	Waste-water treatment & disposal	gallons	10,512,000	$0.05	$525,600	20 gpm @ $0.05 for 12 months (existing treatment system)
14	Probe/well abandonment	Est.	1	$96,250	$96,250	25-percent of installation cost
15	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina Parking Lot Area
16	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
17	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
18	Vegetation	acre	1	$3,500	$3,500	Seeding
19	Storm water Drainage System	Basin	2	$30,000	$60,000	For water runoff during storm post-remediation
				Subtotal	$2,949,628	
	Mobilization/Demobilization @	5%	of	$2,949,628	$147,481	
	Engineering @	15%	of	$2,949,628	$442,444	
	Construction Oversight @	15%	of	$2,949,628	$442,444	
				Subtotal	**$3,981,998**	
	Contingency @	20%	of	$2,949,628	$589,926	
				Total	**$4,571,923**	

Post Construction ***Shallow Groundwater - Kreher Park***

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	Groundwater Monitoring	year	5	$15,000	$75,000
2	Annual report	year	5	$2,500	$12,500
			Subtotal	$17,500	$87,500
	Present worth @7% Discount				**$71,750**
				Total	**$4,643,673**

GRAND TOTAL $16,120,265

Summary	Electrical Resistance Heating	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
	Copper Falls Aquifer	$4,439,200	$221,960	$665,880	$665,880	$887,840	$123,000	$7,003,760
	Shallow Groundwater - Filled Ravine	$2,852,633	$142,632	$427,895	$427,895	$570,527	$51,250	$4,472,832
	Shallow Groundwater - Filled Ravine	$2,949,628	$147,481	$442,444	$442,444	$589,926	$71,750	$4,643,673
	GRAND TOTAL	**$10,241,461**	**$512,073**	**$1,536,219**	**$1,536,219**	**$2,048,292**	**$246,000**	**$16,120,265**

Table F2-10
Alternate GW8: Steam Injection (Dynamic Underground Stripping and Contained Recovery of Oily Waters)

In-situ Treatment **Steam Injection (Dynamic Underground Stripping and Contained Recovery of Oily Waters)**

		Total Area:		
1	***Asphalt Pavement -***	26,000	sq ft	NSPW Property South of St. Claire Street
	Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000	sq ft	NSPW Property North of St. Claire Street
2	***Low Permeability Cap -***			
	Includes 3 feet of clay.	42,500	sq ft	Former Coal Tar Dump Area

Upland Area ***Copper Falls Aquifer (DUS)***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Steam injection well	each	12	$25,000	$300,000	
2	Steam extraction well	per gal	9	$20,000	$180,000	
3	Lateral piping	ln ft	1,000	$250	$250,000	
4	Temp. Monitoring Points	each	12	$2,500	$30,000	
5	Steam Injection System	Est.	1	$350,000	$250,000	
6	Steam generation cost	month	6	$150,000	$900,000	
7	Electrodes - Copper Falls	each	50	$2,500	$125,000	
8	Electrode installation	each	50	$5,000	$250,000	
9	Lateral piping - electrodes	ln ft	10,000	$75	$750,000	
10	Six Phase Heating equipment	Est.	1	$250,000	$250,000	
11	Six Phase Heating construction and setup	Est.	1	$250,000	$250,000	
12	Electrical costs	month	6	$50,000	$300,000	
13	UST/OWS System	Est.	1	$15,000	$15,000	Upgrade existing system
14	Wastewater treatment equipment	Est.	1	$25,000	$25,000	Upgrade existing system
15	Vapor phase treatment equipment & GAC	Est.	1	$25,000	$25,000	Upgrade existing system
16	Operation and Maintenance	month	6	$4,800	$28,800	Existing groundwater extraction system
17	Waste-water treatment & disposal	gallons	5,184,000	$0.10	$518,400	20 gpm @ $0.10
17	Probe/well abandonment	Est.	1	$190,000	$190,000	25-percent of installation cost
				Subtotal	**$4,637,200**	
	Mobilization/Demobilization @	5%	of	$4,637,200	$231,860	
	Engineering @	15%	of	$4,637,200	$695,580	
	Construction Oversight @	15%	of	$4,637,200	$695,580	
				Subtotal	**$6,260,220**	
	Contingency @	20%	of	$4,637,200	$927,440	
				Total	**$7,187,660**	

Post Construction ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	Groundwater Monitoring	year	5	$25,000	$125,000
2	Annual report	year	5	$5,000	$25,000
			Subtotal	$30,000	$150,000
	Present worth @7% Discount				**$123,000**
				Total	**$7,310,660**

Table F2-10
Alternate GW8: Steam Injection (Dynamic Underground Stripping and Contained Recovery of Oily Waters)

Upland Area ***Shallow Groundwater - Filled Ravine (CROW)***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Building Demolition	Est.	1	$50,000	$50,000	Center section of NSPW building overlying filled ravine.
2	Steam injection well	each	10	$25,000	$250,000	
3	Steam extraction well	per gal	5	$20,000	$100,000	
4	Lateral piping	ln ft	1,000	$250	$250,000	
5	Temp. Monitoring Points	each	12	$1,000	$12,000	
6	Steam Injection System	Est.	1	$250,000	$250,000	
7	Steam generation cost	month	6	$50,000	$300,000	
8	UST/OWS System	Est.	1	$15,000	$15,000	Upgrade existing system
9	Wastewater treatment equipment	Est.	1	$25,000	$25,000	Upgrade existing system
10	Vapor phase treatment equipment & GAC	Est.	1	$25,000	$25,000	Upgrade existing system
11	Operation and Maintenance	month	6	$4,800	$28,800	Existing groundwater extraction system
12	Waste-water treatment & disposal	gallons	$2,592,000	$0.10	$259,200	10 gpm @ $0.2
13	Installation of new asphalt pavement	sq. yd.	2,889	$25	$72,222	NSPW Property South of St. Claire Street (includes grading)
14	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$1,698,333**	
	Mobilization/Demobilization @	5%	of	$1,698,333	$84,917	
	Engineering @	15%	of	$1,698,333	$254,750	
	Construction Oversight @	15%	of	$1,698,333	$254,750	
				Subtotal	**$2,292,750**	
	Contingency @	20%	of	$1,698,333	$339,667	
				Total	**$2,632,417**	

Post Construction ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	Groundwater Monitoring	year	5	$10,000	$50,000
2	Annual report	year	5	$2,500	$12,500
			Subtotal	$12,500	$62,500
		Present worth @7% Discount			**$51,250**
				Total	**$2,683,667**

Table F2-10
Alternate GW8: Steam Injection (Dynamic Underground Stripping and Contained Recovery of Oily Waters)

Upland Area ***Shallow Groundwater - Kreher Park (CROW)***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Steam injection well	each	9	$25,000	$225,000	
2	Steam extraction well	per gal	4	$20,000	$80,000	
3	Lateral piping	ln ft	1,000	$250	$250,000	
4	Temp. Monitoring Points	each	12	$1,000	$12,000	
5	Steam Injection System	Est.	1	$250,000	$250,000	
6	Steam generation cost	month	6	$50,000	$300,000	
7	Storage tanks, transfer pumps and piping	Est.	1	$15,000	$15,000	Upgrade existing system
8	Wastewater treatment equipment	Est.	1	$25,000	$25,000	Upgrade existing system
9	Vapor phase treatment equipment & GAC	Est.	1	$25,000	$25,000	Upgrade existing system
10	Operation and Maintenance	month	6	$4,800	$28,800	Existing groundwater extraction system
11	Waste-water treatment & disposal	gallons	$2,592,000	$0.10	$259,200	10 gpm @ $0.20
12	Installation of new asphalt pavement	sq. yd.	1,667	$25	$41,667	NSPW Property South of St. Claire Street (includes grading)
13	Installation of new asphalt pavement	sq. yd.	2,778	$25	$69,444	NSPW Property North of St. Claire Street (includes grading)
	subtotal			**Subtotal**	**$1,581,111**	
	Mobilization/Demobilization @	5%	of	$1,581,111	$79,056	
	Engineering @	15%	of	$1,581,111	$237,167	
	Construction Oversight @	15%	of	$1,581,111	$237,167	
				Subtotal	**$2,134,500**	
	Contingency @	20%	of	$1,581,111	$316,222	
				Total	**$2,450,722**	

Post Construction ***Shallow Groundwater - Kreher Park***

Item No.	Item	Unit	Quantity	Unit Cost	Total
1	Groundwater Monitoring	year	5	$15,000	$75,000
2	Annual report	year	5	$2,500	$12,500
			Subtotal	**$17,500**	**$87,500**
		Present worth @7% Discount			**$71,750**
				Total	**$2,522,472**

GRAND TOTAL $12,516,799

Summary	Steam Injection (DUS or CROW)	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
	Copper Falls Aquifer	$4,637,200	$231,860	$695,580	$695,580	$927,440	$123,000	$7,310,660
	Shallow Groundwater - Filled Ravine	$1,698,333	$84,917	$254,750	$254,750	$339,667	$51,250	$2,683,667
	Shallow Groundwater - Kreher Park	$1,581,111	$79,056	$237,167	$237,167	$316,222	$71,750	$2,522,472
	GRAND TOTAL	**$7,916,644**	**$395,832**	**$1,187,497**	**$1,187,497**	**$1,583,329**	**$246,000**	**$12,516,799**

Table F2-11
Alternate GW9A: Existing Groundwater Extraction (Continued Operation)

Removal **Groundwater Extraction and On-site Treatment**

		Total Area:	
1	***Asphalt Pavement -***	16,000 sq ft	NSPW Property South of St. Claire Street
	Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000 sq ft	NSPW Property North of St. Claire Street

Upland Area ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Installation of new asphalt pavement	sq. yd.	1,778	$25	$44,444	NSPW Property South of St. Claire Street (includes grading)
2	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$105,556**	
	Mobilization/Demobilization @	5%	of	$105,556	$5,278	
	Engineering @	15%	of	$105,556	$15,833	
	Construction Oversight @	15%	of	$105,556	$15,833	
				Subtotal	**$142,500**	
	Contingency @	20%	of	$105,556	$21,111	
				Total	**$163,611**	

Post Construction ***Copper Falls Aquifer/Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Operation and Maintenance	year	30	$57,600	$1,728,000	Existing groundwater extraction system
2	Groundwater extraction (existing wells)	year	30	$78,840	$2,365,200	3 gpm @ $0.05
3	Groundwater Monitoring	year	30	$35,000	$1,050,000	
4	Annual cap inspection and reporting	year	30	$7,500	$225,000	
			Subtotal	**$178,940**	**$5,368,200**	
	Present worth @7% Discount				**$2,220,466**	

GRAND TOTAL $2,384,078

Summary	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
Shallow Groundwater - Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
Copper Falls Aquifer/Filled Ravine	$0	$0	$0	$0	$0	$2,220,466	$2,220,466
GRAND TOTAL	**$105,556**	**$5,278**	**$15,833**	**$15,833**	**$21,111**	**$2,220,466**	**$2,384,078**

Table F2-12
Alternate GW9B: Enhanced Groundwater Extraction

Removal **Groundwater Extraction and On-site Treatment**

		Total Area:		
1	***Asphalt Pavement -***	16,000	sq ft	NSPW Property South of St. Claire Street
	Includes 6 inches stone, 3 inches binder, 2 inches surface.	22,000	sq ft	NSPW Property North of St. Claire Street
		98,000	sq ft	Marina Parking Lot Area
2	***Low Permeability Cap -***			
	Includes 3 feet of clay.	42,500	sq ft	Former Coal Tar Dump Area

Upland Area ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Extraction wells	each	12	$7,500	$90,000	
2	Pumps	per gal	12	$3,500	$42,000	
3	Lateral piping	ln ft	1,500	$75	$112,500	
4	UST/OWS System	Est.	1	$15,000	$15,000	Upgrade existing system
5	Wastewater treatment equipment	Est.	1	$25,000	$25,000	Upgrade existing system
				Subtotal	**$284,500**	
	Mobilization/Demobilization @	5%	of	$284,500	$14,225	
	Engineering @	15%	of	$284,500	$42,675	
	Construction Oversight @	15%	of	$284,500	$42,675	
				Subtotal	**$384,075**	
	Contingency @	20%	of	$284,500	$56,900	
				Total	**$440,975**	

Post Construction ***Copper Falls Aquifer***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Operation and Maintenance	year	30	$57,600	$1,728,000	Existing groundwater extraction system
2	Groundwater extraction (existing wells)	year	30	$394,200	$11,826,000	15 gpm @ $0.05
3	Groundwater Monitoring	year	30	$25,000	$750,000	
4	Annual cap inspection and reporting	year	30	$5,000	$150,000	
			Subtotal	**$481,800**	**$14,454,000**	
	Present worth @7% Discount				**$5,978,656**	

Table F2-12
Alternate GW9B: Enhanced Groundwater Extraction

				Total	**$6,419,631**	

Upland Area ***Shallow Groundwater - Filled Ravine***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Installation of new asphalt pavement	sq. yd.	1,778	$25	$44,444	NSPW Property South of St. Claire Street (includes grading)
2	Installation of new asphalt pavement	sq. yd.	2,444	$25	$61,111	NSPW Property North of St. Claire Street (includes grading)
				Subtotal	**$105,556**	
	Mobilization/Demobilization @	5%	of	$105,556	$5,278	
	Engineering @	15%	of	$105,556	$15,833	
	Construction Oversight @	15%	of	$105,556	$15,833	
				Subtotal	**$142,500**	
	Contingency @	20%	of	$105,556	$21,111	
				Total	**$163,611**	

Kreher Park ***Shallow Groundwater***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Extraction trench	ln ft	1,500	$150	$225,000	
2	Sump and pump	each	1	$20,000	$20,000	
3	Lateral piping	ln ft	1,500	$75	$112,500	
4	Treatment equipment	each	1	$30,000	$30,000	
5	Building	each	1	$25,000	$25,000	
6	UST/OWS System	Est.	1	$15,000	$15,000	
7	Installation of new asphalt pavement	sq. yd.	10,889	$25	$272,222	Marina parking lot
8	Installation of low permeability cap	cy	4,722	$25	$118,056	3 ft. of clay over former coal tar dump area
9	Top Soil	sq. yd.	4,722	$18	$85,000	0.5 ft. topsoil cover over clay cap
10	Vegetation	acre	1	$3,500	$3,500	Seeding
11	Storm water Drainage System	Basin	2	$30,000	$60,000	For water runoff during storm post-remediation
				Subtotal	**$966,278**	
	Mobilization/Demobilization @	5%	of	$966,278	$48,314	
	Engineering @	15%	of	$966,278	$144,942	
	Construction Oversight @	15%	of	$966,278	$144,942	
				Subtotal	**$1,304,475**	
	Contingency @	20%	of	$966,278	$193,256	
				Total	**$1,497,731**	

Table F2-12
Alternate GW9B: Enhanced Groundwater Extraction

Post Construction ***Shallow Groundwater***

Item No.	Item	Unit	Quantity	Unit Cost	Total	Notes
1	Operation and Maintenance	year	30	$57,600	$1,728,000	
2	Waste-water treatment & disposal	year	30	$1,314,000	$39,420,000	50 gpm @ $0.05
3	Groundwater Monitoring	year	30	$25,000	$750,000	
4	Annual cap inspection and reporting	year	30	$5,000	$150,000	
	subtotal			$1,401,600	$42,048,000	
	Present worth @7% Discount				**$17,392,454**	
				Subtotal	**$18,890,185**	

GRAND TOTAL $25,415,372

Summary	Capital Costs	Mob / Demob	Engineering	Construction Oversight	Contingency	OM & M Costs	Estimated Cost
Copper Falls Aquifer	$284,500	$14,225	$42,675	$42,675	$56,900	$5,978,656	$6,419,631
Shallow Groundwater - Filled Ravine	$105,556	$5,278	$15,833	$15,833	$21,111	$0	$163,611
Shallow Groundwater - Kreher Park	$966,278	$48,314	$144,942	$144,942	$193,256	$17,392,454	$18,890,185
GRAND TOTAL	$1,356,333	$67,817	$203,450	$203,450	$271,267	$23,371,111	$25,473,427

APPENDIX F3

PRELIMNARY REMEDIATION COST ESTIMATES FOR SEDIMENT

Table F3-1. Cost Summary for Sediment Remedial Alternatives.

Alternative	Dredge Volume (cy)[1]	Sediment Weight (t)[2]	Water Volume (Mgal)	Mob/Demob	Mech Dredge & Sediment Handling	Hydraulic Dredge & Sediment Handling	Sediment Transport & Disposal	Thermal Treatment	Subaqueous Cap	CDF	Water Treatment	Misc (H&S; Mitigation)	Post Construction[3]	Planning & Engineering @ 15%	Oversight @ 15%	Contingency @ 20%[4]	Total
SED-2	70,663	38,589	$17	$1,151,155	$5,096,964					$14,400,902	$1,905,801	$1,619,440	$715,090	$3,626,140	$3,626,140	$4,834,853	$36,976,485
SED-3A	77,822	33,999	8	$932,593	$11,665,778		$2,702,164		$2,451,400		$1,713,075	$119,440	$715,090	$2,937,667	$2,937,667	$3,916,890	$30,091,764
SED-3B	77,822	33,999	8	$1,071,909	$10,173,234		$1,750,243	$5,230,796	$2,451,400		$1,713,075	$119,440	$715,090	$3,376,514	$3,376,514	$4,502,019	$34,480,234
SED-3C	77,822	33,999	70	$1,132,426		$11,078,571	$2,692,814		$2,560,515		$6,197,188	$119,440	$715,090	$3,567,143	$3,567,143	$4,756,191	$36,386,521
SED-3D	77,822	33,999	70	$1,301,571		$10,227,634	$1,750,243	$5,230,796	$2,506,115		$6,197,188	$119,440	$715,090	$4,099,948	$4,099,948	$5,466,597	$41,714,569
SED-4A	133,906	58,500	13	$1,287,762	$18,595,427		$4,634,149				$2,296,786	$228,880	$715,090	$4,056,451	$4,056,451	$5,408,601	$41,279,596
SED-4B	133,906	58,500	13	$1,528,250	$16,025,908		$3,011,581	$9,001,843			$2,296,786	$228,880	$715,090	$4,813,987	$4,813,987	$6,418,650	$48,854,962
SED-4C	133,906	58,500	121	$1,615,830		$17,584,105	$4,436,108				$10,067,515	$228,880	$715,090	$5,089,866	$5,089,866	$6,786,488	$51,613,748
SED-4D	133,906	58,500	121	$1,916,784		$16,025,908	$3,011,581	$9,001,792			$10,067,515	$228,880	$715,090	$6,037,869	$6,037,869	$8,050,492	$61,093,779
SED-5A	133,906	58,500	180	$2,054,744	$27,570,933		$4,984,160				$7,817,986	$721,800	$715,090	$6,472,443	$6,472,443	$10,787,406	$67,597,005
SED-5B	133,906	58,500	180	$2,497,981	$29,056,761		$3,361,280	$9,001,800			$7,817,986	$721,800	$715,090	$7,868,641	$7,868,641	$13,114,402	$82,024,383

1: Includes Wood
2: Without Wood
3: Present Value at 7% Discount Factor
4: A 25% contingency was applied to Alternatives 5A and 5B.

Table F3-2. Alternate SED-2: Construct CDF, Dredge Sediment > PRG into CDF, Cap.

Total Area:	338,091	sq ft	Estimate of 8.8 acres based upon GIS
Total Sediment Volume:	70,663	cy	Based upon GIS Estimate
Total Volume of Wood Waste:	100	cy	Estimate of wood derived from side scan sonar
Total Sediment Weight:	38,589	tons	Based on 65% moisture for disposal
Total Volume of Water:	17	Mgal	Water volume estimate based on displacing the same volume of water as the sediment volume plus 20%

Mob/Demob	**Unit**	**Quanitity**	**Unit Cost**	**Total**	
Mob/Demob	ls	1	$1,151,155	**$1,151,155**	Estimate at 5% of total costs except without engineering, contingency and LT monitoring

Construct CDF

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	Includes installation of electric upon completion ($40k) & move/abandon existing utilities ($60k)
2	24 hr. Security of Site	weekly	76	$2,695	$204,820	$15/hr X 24 hr X 7 days + $25/day (expenses)
3	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
4	Pre-Trenching Activities	day	17	$2,826	$48,042	Pre-trench along landside to 10 ft. Assume 150 ft/day
5	Dispose of debris	ea	2	$1,500	$3,000	Dispose of debris in a 20 cy. roll off box
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during sheetpile wall construction using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	Move HC Boom	ft	5460	$1	$5,460	Move HC Boom after sheetpile installation (1/4 cost of installation)
10	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
11	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
12	Drive Sheetpile Along Railroad	sq ft	28050	$48	$1,357,620	Depth approx 25 ft
13	Drive Sheetpile Along Ellis Ave	sq ft	22378	$48	$1,083,071	Depth tapers from 25-40 ft from railroad to lakeside
14	Drive Sheetpile Along Prentice Ave	sq ft	24068	$48	$1,164,867	Depth tapers from 25-40 ft from railroad to lakeside
15	Drive Sheetpile in Water	sq ft	56925	$54	$3,073,950	Single sheetpile wall. Depth approx 45 ft
16	Demolition and Disposal Existing WWTP	sq ft	41935	$5	$209,675	Cost to demolish structure and dispose debris at landfill, does not include disposal of hazardous materials i.e. asbestos
17	Construct Sediment Holding Ponds	cy	21258	$20	$425,165	Surface ponds 10 ft. high, 2H:1V side slopes, 595' X 200', 2 ft clay liner, 2 ft freeboard (contingent on type of dredging)
				Subtotal	**$7,781,910**	Total Volume of Clay Material: 21,258 cy, Total Volume Holding Pond: 22,170 cy

Mechanical Dredging

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Bathymetric Survey (pre, mid, post)	ea	3	$37,500	$112,500	Pre, mid, post Survey
2	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
3	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
5	Dredge Sediments	cy	70663	$30	$2,119,890	Dredge >10 ppm volume based on Minneapolis calculations in separate spreadsheet
6	Air Emissions Monitoring	weeks	45	$8,725	$392,625	Monitor air quality during construction of CDF, dredging and CDF capping based on 5 stations 3 times/week using NIOSH methods
7	Water Quality Monitoring	weeks	38	$9,000	$342,000	Daily turbidity, and TSS and PAHs monitoring weekly through dredging and dike construction activities
8	Installation of Rock Buttress	tons	39872	$50	$1,993,600	Install rock buttress during dredging activities for CDF stabilization. (26581 cy rocks X 1.5) =39,872 tons
9	Benthic habitat/thin layer	cy	7075	$18	$127,349	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$5,096,964**	

Water Treatment

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Sand Filter Capital Cost	ea	1	$385,000	$385,000	Stryker Bay cost estimates were used for this estimate. Sand filters are
2	Oil Water Separator	ea	2	$25,000	$50,000	dual media with 250 gpm design flow rate with auto backwashing
3	Oil Water Separator O&M	Mgal	17	$2,700	$46,238	controls based on vendor quotes.The carbon system would be two
4	Carbon Filtration	Mgal	17	$67,000	$1,147,396	10,000 lb beds with manual piping controls and includes the estimated
5	Water Quality Testing	Mgal	17	$2,400	$41,101	carbon consumption to average out to $0.067/gallon cost based on jar
6	O&M	day	98	$2,400	$236,066	tests on sediments of Stryker Bay.
				Subtotal	**$1,905,801**	

CDF Capping

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
2	Geomembrane	sq ft	773152	$2	$1,546,304	40 mil HDPE from shoreline to sheetpile (cost is based on other bids and experience, $1 for material and $1 to install/sq ft)
3	Geocomposite	sq ft	773152	$2	$1,546,304	Geotextile/geonet composite drainage layer from shoreline to sheetpile, cost based on bids $1 material and $1 to install/ sq ft.
4	Sand and clay cap over CDF	cy	50088	$22	$1,101,926	1.5 ft. sand plus 2 ft of clay cover under geomembrane from shoreline to sheetpile
5	Top Soil over CDF	cy	6261	$18	$112,697	0.5 ft. topsoil cover over sand layer from shoreline to sheetpile
6	Vegetation	acre	7.8	$3,500	$27,165	Seeding from shoreline to sheetpile
7	Asphalt	sq. yd.	33733	$25	$843,333	Area to be paved (6 inches stone, 3 inches binder, 2 inches surface) over current park along Marina Drive
8	Clay Cover over land	cy	32233	$22	$709,137	2 ft. clay cover from shoreline to sheet walls inc. Marina Drive (pavement)
9	Local soil over entire area	cy	57271	$10	$572,705	2ft of local soils over clay and membrane cap
10	Top Soil over land	cy	2436	$18	$43,851	0.5 ft. topsoil cover over sand layer from shoreline to Marina Drive (pavement)
11	Vegetation on land	acre	3.02	$3,500	$10,570	Seeding from shoreline to sheet pile s except Marina Drive (pavement) to
12	Stormwater Drainage System	ls	1	$105,000	$105,000	For water runoff during storm post-remediation (1300 ft X 2 + 500ft + 4 Catch Basins) = 2600+500=3100 X $30/sq ft + (4 X 3000) = $105,000
				Subtotal	**$6,618,992**	

Table F3-2. Alternate SED-2: Construct CDF, Dredge Sediment > PRG into CDF, Cap.

Misc

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	weeks	76	$1,440	$109,440	Once a week, for 2 years (38 weeks/yr)
3	Wetland Mitigation	ls	1	$1,500,000	$1,500,000	
				Subtotal	**$1,619,440**	
				Total	$24,174,264	
				Engineering @ 15%:	$3,626,140	
				Oversight @ 15%:	$3,626,140	
				Subtotal	$31,426,543	
				Contingency @ 20%	$4,834,853	Only taken on Capital Costs not Engineering
				TOTAL	**$36,261,395**	

Post Construction

Item No.	Item	Unit	Quanitity	Unit Costs	Total	Notes
1	Monitoring	yr	30	$40,000	$1,200,000	Monitor locations with <20 ppm for length determined by US EPA
2	Reporting	yr	30	$12,000	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000	$300,000	Based on contractor estimates
			Subtotal	$62,000	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	
				GRAND TOTAL	**$36,976,485**	

Summary (Capital Costs)	Cost	Cost + Oversight & Engineering	Contingency
Mob/demob & Misc	$ 2,770,595	$ 3,601,774	$ 554,119
Construct CDF	$ 7,781,910	$ 10,116,483	$ 1,556,382
Dredge	$ 5,096,964	$ 6,626,054	$ 1,019,393
Water Treatment	$ 1,905,801	$ 2,477,541	$ 381,160
Complete CDF	$ 6,618,992	$ 8,604,690	$ 1,323,798
Total Estimated Cost	$ 24,174,264	$ 31,426,543	$ 4,834,853
		Total Capital Cost With Contingency	$ 36,261,395

Table F3-3. Alternative SED- 3A:Mechanically Dredge Sediments (0-4 ft) > PRG and Cap.

Total Area:	696,960 sq ft	Based upon GIS calculations
Total Sediment Volume:	77,822 cy	Based upon GIS calculations
Total Volume of Wood Waste:	15,564 cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight:	33,999 tons	Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal
Total Volume of Water:	7.79 Mgal	Water volume estimate based on 46% solid content by volume and dewatered to 65% solids plus 20% additonal water

Mob/Demob

	Unit	Quanitity	Unit Cost	Total	
Mob/Demob	ls	1	$932,593	**$932,593**	Estimate at 5% of total costs except without engineering, contingency and LT monitoring

Mechanical Dredging & Sediment Treatment

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
2	24 hr. Security of Site	weekly	45	$2,695	$121,275	$15/hr X 24 hr X 7 days + $25/day (expenses)
3	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
4	Survey	ea	3	$37,500	$112,500	Pre- and Post Dredge and post cap - Bathymetric Survey
5	Install Sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	15564	$45	$700,398	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Large Wood Waste Disposal	ea	778	$1,500	$1,167,330	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (15,564 cy)/20 cy/box
13	Mechanically Dredge Sediment	cy	62258	$30	$1,867,728	Mechanically dredge sediments with a concentration greater than the PRG (Includes transport to land cost). Assume MD 200 cy/day of (77,822 - 15,564 cy) affected sediment
14	Screening	day	104	$2,500	$259,407	Screening system to separate wood from sediments
15	Air Emissions Monitoring	weeks	45	$8,725	$392,625	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	38	$9,000	$342,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Filterpress	cy	18677	$35	$653,695	Total dredged minus wood and include 20 % for fines only, rate based on bids
18	Stabilization	cy	37258	$81	$3,017,866	Cost based on FRTR site guide with 15% cement added. Includes all costs minus mob/demob for a 50,000 yard soil site using RACER software
19	Cap shoreline slope	cy	19259	$25	$481,475	2'x100'x1500'
20	Benthic Habitat/Thin layer	cy	10180	$18	$183,240	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$11,665,778**	

Transport & Disposal

Item No.		Unit	Quanitity	Unit Cost	Total	
1	Load	day	72	$1,440	$103,570	40 trucks/day X 20 tons/truck = 800 tons/day
2	Haul to landfill	ton	57539	$27	$1,562,896	Truck all sediment to Seven Mile LF - Eau Claire
3	Disposal	ton	57539	$18	$1,035,698	Tipping Fee
				Subtotal	**$2,702,164**	

Water Treatment:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Pond and Sand Filter Capital Cost	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	7.79	$2,700	$21,022	
4	Carbon Sand Filtration	Mgal	7.79	$67,000	$521,654	Stryker Bay Cost Estimates (See CDF cost Sheet)
5	Water Quality Testing	Mgal	7.79	$2,400	$18,686	
6	O&M	day	104	$2,400	$249,030	
				Subtotal	**$1,713,075**	

Capping:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Liner of GCL mat or GAC mat	sq ft	326700	$1.50	$490,050	GCL or GAC mat to retard contaminant transport and provide a stable cap base
2	Mat liner installation	sq ft	326700	$1	$326,700	Installation of organic clay liner and geosynthetic. Assume 1 acres/day at $4000/day
4	Stone Cover	ton	18150	$35	$635,250	Includes cost for barge. Assumes stone placement same time as sand cover 1 ft thick
5	Sand Cover Fill	cy	6050	$25	$151,250	Average of 0.5 ft to level after dredging for mat placement and for thin cap area
6	Sand Cover & install	cy	30250	$25	$756,250	2.5 ft sand cover
7	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
8	Survey	ea	1	$37,500	$37,500	Post-Capping sand before rock Bathymetric Survey
				Subtotal	**$2,451,400**	

MISC 1

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	weeks	76	$1,440	$109,440	Once a week, for 2 years (38 weeks/yr)
				Subtotal	**$119,440**	

Total:	$19,584,449	
Engineering @ 15%:	$2,937,667	
Oversight @ 15%:	$2,937,667	
Subtotal:	$25,459,784	
Contingency @ 20%:	$3,916,890	Only taken on Capital Costs not Engineering
TOTAL:	**$29,376,674**	

Table F3-3. Alternative SED- 3A:Mechanically Dredge Sediments (0-4 ft) > PRG and Cap.

Post-Construction:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Monitoring	yr	30	$40,000	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000	$300,000	Comments from 2 bidders
				Subtotal	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $30,091,764

Summary (Capital Costs)	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 1,052,033	$ 1,367,643	$ 210,407
Dredge and Sediment Handling	$ 11,665,778	$ 15,165,512	$ 2,333,156
Transport & Disposal	$ 2,702,164	$ 3,512,813	$ 540,433
Water Treatment	$ 1,713,075	$ 2,226,997	$ 342,615
Cap	$ 2,451,400	$ 3,186,820	$ 490,280
Total Estimated Cost	$ 19,584,449	$ 25,459,784	$ 3,916,890
		Total Capital Cost With Contingency	$ 29,376,674

Table F3-4. Alternative SED- 3B:Mechanically Dredge Sediments (0-4 ft) > PRG, Cap, Thermally Treat.

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Sediment Volume:	77,822	cy	Based upon GIS calculations
Total Volume of Wood Waste:	15,564	cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight:	33,999	tons	Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal
Total Volume of Water:	7.79	Mgal	Water volume estimate based on 46% solid content by volume to 65% solids plus 20%

Mob/Demob

	Unit	Quanitity	Unit Cost	Total	
Mob/Demob	ls	1	$1,071,909	**$1,071,909**	Estimate at 5% of total costs except without engineering, contingency and LT monitoring

Mechanical Dredging & Sediment Treatment

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
2	24 hr. Security of Site	weekly	45	$2,695	$121,275	$15/hr X 24 hr X 7 days + $25/day (expenses)
3	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
4	Survey	ea	3	$37,500	$112,500	Pre- and Post Dredge and Post cap - Bathymetric Survey
5	Install Sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	15564	$45	$700,398	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Large Wood Waste Disposal	ea	778	$1,500	$1,167,330	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (15,564 cy)/20 cy/box
13	Mechanically Dredge Sediment	cy	62258	$30	$1,867,728	Mechanically dredge sediments with a concentration greater than the PRG (Includes transport to land cost). Assume MD 200 cy/day of (77,822 - 15,564 cy) affected sediment
14	Screening	day	104	$2,500	$259,407	Screening system to separate wood from sediments
15	Air Emissions Monitoring	weeks	45	$8,725	$392,625	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	38	$9,000	$342,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Mechanical & Gravity Methods	cy	62258	$35	$2,179,016	Total dredged minus wood, rate based on bids
18	Cap shoreline slope	cy	19259	$25	$481,475	2'x100'x1500'
19	Benthic Habitat/Thin layer	cy	10180	$18	$183,240	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$10,173,234**	

Thermal Treatment

	Unit	Quanitity	Unit Cost	Total	
Thermal Trearment	ton	52308	$100	**$5,230,796**	Bid of $80/ton plus misc items $20/ton = $100/ton

Transport & Disposal

Item No.		Unit	Quanitity	Unit Cost	Total	
1	Load	day	47	$1,440	$67,317	40 trucks/day X 20 tons/truck = 800 tons/day
2	Haul to landfill	ton	37398	$27	$1,009,756	Truck all sediment to Seven Mile LF - Eau Claire Plus 10% for stabilization & excess moisture
3	Disposal	ton	37398	$18	$673,170	Tipping Fee
				Subtotal	**$1,750,243**	

Water Treatment:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Pond and Sand Filter	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	7.79	$2,700	$21,022	Stryker Bay Cost Estimates (See CDF cost Sheet)
4	Carbon Sand Filtration	Mgal	7.79	$67,000	$521,654	
5	Water Quality Testing	Mgal	7.79	$2,400	$18,686	
6	O&M	day	104	$2,400	$249,030	
				Subtotal	**$1,713,075**	

Capping:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Liner of GCL mat or GAC mat	sq ft	326700	$1.50	$490,050	One layer of either geotextile mat to retard contaminant transport and provide a cap base
2	Mat liner installation	sq ft	326700	$1	$326,700	Installation of organic clay liner and geosynthetic. Assume 1 acres/day at $4000/day
4	Stone Cover	ton	18150	$35	$635,250	Includes cost for barge. Assumes stone placement same time as sand cover 1 ft thick
5	Sand Cover Fill	cy	6050	$25	$151,250	Average of 0.5 ft to level after dredging for mat placement
6	Sand Cover & install	cy	30250	$25	$756,250	2.5 ft sand cover
7	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
8	Survey	ea	1	$37,500	$37,500	Post-Capping sand before rock-Bathymetric Survey
				Subtotal	**$2,451,400**	

MISC

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	week	76	$1,440	$109,440	Once a week, for 2 years (38 weeks/yr)
				Subtotal	**$119,440**	

Total:	$22,510,096	
Engineering @ 15%:	$3,376,514	
Oversight @ 15%:	$3,376,514	
Subtotal:	$29,263,125	
Contingency @ 20%:	$4,502,019	Only taken on Capital Costs not Engineering
TOTAL:	**$33,765,144**	

Table F3-4. Alternative SED- 3B:Mechanically Dredge Sediments (0-4 ft) > PRG, Cap, Thermally Treat.

Post-Construction:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Monitoring	yr	30	$40,000	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000	$300,000	
				Subtotal	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $34,480,234

Summary	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 1,191,349	$ 1,548,754	$ 238,270
Dredge and Sediment Handling	$ 10,173,234	$ 13,225,204	$ 2,034,647
Thernal Treatment	$ 5,230,796	$ 6,800,034	$ 1,046,159
Transport & Disposal	$ 1,750,243	$ 2,275,316	$ 350,049
Water Treatment	$ 1,713,075	$ 2,226,997	$ 342,615
Cap	$ 2,451,400	$ 3,186,820	$ 490,280
Total Estimated Cost	$ 22,510,096	$ 29,263,125	$ 4,502,019

Total Capital Cost With Contingency $33,765,144

Table F3-5. Alternative SED- 3C:Hydraulically Dredge Sediments (0-4 ft) > PRG, Cap.

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Sediment Volume:	77,822	cy	Based upon GIS calculations
Total Volume of Wood Waste:	15,564	cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight:	33,999	tons	Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal
Total Volume of Water:	70	Mgal	Water volume estimate based on 46% solid content by volume to 65% solids plus 20%

Mob/Demob

	Unit	Quanitity	Unit Cost	Total	
Mob/Demob	ls	1	$1,132,426	**$1,132,426**	Estimate at 5% of total costs except without engineering, contingency and LT monitoring

Hydraulic Dredging & Sediment Treatment

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Survey	ea	3	$37,500	$112,500	Pre- and Post Dredge - Bathymetric Survey
2	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
3	24 hr. Security of Site	weekly	45	$2,695	$121,275	$15/hr X 24 hr X 7 days + $25/day (expenses)
4	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
5	Install Sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	15564	$45	$700,398	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Large Wood Waste Disposal	ea	778	$1,500	$1,167,330	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (15,564 cy)/20 cy/box
13	Hydraulically Dredge Sediment	cy	62258	$30	$1,867,728	Hydraulically dredge sediments with a concentration greater the PRG (Includes transport to land cost). Assume MD 200 cy/day of (77,822 - 15,564 cy) affected sediment
14	Screening	day	104	$2,500	$259,407	Screening system to separate wood from sediments
15	Air Emissions Monitoring	weeks	45	$8,725	$392,625	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	38	$9,000	$342,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Filterpress	cy	62258	$35	$2,179,016	Total dredged minus wood, rate based on bids
18	Stabilization	cy	11177	$81	$905,337	Total dredged minus wood and include 30 % for fines only, rate based on bids
19	Cap shoreline slope	cy	19259	$25	$481,475	2'x100'x1500'
20	Benthic Habitat/Thin layer	cy	10180	$18	$183,240	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$11,078,571**	

Transport & Disposal

Item No.		Unit	Quanitity	Unit Cost	Total	
1	Load	day	72	$1,440	$103,570	40 trucks/day X 20 tons/truck = 800 tons/day
2	Haul to landfill	ton	57539	$27	$1,553,546	Truck all sediment to Seven Mile LF - Eau Claire plus 10% for stabilization & excess moisture
3	Disposal	ton	57539	$18	$1,035,698	Tipping Fee
				Subtotal	**$2,692,814**	

Water Treatment:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Pond and Sand Filter Capital Cost	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	70	$2,700	$188,943	
4	Carbon Sand Filtration	Mgal	70	$67,000	$4,688,584	Stryker Bay Cost Estimates (See CDF cost Sheet)
5	Water Quality Testing	Mgal	70	$2,400	$167,949	
6	O&M	day	104	$2,400	$249,030	
				Subtotal	**$6,197,188**	

Capping:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Liner of GCL mat or GAC mat	sq ft	326700	$1.5	$490,050	One layer of either geotextile mat to retard contaminant transport and provide a cap base
2	Mat liner installation	sq ft	326700	$1	$326,700	Installation of organic clay liner and geosynthetic. Assume 1 acres/day at $4000/day
4	Stone Cover	ton	18150	$35	$635,250	Includes cost for barge. Assumes stone placement same time as sand cover 1 ft thick
5	Sand Cover Fill	cy	10415	$25	$260,365	Average of 0.5 ft to level after dredging for mat placement
6	Sand Cover & install	cy	30250	$25	$756,250	2.5 ft sand cover
7	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
8	Survey	ea	1	$37,500	$37,500	Post-Capping sand before rock-Bathymetric Survey
				Subtotal	**$2,560,515**	

MISC

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	day	76	$1,440	$109,440	Once a week, for 2 years (38 weeks/yr)
				Subtotal	**$119,440**	

Total:	$23,780,954	
Engineering @ 15%:	$3,567,143	
Oversight @ 15%:	$3,567,143	
Subtotal:	$30,915,240	
Contingency @ 20%:	$4,756,191	Only taken on Capital Costs not Engineering
TOTAL:	**$35,671,431**	

Table F3-5. Alternative SED- 3C:Hydraulically Dredge Sediments (0-4 ft) > PRG, Cap.

Post-Construction:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Monitoring	yr	30	$40,000.00	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000.00	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000.00	$300,000	
				Subtotal	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $36,386,521

Summary	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 1,251,866	$ 1,627,426	$ 250,373
Dredge and Sediment Handling	$ 11,078,571	$ 14,402,142	$ 2,215,714
Transport & Disposal	$ 2,692,814	$ 3,500,658	$ 538,563
Water Treatment	$ 6,197,188	$ 8,056,344	$ 1,239,438
Cap	$ 2,560,515	$ 3,328,670	$ 512,103
Total Estimated Cost	$ 23,780,954	$ 30,915,240	$ 4,756,191

Total Capital Cost With Contingency $ 35,671,431

Table F3-6. Alternative SED- 3D:Hydraulically Dredge Sediments (0-4 ft), Cap Thermally Treat.

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Sediment Volume:	77,822	cy	Based upon GIS calculations
Total Volume of Wood Waste:	15,564	cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight:	33,999	tons	Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal
Total Volume of Water:	70	Mgal	Water volume estimate based on 46% solid content by volume to 65% solids plus 20%

Mob/Demob

	Unit	Quanitity	Unit Cost	Total	
Mob/Demob	ls	1	$1,301,571	**$1,301,571**	Estimate at 5% of total costs except without engineering, contingency and LT monitoring

Hydraulic Dredging

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Survey	ea	3	$37,500	$112,500	Pre- and Post Dredge - Bathymetric Survey
2	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
3	24 hr. Security of Site	weekly	45	$2,695	$121,275	$15/hr X 24 hr X 7 days + $25/day (expenses)
4	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
2	Install Sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	15564	$45	$700,398	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Large Wood Waste Disposal	ea	778	$1,500	$1,167,330	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (15,564 cy)/20 cy/box
13	Mechanically Dredge Sediment	cy	62258	$30	$1,867,728	Hydraulically dredge sediments with a concentration greater than the PRG (Includes transport to land cost). Assume MD 200 cy/day of (77,822 - 15,564 cy) affected sediment
14	Screening	day	104	$2,500	$259,407	Screening system to separate wood from sediments
15	Air Emissions Monitoring	weeks	45	$8,725	$392,625	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	38	$9,000	$342,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Filterpress	cy	62258	$35	$2,179,016	Total dredged minus wood, rate based on bids
18	Cap shoreline slope	cy	19259	$25	$481,475	2'x100'x1500'
19	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
20	Benthic Habitat/Thin layer	cy	10180	$18	$183,240	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$10,227,634**	

Thermal Treatment	Unit	Quanitity	Unit Cost	Total	
Thermal Trearment	ton	52308	$100	**$5,230,796**	Bid of $80/ton plus misc items $20/ton = $100/ton

Transport & Disposal

Item No.		Unit	Quanitity	Unit Cost	Total		
1	Load	day	47	$1,440	$67,317	40 trucks/day X 20 tons/truck = 800 tons/day	
2	Haul to landfill	ton	37398	$27	$1,009,756	Weight plus 10% for wetting	*Truck all sediment to Seven Mile LF - Eau Claire*
3	Disposal	ton	37398	$18	$673,170	Weight plus 10% for wetting	
				Subtotal	**$1,750,243**		

Water Treatment:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Pond and Sand Filter Capital Cost	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	70	$2,700	$188,943	
4	Carbon Sand Filtration	Mgal	70	$67,000	$4,688,584	Stryker Bay Cost Estimates (See CDF cost Sheet)
5	Water Quality Testing	Mgal	70	$2,400	$167,949	
6	O&M	day	104	$2,400	$249,030	
				Subtotal	**$6,197,188**	

Capping:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Liner of GCL mat or GAC mat	sq ft	326700	$1.5	$490,050	One layer of either geotextile mat to retard contaminant transport and provide a cap base
2	Mat liner installation	sq ft	326700	$1	$326,700	Installation of organic clay liner and geosynthetic. Assume 1 acres/day at $4000/day
4	Stone Cover	ton	18150	$35	$635,250	Includes cost for barge. Assumes stone placement same time as sand cover 1 ft thick
5	Sand Cover Fill	cy	10415	$25	$260,365	Average of 0.5 ft to level after dredging for mat placement
6	Sand Cover & install	cy	30250	$25	$756,250	2.5 ft sand cover
8	Survey	ea	1	$37,500	$37,500	Post-Capping Bathymetric Survey
				Subtotal	**$2,506,115**	

MISC

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	day	76	$1,440	$109,440	Once a week, for 2 years (38 weeks/yr)
				Subtotal	**$119,440**	

Total:	$27,332,986	
Engineering @ 15%:	$4,099,948	
Oversight @ 15%:	$4,099,948	
Subtotal:	$35,532,882	
Contingency @ 20%:	$5,466,597	Only taken on Capital Costs not Engineering
TOTAL:	**$40,999,479**	

Table F3-6. Alternative SED- 3D:Hydraulically Dredge Sediments (0-4 ft), Cap Thermally Treat.

Post-Construction:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Monitoring	yr	30	$40,000.00	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000.00	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000.00	$300,000	
				Subtotal	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $41,714,569

Summary	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 1,421,011	$ 1,847,314	$ 284,202
Dredge and Sediment Handling	$ 10,227,634	$ 13,295,924	$ 2,045,527
Thermal Treatment	$ 5,230,796	$ 6,800,034	$ 1,046,159
Transport & Disposal	$ 1,750,243	$ 2,275,316	$ 350,049
Water Treatment	$ 6,197,188	$ 8,056,344	$ 1,239,438
Cap	$ 2,506,115	$ 3,257,950	$ 501,223
Total Estimated Cost	**$ 27,332,986**	**$ 35,532,882**	**$ 5,466,597**

Total Capital Cost With Contingency $ 40,999,479

Table F3-7. Alternative 4A: Mechanical Dredging of All Sediments > PRG .

Total Area:	696,960 sq ft	Based upon GIS calculations
Total Sediment Volume:	133,906 cy	Based upon GIS calculations
Total Volume of Large Wood Waste:	26,781 cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight:	58,500 tons	Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal
Total Volume of Water:	13.39 Mgal	Water volume estimate based on 46% solid content by volume and 65% for dewatering, plus 20%

Mob/Demob

	Unit	Quanitity	Unit Cost	Total	
Mob/Demob	ls	1	$1,287,762	**$1,287,762**	Approx 5% total cost

Mechanical Dredging & Sediment Treatment

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Survey	ea	2	$37,500	$75,000	Pre- and Post- Bathymetric Survey
2	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
3	24 hr. Security of Site	weekly	90	$2,695	$242,550	$15/hr X 24 hr X 7 days + $25/day (expenses)
4	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
5	Install sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	26781	$45	$1,205,150	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Screening	day	179	$2,500	$446,352	Screening system to separate wood from sediments
13	Large Wood Waste Disposal	ea	1339	$1,500	$2,008,583	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (26,781 cy)/20 cy/box
14	Dredge Sediment	cy	107124	$30	$3,213,733	Mechanically dredge sediments with a concentration greater than the PRG (Includes transport to land cost). Assume MD 200 cy/day of (133,096 - 26,781 cy) affected sediment
15	Air Emissions Monitoring	weeks	90	$8,725	$785,250	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	76	$9,000	$684,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Filterpress	cy	32137	$35	$1,124,795	Total dredged minus wood and 30 % for fines only, rate based on bids
18	Stabilization	cy	64124	$81	$5,194,079	Cost based on FRTR site guide with 15% cement added. Includes all costs minus mob/demob for a 50,000 yard soil site using RACER software
19	Cap shoreline slope	cy	38519	$25	$962,975	4'x100'x1500' plus 0.5 ft cap in dredge area
20	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
21	Benthic Habitat/Thin layer	cy	12907	$18	$232,320	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$18,595,427**	

Transport & Disposal

Item No.		Unit	Quanitity	Unit Cost	Total	
1	Load	day	124	$1,440	$178,236	40 trucks/day X 20 tons/truck = 800 tons/day
2	Haul to landfill	ton	99020	$27	$2,673,547	Sediment less wood plus stabilizer 10% Truck all sediment to Seven Mile LF - Eau Claire
3	Disposal	ton	99020	$18	$1,782,365	Sediment less wood plus stabilizer 10% Truck all sediment to Seven Mile LF - Eau Claire
				Subtotal	**$4,634,149**	

Water Treatment:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Pond and Sand Filter	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	13.39	$2,700	$36,160	
4	Carbon Filtration	Mgal	13.39	$67,000	$897,304	Stryker Bay Cost Estimates (See CDF cost Sheet)
5	Water Quality Testing	Mgal	13.39	$2,400	$32,142	
6	O&M	day	179	$2,400	$428,498	
				Subtotal	**$2,296,786**	

Misc:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	day	152	$1,440	$218,880	Once a week, for duration of project, doubled based on bidders comments
				Subtotal	**$228,880**	

Total:	$27,043,004	
Engineering @ 15%:	$4,056,451	
Oversight @ 15%:	$4,056,451	
Subtotal:	$35,155,906	
Contingency @ 20%:	$5,408,601	Only taken on Capital Costs not Engineering
TOTAL:	**$40,564,506**	

Table F3-7. Alternative 4A: Mechanical Dredging of All Sediments > PRG .

Post-Construction:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Monitoring	yr	30	$40,000.00	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000.00	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000.00	$300,000	
				Subtotal	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $41,279,596

Summary	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 1,516,642	$ 1,971,635	$ 303,328
Dredge	$ 18,595,427	$ 24,174,055	$ 3,719,085
Transport and Disposal	$ 4,634,149	$ 6,024,394	$ 926,830
Water Treatment	$ 2,296,786	$ 2,985,822	$ 459,357
Total Estimated Cost	$ 27,043,004	$ 35,155,906	$ 5,408,601

Total Capital Cost With Contingency $ 40,564,506

Table F3-8. Alternative 4B: Mechanical Dredging of All Sediments > PRG, Thermal Treatment.

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Sediment Volume:	133,906	cy	Based upon GIS calculations
Total Volume of Large Wood Waste:	26,781	cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight:	58,500	tons	Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal
Total Volume of Water:	13.4	Mgal	Water volume estimate based on 46% solid content by volume plus 20%

Mob/Demob

	Unit	Quanitity	Unit Cost	Total	Notes
Mob/Demob	ls	1	$1,528,250	**$1,528,250**	Approx 5% total cost

Mechanical Dredging & Sediment Treatment

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Survey	ea	2	$37,500	$75,000	Pre- and Post- Bathymetric Survey
2	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
3	24 hr. Security of Site	weekly	90	$2,695	$242,550	$15/hr X 24 hr X 7 days + $25/day (expenses)
4	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
5	Install Sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	26781	$45	$1,205,150	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Screening	day	179	$2,500	$446,352	Screening system to separate wood from sediments
13	Large Wood Waste Disposal	ea	1339	$1,500	$2,008,583	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (26,781 cy)/20 cy/box
14	Dredge Sediment	cy	107124	$30	$3,213,733	Mechanically dredge sediments with a concentration greater than 10 ppm (Includes transport to land cost). Assume MD 200 cy/day of (133,096 - 26,781 cy) affected sediment
15	Air Emissions Monitoring	weeks	90	$8,725	$785,250	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	76	$9,000	$684,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Mechanical & Gravity Methods	cy	107124	$35	$3,749,355	Total dredged minus wood, rate based on bids
18	cap shoreline slope	cy	38519	$25	$962,975	4'x100'x1500' plus 0.5 ft cap in dredge area
19	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
20	Benthic Habitat/Thin layer	cy	12907	$18	$232,320	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$16,025,908**	

Thermal Treatment	Unit	Quanitity	Unit Cost	Total	Notes
Thermal Trearment	ton	90018	$100	**$9,001,843**	Bid of $80/ton plus misc items $20/ton = $100/ton

Transport & Disposal

Item No.		Unit	Quanitity	Unit Cost	Total	Notes
1	Load	day	80	$1,440	$115,830	40 trucks/day X 20 tons/truck = 800 tons/day
2	Haul to landfill	ton	64350	$27	$1,737,450	Truck all sediment to Seven Mile LF - Eau Claire plus 10% wetting
3	Disposal	ton	64350	$18	$1,158,300	Tipping Fee
				Subtotal	**$3,011,581**	

Water Treatment:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Pond and Sand Filter Capital Cost	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	13.4	$2,700	$36,160	
4	Carbon Filtration	Mgal	13.4	$67,000	$897,304	Stryker Bay Cost Estimates (See CDF cost Sheet)
5	Water Quality Testing	Mgal	13.4	$2,400	$32,142	
6	O&M	day	179	$2,400	$428,498	
				Subtotal	**$2,296,786**	

Misc:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	day	152	$1,440	$218,880	Once a week, for duration of project, doubled based on bidders comments
				Subtotal	**$228,880**	

Total:	$32,093,248	
Engineering @ 15%:	$4,813,987	
Oversight @ 15%:	$4,813,987	
Subtotal:	$41,721,222	
Contingency @ 20%:	$6,418,650	Only taken on Capital Costs not Engineering
TOTAL:	**$48,139,872**	

Table F3-8. Alternative 4B: Mechanical Dredging of All Sediments > PRG, Thermal Treatment.

Post-Construction:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Monitoring	yr	30	$40,000	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000	$300,000	
				Subtotal	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $48,854,962

Summary	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 1,757,130	$ 2,284,269	$ 351,426
Dredge	$ 16,025,908	$ 20,833,681	$ 3,205,182
Thermal Treatment	$ 9,001,843	$ 11,702,396	$ 1,800,369
Transport and Disposal	$ 3,011,581	$ 3,915,055	$ 602,316
Water Treatment	$ 2,296,786	$ 2,985,822	$ 459,357
Total Estimated Cost	$ 32,093,248	$ 41,721,222	$ 6,418,650
		Total Capital Cost With Contingency	$ 48,139,872

Table F3-9. Alternative 4C: Hydraulic Dredging of All Sediments > PRG.

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Sediment Volume:	133,906	cy	Based upon GIS calculations
Total Volume of Large Wood Waste:	26,781	cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight	58,500	tons	Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal
Total Volume of Water:	121	Mgal	Based upon 10% solids

Mob/Demob

	Unit	Quamtity	Unit Costs	Total	Notes
Mob/Demob	ls	1	$1,615,830.42	**$1,615,830**	Approx 5% total cost

Mechanical Dredging & Sediment Treatment

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Survey	ea	2	$37,500	$75,000	Pre- and Post- Bathymetric Survey
2	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
3	24 hr. Security of Site	weekly	90	$2,695	$242,550	$15/hr X 24 hr X 7 days + $25/day (expenses)
4	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
5	Install Sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	26781	$45	$1,205,150	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Screening	day	179	$2,500	$446,352	Screening system to separate wood from sediments
13	Large Wood Waste Disposal	ea	1339	$1,500	$2,008,583	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (26,781 cy)/20 cy/box
14	Dredge Sediment	cy	107124	$30	$3,213,733	Mechanically dredge sediments with a concentration greater than 10 ppm (Includes transport to land cost). Assume MD 200 cy/day of (133,096 - 26,781 cy) affected sediment
15	Air Emissions Monitoring	weeks	90	$8,725	$785,250	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	76	$9,000	$684,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Filterpress	cy	107124	$35	$3,749,355	Total dredged minus wood, rate based on bids
18	Stabilization	cy	19237	$81	$1,558,197	Cost based on FRTR site guide with 15% cement added. Assumes 30% fines still need stabilization. Includes all costs minus mob/demob for a 50,000 yard soil site using RACER software
19	Cap shoreline slope	cy	38519	$25	$962,975	4'x100'x1500' plus 0.5 ft cap in dredge area
20	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
21	Benthic Habitat/Thin layer	cy	12907	$18	$232,320	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$17,584,105**	

Transport & Disposal

Item No.		Unit	Quanitity	Unit Cost	Total	Notes
1	Load	day	124	$1,440	$178,236	40 trucks/day X 20 tons/truck = 800 tons/day
2	Haul to landfill	ton	99020	$25	$2,475,507	Sediment weight plus 10% - Truck all sediment to Seven Mile LF - Eau Claire
3	Disposal	ton	99020	$18	$1,782,365	Tipping Fee
				Subtotal	**$4,436,108**	

Water Treatment:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Pond and Sand Filter	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	121	$2,700	$327,158	
4	Carbon Filtration	Mgal	121	$67,000	$8,118,370	Stryker Bay Cost Estimates (See CDF cost Sheet)
5	Water Quality Testing	Mgal	121	$2,400	$290,807	
6	O&M	day	179	$2,400	$428,498	
				Subtotal	**$10,067,515**	

Misc:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	week	152	$1,440	$218,880	Once a week, for duration of project
				Subtotal	**$228,880**	

Total:	$33,932,439	
Engineering @ 15%:	$5,089,866	
Oversight @ 15%:	$5,089,866	
Subtotal:	$44,112,171	
Contingency @ 20%:	$6,786,488	Only taken on Capital Costs not Engineering
TOTAL:	**$50,898,658**	

Table F3-9. Alternative 4C: Hydraulic Dredging of All Sediments > PRG.

Post-Construction:

Item No.	Item	Unit	Quanitity	Unit Cost	Total	Notes
1	Monitoring	yr	30	$40,000	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000	$300,000	
					$1,860,000	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $51,613,748

Summary	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 1,844,710	$ 2,398,124	$ 368,942
Dredge	$ 17,584,105	$ 22,859,337	$ 3,516,821
Transport and Disposal	$ 4,436,108	$ 5,766,941	$ 887,222
Water Treatment	$ 10,067,515	$ 13,087,769	$ 2,013,503
Total Estimated Cost	$ 33,932,439	$ 44,112,171	$ 6,786,488

Total Capital Cost With Contingency $ 50,898,658

Table F3-10. Alternative 4D: Hydraulic Dredging of All Sediments > PRG, Thermal Treatment.

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Sediment Volume:	133,906	cy	Based upon GIS calculations
Total Volume of Large Wood Waste:	26,781	cy	Assume large wood waste is 20% of total sediments
Total Sediment Weight:	58,500	tons	(Weight estimate based on SG = 2.6 dry weight, 65%solids for disposal)
Total Volume of Water:	121	Mgal	(Water volume estimate based on 46% solid content by volume)

Mob/Demob

	Unit	Quamtity	Unit Costs	Total	Notes
Mob/Demob	ls	1	$1,916,784	**$1,916,784**	Approx 5% total cost

Mechanical Dredging & Sediment Treatment

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Survey	ea	2	$37,500	$75,000	Pre- and Post- Bathymetric Survey
2	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	
3	24 hr. Security of Site	weekly	90	$2,695	$242,550	$15/hr X 24 hr X 7 days + $25/day (expenses)
4	Perimeter Fence	ln ft	2528	$20	$50,560	Fence along land side
5	Install Sheet pile outside dredge area	sq ft	45000	$48	$2,160,000	Install sheet pile wall instead of silt curtains
6	Install HC Boom	ft	5460	$4	$21,840	Install HC Boom on both sides of the wall in water pre-wall installation activities on both sides of sheetpile & 200 ft on each shore
7	HC Boom Debris Disposal Labor	ea	2	$3,000	$6,000	Remove debris twice during dredging using a barge
8	Debris Disposal	ea	2	$1,500	$3,000	Dispose of debris in 20 cy. roll off box
9	HC Boom Removal	ft	5460	$4	$21,840	Removal of HC Boom into roll off box
10	Dispose of Boom	ea	2	$1,500	$3,000	Dispose of HC Boom in two 20 cy. roll off boxes
11	Large Wood Waste Removal	cy	26781	$45	$1,205,150	Assume removal of large debris will take 20% of the total at 1.5 times the dredge rate or 45/cy
12	Screening	day	179	$2,500	$446,352	Screening system to separate wood from sediments
13	Large Wood Waste Disposal	ea	1339	$1,500	$2,008,583	Dispose of large debris in a 20 cy. roll off box. Assume 20% is large waste = (26,781 cy)/20 cy/box
14	Dredge Sediment	cy	107124	$30	$3,213,733	Mechanically dredge sediments with a concentration greater than 10 ppm (Includes transport to land cost). Assume MD 200 cy/day of (133,096 - 26,781 cy) affected sediment
15	Air Emissions Monitoring	weeks	90	$8,725	$785,250	Monitor air quality during construction and dredging based on 5 stations 3 times/week using NIOSH methods
16	Water Quality Monitoring	weeks	76	$9,000	$684,000	Daily Water Quality Monitoring through dredging process (including time to remove large wood waste)
17	Dewatering - Filterpress	cy	107124	$35	$3,749,355	Total dredged minus wood, rate based on bids
18	cap shoreline slope	cy	38519	$25	$962,975	4'x100'x1500' plus 0.5 ft cap in dredge area
19	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2600 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1360 tons @ 130 pcf
20	Benthic Habitat/Thin layer	cy	12907	$18	$232,320	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	**$16,025,908**	

Thermal Treatment

	Unit	Quamtity	Unit Costs	Total	Notes
Thermal Trearment	ton	90018	$100	**$9,001,792**	Bid of $80/ton plus misc items $20/ton = $100/ton

Transport & Disposal

Item No.		Unit	Quamtity	Unit Costs	Total	Notes
1	Load	day	80	$1,440	$115,830	40 trucks/day X 20 tons/truck = 800 tons/day
2	Haul to landfill	ton	64350	$27	$1,737,450	Sediment weight plus 10% wetting - Truck all sediment to Seven Mile LF - Eau Claire
3	Disposal	ton	64350	$18	$1,158,300	Tipping Fee
				Subtotal	**$3,011,581**	

Water Treatment:

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Pond and Sand Filter Capital Cost	ea	1	$852,682	$852,682	
2	Oil Water Separator	ea	2	$25,000	$50,000	
3	Oil Water Separator O&M	Mgal	121	$2,700	$327,158	
4	Carbon Filtration	Mgal	121	$67,000	$8,118,370	Stryker Bay Cost Estimates (See CDF cost Sheet)
5	Water Quality Testing	Mgal	121	$2,400	$290,807	
6	O&M	day	179	$2,400	$428,498	
				Subtotal	**$10,067,515**	

Misc:

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	$100/hr X 40 hr/wk X 2.5 weeks
2	Health & Safety Personnel	week	152	$1,440	$218,880	Once a week, for duration of project
				Subtotal	**$228,880**	

Total:	$40,252,459	
Engineering @ 15%:	$6,037,869	
Oversight @ 15%:	$6,037,869	
Subtotal:	$52,328,197	
Contingency @ 20%:	$8,050,492	Only taken on Capital Costs not Engineering
TOTAL:	**$60,378,689**	

Table F3-10. Alternative 4D: Hydraulic Dredging of All Sediments > PRG, Thermal Treatment.

Post-Construction:

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Monitoring	yr	30	$40,000.00	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000.00	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000.00	$300,000	
				Subtotal	**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $61,093,779

Summary	**Cost**	**Cost + Oversight & Engineering**	**Contingency**
Mob/demob & Misc	$ 2,145,664	$ 2,789,363	$ 429,133
Dredge	$ 16,025,908	$ 20,833,681	$ 3,205,182
Thermal Treatment	$ 9,001,792	$ 11,702,329	$ 1,800,358
Transport and Disposal	$ 3,011,581	$ 3,915,055	$ 602,316
Water Treatment	$ 10,067,515	$ 13,087,769	$ 2,013,503
Total Estimated Cost	$ 40,252,459	$ 52,328,197	$ 8,050,492

Total Capital Cost With Contingency $ 60,378,689

Table F3-11. Alternative 5A: Dry Excavation of all Sediments > PRG

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Wet Sediment Volume:	133,906	cu yd	Includes volume of water in sediments
Total Dry Sediment Weight:	58,500	tons	(Weight estimate based on SG = 2.6 dry weight, 75% volume reduction)
Estimated Volume of Water to be Treated:	180	Mgal	

Mobilization/Demobilization

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Mob/Demob	ls	1	$2,054,744	$2,054,744	Approx 5% total cost

Subtotal, Mobilization/Demobilization $2,054,744

Sediment Removal and Treatment

Pre-Construction Activities

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	Perimeter Fence	lf	1680	$20	$33,600	Fence along land side where there is no sheet pile wall (with 20 ft overlap), back to the railroad tracks
2	Pre- and Post-Bathymetric Survey	ea	2	$37,500	$75,000	
3	Pretrenching along Proposed Landward Sheet Pile Alignment	day	15	$1,800	$27,000	2680 lft at appx 200 lft per day
4	Removal of Existing Site Features	ls	1	$100,000	$100,000	
5	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	Includes installation of electric upon completion ($40k) & move/abandon existing utilities ($60k)
				Subtotal	***$335,600***	

Containment with Pipe and Sheet Pile System at 2900N, Wave Attenuator

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	2,200 linear feet of WhisprWave® Floating Wave Attenuator	ls	1	5029950	$5,029,950	Purchase, ship, and install wave attenuator device
2	Install HC Boom in Lake	lf	1770	$4	$7,080	Install HC Boom on one side of piling and extend to shorelines
3	Pipe / AZ Combined Wall System in Bay	sec	184	$24,880	$4,583,158	PA36/13 pipe/sht piling;(Pipe)142.7 lb/ft x 61 ft + (sheeting)22.02 lb/ft2 x 231 ft2 = 13800 lbs @ $0.80/lb = $11,040 + $1400 (seal) = $12,4 Length,ft: 1400
4	West Sheetpiling	sf	49920	$62	$3,095,040	Includes $56 sq/ft for PZ35 piling (35lbs/sq ft @ $0.80/lb + $28 for in: Length,ft: 960
5	East Sheetpiling	sf	21615	$62	$1,340,130	Includes $56 sq/ft for PZ35 piling (35lbs/sq ft @ $0.80/lb + $28 for in: Length,ft: 655
6	South Sheetpiling	sf	31455	$62	$1,950,210	Includes $56 sq/ft for PZ35 piling (35lbs/sq ft @ $0.80/lb + $28 for in: Length,ft: 1165
7	Remove HC Boom from Lake	lf	1770	$4	$7,080	Remove HC Boom on one side of piling and extend to shorelines
8	Dispose HC Boom	ea	3	$1,500	$4,500	Dispose of HC Boom in 20 cy. roll off boxes
9	Silt Fence	lf	1640	$20	$32,800	Along south, east, and west sides of Kreher Park, back to the railroad track, beyond the sheetpile wall
				Subtotal	***$16,049,948***	

Sediment Drainage Pad

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Asphalt Drainage Pad Construction	sq yd	4170	$45	$187,650	150 ft x 250 ft = 37,500 sq ft = 4,170 sq yd
2	Pumping excess/drained water to WWTP	day	670	$300	$201,000	
				Subtotal	***$388,650***	

Sediment Removal

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Cutoff and Remove Old Pilings	ea	40	$500	$20,000	
2	Remove Existing Shoreline Riprap	ton	7500	$20	$150,000	
3	Crane w/ dragline	day	300	$4,500	$1,350,000	58,500 tons dry sediments x 50% increase to account for moisture in the sediments = 87,750 tons, assumes ~300 tons are removed per day
4	Dozers (2)	day	300	$3,600	$1,080,000	2 Dozers at $1800 per day per dozer
5	Excavators (2)	day	300	$3,600	$1,080,000	2 Excavators at $1800 per day per excavator
6	Conveyors (4)	day	150	$2,000	$300,000	4 Conveyors at $500 per day per conveyor
7	Confirmation Samples	ea	400	$200	$80,000	
8	Air Emissions Monitoring	weeks	60	$8,725	$523,500	Monitor air quality during sediment removal based on 5 stations 3 times/week using NIOSH methods
9	Temporary Barriers	ea	100	$1,500	$150,000	Jersey barriers to provide separation of areas
				Subtotal	***$4,733,500***	

Waste Separation/Stabilization

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Remove Large Wood/Debris Waste	day	300	$1,800	$540,000	Load at $1800/day for period of ~300 days of sediment processing
2	Dispose Large Wood/Debris Waste at 20 cu yd per roll-off box	ea	1340	$1,500	$2,010,000	Dispose of large debris as special waste in a 20 cy. roll off box. Assume 20% is large waste = (26,781 cy)/20 cy/box = 1,340 boxes
3	Waste Sampling for Landfilling	ea	10	$400	$4,000	
4	Mixing Reagent for Stabilization	cu yd	64124	$35	$2,244,340	Reagent and mixing costs combined; assume 2/3 of remaining sediments needs to be stabilized (87750 tons / 1.5 tons/cu yd = 58500 cu yd * 2/3 = 39,000 cu yd)
5	Flexible Hose/Pipe for Reagent	lf	1520	$10	$15,200	To get reagent to the mixing area/s within the drained Bay
				Subtotal	***$4,813,540***	

Shoreline Restoration

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Place 0.5 ft Clean Sand in Bay + 30,000 cu yds Near Shore	cu yd	38519	$25	$962,975	8/2x100'x2600'
2	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2500 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1300 tons @ 130 pcf
3	Benthic Habitat/Thin layer	cy	12907	$18	$232,320	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	***$1,249,695***	

Subtotal, Sediment Removal and Treatment $27,570,933

Table F3-11. Alternative 5A: Dry Excavation of all Sediments > PRG

Water Removal and Treatment

Ground Water Capture System Upgradient of Containment Wall

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	Trench Excavation	lf	1165	$50	$58,250	18 ft deep by 3 ft wide
2	Contaminated Soil Disposal	tons	3495	$60	$209,700	Dispose as special waste at $60/ton; Assumes 1.5 tons/cu yd
3	Trench Filter Fabric	sf	48930	$1	$48,930	Fabric along both sides and the bottom of the trench, and between the gravel backfill and the overlying soil backfill material
4	Gravel Backfill	tons	2718	$20	$54,367	From 4 ft to ~18 ft bgs, 3 ft wide; 1.5 tons/cu yd
5	Collection Pipe, 4-in HDPE Perforated	lf	1245	$30	$37,350	1165 ft of pipe in trench, 4 - 20 ft segments from the sumps to the header
6	Trenching, Backfill, and Compaction	cu yd	518	$20	$10,356	Soil material above the gravel in the trench; from 0 to 4 ft bgs; 1.5 tons/cu yd
7	Discharge Piping, 6-in HDPE	lf	1335	$38	$50,730	1165 ft of header pipe placed on ground surface, 170 ft from header pipe to WWTP
8	Connection to Sanitary Pump Station	ea	1	$2,000	$2,000	
9	Water Samples	ea	100	$200	$20,000	
10	Collection Sump	ea	4	$2,000	$8,000	
11	Sump Pump	ea	4	$4,500	$18,000	
12	Sump Level Controls	ea	4	$2,500	$10,000	
13	Electrical Conduit	lf	1245	$10	$12,450	1065 ft of conduit pipe placed on ground surface, and 4 - 20 ft segments from the sumps to the header
14	Misc. Electrical	ls	1	$10,000	$10,000	
15	Grout Ground Water Treatment System Trench at end of Project	cu yd	820	$25	$20,500	18 ft deep, 3 ft wide, 1165 lf; assumes 35% void space
				Subtotal	***$570,632***	

Lake Water Removal System Inside of Containment

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	2 Pumps at 500 gpm w/ Operator to Initially Drain Bay	day	50	$7,840	$392,000	[$85/hr x 8 hrs + 127.50/hr x 16 hr + $1200/day pump] x 2; ~60,000,000 gal in Bay; 2 - 500gpm pumps = 1,440,000 gpd; added 8 add'l days for rain, gw, and lake water infiltration
2	Sump pumps variable discharge 10 to 100 gpm	ea	8	$4,500	$36,000	Dewater sediments
3	Collection/discharge piping, 12-in HDPE	lf	3280	$5.50	$18,040	Two collection pipes runs on land along Bay from the NW and NE corners of the Bay until reaching WWTP; Discharge pipe runs to the east to Lake Superior (east of the containment area)
4	Connection to WWTP	ea	3	$2,000	$6,000	Two intake connections from each side of the Bay (West and East), one outgoing connection for treated water going to Lake Superior
5	Start-up Samples	ea	200	$200	$40,000	
6	Electrical Conduit	lf	1450	$10	$14,500	Runs on land along Bay to the west and east, connects up with the Ground Water Capture System conduit to the south
7	Connection to City Power Supply	ls	1	$20,000	$20,000	Connection and transformer
8	1 500 gpm Pump w/ Operator to Drain Bay 4 weeks each Spring	day	84	$3,920	$329,280	[$85/hr x 8 hrs + 127.50/hr x 16 hr + $1200/day pump] x 1; Assumes there will be 3 unworked winters between 4 working seasons
				Subtotal	***$855,820***	

Ground/Lake Water Treatment System

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
	Year 2 Startup					Start-up is for approximately 50 days in Year 2 and 28 days in subsequent years 3 and 4.
	Carbon Adsorber System (1500 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	2	$49,335	$98,670	
2	*Rental**	Months	6	$5,000	$30,000	*There is a three month minimum rental for each of the two units
3	*Rental Termination: carbon removal, demobilization*	ea	2	$41,935	$83,870	
4	Oil Water Separator and associated system (200 gpm) (purchase)	ea	1	$30,000	$30,000	
5	Fuel and energy surcharge (estimated 8.65%)	ea	2	$10,490	$20,980	
6	Connecting piping, pumps, accessories	ea	1	$20,000	$20,000	
7	Operation and Maintenance (labor)	hours	900	$100	$90,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				***$373,520***	
	Year 2 During and After Startup					
	Carbon Adsorption System and Bag System for Filtration (200 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	1	$28,675	$28,675	
2	*Rental***	Months	6	$1,500	$9,000	**Six months for each units plus the first month that comes with the rental for a total of seven months use-time.
3	*Rental Termination:carbon removal,system disassembly,demob*	ea	1	$39,350	$39,350	
4	*Carbon Exchange Rate*	gallons	30000000	$0.067	$2,010,000	
5	*BF400 Four Bag Filter Skid*	Months	7	$4,000	$28,000	
6	*Filter Bags (5 micron rating) - Bag of 50*	Cases	8	$600	$4,800	
7	Fuel and energy surcharge (estimated 8.65%)	ea	1	$183,365	$183,365	
8	Dispose soil in filter bags (special waste)	tons	17	$60	$1,020	All filter bags will fill with fines and have to be disposed as special waste. Assumed average cost is $60/ton.
9	Oil Disposal	gallons	200	$3	$600	Oil from oil/water separator will be collected in a 55 gallon drum and disposed as necessary.
10	Operation and Maintenance (labor)	hours	2150	$100	$215,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				***$2,519,810***	
	Year 3, 4 Startup					Start-up is for approximately 50 days in Year 2 and 28 days in subsequent years 3 and 4.
	Carbon Adsorber System (1500 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	4	$49,335	$197,340	
2	*Monthly rental**	Months	12	$5,000	$60,000	*There is a three month minimum rental for each of the two units
3	*Rental Termination: carbon removal, demobilization*	ea	4	$41,935	$167,740	
4	Fuel and energy surcharge (estimated at 8.65%)	ea	2	$18,385	$36,769	
5	Operation and Maintenance (labor)	hours	1200	$100	$120,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				***$581,849***	
	Year 3, 4 During and After Startup					
	Carbon Adsorption System and Bag System for Filtration (200 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	2	$28,675	$57,350	
2	*Monthly rental***	Months	12	$1,500	$18,000	**Six months for each units plus the first month that comes with the rental for a total of seven months use-time.
3	*Rental Termination:carbon removal,system disassembly,demob*	ea	2	$39,350	$78,700	
4	*Carbon Exchange Rate*	gallons	30000000	$0.067	$2,010,000	
5	*BF400 Four Bag Filter Skid*	Months	14	$4,000	$56,000	
6	*Filter Bags (5 micron rating) - Bag of 50*	Cases	16	$600	$9,600	
7	Fuel and energy surcharge (estimated 8.65%)	ea	2	$96,432	$192,865	
8	Dispose soil in filter bags (special waste)	tons	34	$60	$2,040	All filter bags will fill with fines and have to be disposed as special waste. Assumed average cost is $60/ton.
9	Oil Disposal	gallons	600	$3	$1,800	Oil from oil/water separator will be collected in a 55 gallon drum and disposed as necessary.
10	Operation and Maintenance (labor)	hours	4900	$100	$490,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				*$2,916,355*	
				Subtotal	***$6,391,534***	Total for 3 years

Subtotal, Water Removal and Treatment **$7,817,986**

Sediment Transport and Disposal

Table F3-11. Alternative 5A: Dry Excavation of all Sediments > PRG

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Load,	ton	124	$1,440.00	$178,560	One-third of total weight wet (87750 / 3) = 29250 tons
2	Haul to Landfill	ton	99020	$27.00	$2,673,540	Assumes 20% weight increase for stabilized waste = 39000 cu yd x 1.2 = 46800 cu yd * 1.5 tons/cu yd = 70200 tons
3	Disposal of NAPL offsite	ton	99020	$18.00	$1,782,360	
4	Disposal of NAPL offsite	gal	5000	$8	$40,000	Same units used in 1998 cost
5	Cut Perimeter Sheet Pile Wall and Dispose of Piling	sf	10720	$25	$268,000	Three sides of site; 4 ft x 2680 lf = 10,720 sq ft
6	Remove Asphalt Drainage Pad and Dispose	sq yd	4170	$10	$41,700	
	Subtotal, Sediment Transport and Disposal				**$4,984,160**	

Miscellaneous

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	
2	Health & Safety Personnel	wk	120	$1,440	$172,800	Once a week for duration of project; 3.8 years of work * 52 wks / yr * 7/12 (working 7 months of the year)
3	24 hr Security of Site	wk	200	$2,695	$539,000	$15/hr X 24 hr X 7 days + $25/day (expenses); 3.8 years of work * 52 wks / yr
	Subtotal, Miscellaneous				**$721,800**	

Subtotal:	$43,149,623
Engineering @ 15%:	$6,472,443
Oversight @ 15%:	$6,472,443
Subtotal:	$56,094,510
Contingency @ 25%:	$10,787,406
TOTAL:	**$66,881,915**

Post-Construction

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Monitoring	yr	30	$40,000	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000	$300,000	
			Subtotal, Post-Construction		**$1,860,000**	
	Present worth @ 7% discount factor				**$715,090**	

GRAND TOTAL: $67,597,005

Table F3-12. Alternative 5B: Dry Excavation of all Sediments > PRG, Thermal Treatment

Total Area:	696,960	sq ft	Based upon GIS calculations
Total Wet Sediment Volume:	133,906	cu yd	Includes volume of water in sediments
Total Dry Sediment Weight:	58,500	tons	(Weight estimate based on SG = 2.6 dry weight, 75% volume reduction)
Estimated Volume of Water to be Treated:	180	Mgal	

Mobilization/Demobilization

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Mob/Demob	ls	1	$2,497,981	$2,497,981	Approx 5% total cost

Subtotal, Mobilization/Demobilization $2,497,981

Sediment Removal

Pre-Construction Activities

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	Perimeter Fence	lf	1680	$20	$33,600	Fence along land side where there is no sheet pile wall (with 20 ft overlap), back to the railroad tracks
2	Pre- and Post-Bathymetric Survey	ea	2	$37,500	$75,000	
3	Pretrenching along Proposed Landward Sheet Pile Alignment	day	15	$1,800	$27,000	2680 lft at appx 200 lft per day
4	Removal of Existing Site Features	ls	1	$100,000	$100,000	
5	Move/Abandon Existing Utilities	ls	1	$100,000	$100,000	Includes installation of electric upon completion ($40k) & move/abandon existing utilities ($60k)
				Subtotal	***$335,600***	

Containment with Pipe and Sheet Pile System at 2900N, Wave Attenuator

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	2,200 linear feet of WhisprWave® Floating Wave Attenuator	ls	1	5029950	$5,029,950	Purchase, ship, and install wave attenuator device
2	Install HC Boom in Lake	lf	1770	$4	$7,080	Install HC Boom on one side of piling and extend to shorelines
3	Pipe / AZ Combined Wall System in Bay	sec	184	$24,880	$4,583,158	PA36/13 pipe/sht piling;(Pipe)142.7 lb/ft x 61 ft + (sheeting)22.02 lb/ft2 x 231 ft2 = 13800 lbs @ $0.80/lb = $11,040 + $1400 (seal) = $12, Length,ft: 1400
4	West Sheetpiling	sf	49920	$62	$3,095,040	Includes $56 sq/ft for PZ35 piling (35lbs/sq ft @ $0.80/lb + $28 for in Length,ft: 960
5	East Sheetpiling	sf	21615	$62	$1,340,130	Includes $56 sq/ft for PZ35 piling (35lbs/sq ft @ $0.80/lb + $28 for in Length,ft: 655
6	South Sheetpiling	sf	31455	$62	$1,950,210	Includes $56 sq/ft for PZ35 piling (35lbs/sq ft @ $0.80/lb + $28 for in Length,ft: 1165
7	Remove HC Boom from Lake	lf	1770	$4	$7,080	Remove HC Boom on one side of piling and extend to shorelines
8	Dispose HC Boom	ea	3	$1,500	$4,500	Dispose of HC Boom in 20 cy. roll off boxes
9	Silt Fence	lf	1640	$20	$32,800	Along south, east, and west sides of Kreher Park, back to the railroad track, beyond the sheetpile wall
				Subtotal	***$16,049,948***	

Sediment Drainage Pad

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Asphalt Drainage Pad Construction	sq yd	4170	$45	$187,650	150 ft x 250 ft = 37,500 sq ft = 4,170 sq yd
2	Pumping excess/drained water to WWTP	day	670	$300	$201,000	
				Subtotal	***$388,650***	

Sediment Removal

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Cutoff and Remove Old Pilings	ea	40	$500	$20,000	
2	Remove Existing Shoreline Riprap	ton	7500	$20	$150,000	
3	Crane w/ dragline	day	300	$4,500	$1,350,000	58,500 tons dry sediments x 50% increase to account for moisture in the sediments = 87,750 tons, assumes ~300 tons are removed per day
4	Dozers (2)	day	300	$3,600	$1,080,000	2 Dozers at $1800 per day per dozer
5	Excavators (2)	day	300	$3,600	$1,080,000	2 Excavators at $1800 per day per excavator
6	Conveyors (4)	day	150	$2,000	$300,000	4 Conveyors at $500 per day per conveyor
7	Confirmation Samples	ea	400	$200	$80,000	
8	Air Emissions Monitoring	weeks	60	$8,725	$523,500	Monitor air quality during sediment removal based on 5 stations 3 times/week using NIOSH methods
9	Temporary Barriers	ea	100	$1,500	$150,000	Jersey barriers to provide separation of areas
10	Remove Large Wood/Debris Waste	day	300	$1,800	$540,000	Load at $1800/day for period of ~300 days of sediment processing
11	Dispose Large Wood/Debris Waste at 20 cu yd per roll-off box	ea	1340	$1,500	$2,010,000	Dispose of large debris as special waste in a 20 cy. roll off box. Assume 20% is large waste = (26,781 cy)/20 cy/box = 1,340 boxes
				Subtotal	***$7,283,500***	

Sediment Dewatering

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Dewatering - Filterpress	cy	107125	$35	$3,749,368	Total dredged minus wood, rate based on bids
				Subtotal	***$3,749,368***	

Shoreline Restoration

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	cap shoreline slope	cu yd	38519	$25	$962,975	Area of Bay ~912,600 sq ft; 912600 ft2 x 0.5 ft / 27 yd3/ft3 = 16,900 cu yd + 30,000 cu yd = 46,900 cu yd
2	Install Rip-Rap Shore Protection	ton	1360	$40	$54,400	~2500 lf of shorline inside 2900N, 8ft wide, 1 ft thick rip-rap = 20,800 cu ft of rip-rap = 1300 tons @ 130 pcf
3	Benthic Habitat/Thin layer	cy	12907	$18	$232,320	Apply 0.5 ft of fish mix @ $18/cy (Stryker Bay estimates) to dredge area.
				Subtotal	***$1,249,695***	

Subtotal, Sediment Removal $29,056,761

Water Removal and Treatment

Ground Water Capture System Upgradient of Containment Wall

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	Trench Excavation	lf	1165	$50	$58,250	18 ft deep by 3 ft wide
2	Contaminated Soil Disposal	tons	3495	$60	$209,700	Dispose as special waste at $60/ton; Assumes 1.5 tons/cu yd

Table F3-12. Alternative 5B: Dry Excavation of all Sediments > PRG, Thermal Treatment

3	Trench Filter Fabric	sf	48930	$1	$48,930	Fabric along both sides and the bottom of the trench, and between the gravel backfill and the overlying soil backfill material
4	Gravel Backfill	tons	2718	$20	$54,367	From 4 ft to ~18 ft bgs, 3 ft wide; 1.5 tons/cu yd
5	Collection Pipe, 4-in HDPE Perforated	lf	1245	$30	$37,350	1165 ft of pipe in trench, 4 - 20 ft segments from the sumps to the header
6	Trenching, Backfill, and Compaction	cu yd	518	$20	$10,356	Soil material above the gravel in the trench; from 0 to 4 ft bgs; 1.5 tons/cu yd
7	Discharge Piping, 6-in HDPE	lf	1335	$38	$50,730	1165 ft of header pipe placed on ground surface, 170 ft from header pipe to WWTP
8	Connection to Sanitary Pump Station	ea	1	$2,000	$2,000	
9	Water Samples	ea	100	$200	$20,000	
10	Collection Sump	ea	4	$2,000	$8,000	
11	Sump Pump	ea	4	$4,500	$18,000	
12	Sump Level Controls	ea	4	$2,500	$10,000	
13	Electrical Conduit	lf	1245	$10	$12,450	1065 ft of conduit pipe placed on ground surface, and 4 - 20 ft segments from the sumps to the header
14	Misc. Electrical	ls	1	$10,000	$10,000	
15	Grout Ground Water Treatment System Trench at end of Projec	cu yd	820	$25	$20,500	18 ft deep, 3 ft wide, 1165 lf; assumes 35% void space
				Subtotal	***$570,632***	

Lake Water Removal System Inside of Containment

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
1	2 Pumps at 500 gpm w/ Operator to Initially Drain Bay	day	50	$7,840	$392,000	[$85/hr x 8 hrs + 127.50/hr x 16 hr + $1200/day pump] x 2; ~60,000,000 gal in Bay; 2 - 500gpm pumps = 1,440,000 gpd; added 8 add'l days for rain, gw, and lake water infiltration
2	Sump pumps variable discharge 10 to 100 gpm	ea	8	$4,500	$36,000	Dewater sediments
3	Collection/discharge piping, 12-in HDPE	lf	3280	$5.50	$18,040	Two collection pipes runs on land along Bay from the NW and NE corners of the Bay until reaching WWTP; Discharge pipe runs to the east to Lake Superior (east of the containment a
4	Connection to WWTP	ea	3	$2,000	$6,000	Two intake connections from each side of the Bay (West and East), one outgoing connection for treated water going to Lake Superior
5	Start-up Samples	ea	200	$200	$40,000	
6	Electrical Conduit	lf	1450	$10	$14,500	Runs on land along Bay to the west and east, connects up with the Ground Water Capture System conduit to the south
7	Connection to City Power Supply	ls	1	$20,000	$20,000	Connection and transformer
8	1 500 gpm Pump w/ Operator to Drain Bay 4 weeks each Spring	day	84	$3,920	$329,280	[$85/hr x 8 hrs + 127.50/hr x 16 hr + $1200/day pump] x 1; Assumes there will be 3 unworked winters between 4 working seasons
				Subtotal	***$855,820***	

Ground/Lake Water Treatment System

Item No.	Item	Unit	Quamtity	Unit Cost	Total	Notes
	Year 2 Startup					Start-up is for approximately 50 days in Year 2 and 28 days in subsequent years 3 and 4.
	Carbon Adsorber System (1500 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	2	$49,335	$98,670	
2	*Rental**	Months	6	$5,000	$30,000	*There is a three month minimum rental for each of the two units
3	*Rental Termination: carbon removal, demobilization*	ea	2	$41,935	$83,870	
4	Oil Water Separator and associated system (200 gpm) (purchas	ea	1	$30,000	$30,000	
5	Fuel and energy surcharge (estimated 8.65%)	ea	2	$10,490	$20,980	
6	Connecting piping, pumps, accessories	ea	1	$20,000	$20,000	
7	Operation and Maintenance (labor)	hours	900	$100	$90,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				***$373,520***	
	Year 2 During and After Startup					
	Carbon Adsorption System and Bag System for Filtration (200 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	1	$28,675	$28,675	
2	*Rental***	Months	6	$1,500	$9,000	**Six months for each units plus the first month that comes with the rental for a total of seven months use-time.
3	*Rental Termination:carbon removal,system disassembly,demob*	ea	1	$39,350	$39,350	
4	*Carbon Exchange Rate*	gallons	30000000	$0.067	$2,010,000	
5	*BF400 Four Bag Filter Skid*	Months	7	$4,000	$28,000	
6	*Filter Bags (5 micron rating) - Bag of 50*	Cases	8	$600	$4,800	
7	Fuel and energy surcharge (estimated 8.65%)	ea	1	$183,365	$183,365	
8	Dispose soil in filter bags (special waste)	tons	17	$60	$1,020	All filter bags will fill with fines and have to be disposed as special waste. Assumed average cost is $60/ton.
9	Oil Disposal	gallons	200	$3	$600	Oil from oil/water separator will be collected in a 55 gallon drum and disposed as necessary.
10	Operation and Maintenance (labor)	hours	2150	$100	$215,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				***$2,519,810***	
	Year 3, 4 Startup					Start-up is for approximately 50 days in Year 2 and 28 days in subsequent years 3 and 4.
	Carbon Adsorber System (1500 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	4	$49,335	$197,340	
2	*Monthly rental**	Months	12	$5,000	$60,000	*There is a three month minimum rental for each of the two units
3	*Rental Termination: carbon removal, demobilization*	ea	4	$41,935	$167,740	
4	Fuel and energy surcharge (estimated at 8.65%)	ea	2	$18,385	$36,769	
5	Operation and Maintenance (labor)	hours	1200	$100	$120,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				***$581,849***	
	Year 3, 4 During and After Startup					
	Carbon Adsorption System and Bag System for Filtration (200 gpm)					Assumes activated carbon of lake water sufficient to discharge water back into Lake Superior
1	*Rental Initiation: mobilization, set-up, carbon*	ea	2	$28,675	$57,350	
2	*Monthly rental***	Months	12	$1,500	$18,000	**Six months for each units plus the first month that comes with the rental for a total of seven months use-time.
3	*Rental Termination:carbon removal,system disassembly,de*	ea	2	$39,350	$78,700	
4	*Carbon Exchange Rate*	gallons	30000000	$0.067	$2,010,000	
5	*BF400 Four Bag Filter Skid*	Months	14	$4,000	$56,000	
6	*Filter Bags (5 micron rating) - Bag of 50*	Cases	16	$600	$9,600	
7	Fuel and energy surcharge (estimated 8.65%)	ea	2	$96,432	$192,865	
8	Dispose soil in filter bags (special waste)	tons	34	$60	$2,040	All filter bags will fill with fines and have to be disposed as special waste. Assumed average cost is $60/ton.
9	Oil Disposal	gallons	600	$3	$1,800	Oil from oil/water separator will be collected in a 55 gallon drum and disposed as necessary.
10	Operation and Maintenance (labor)	hours	4900	$100	$490,000	Two employees for 50 hours per week for operations and maintenance. Operations (including startup) are to be maintained for 7 months per year for 4 years.
	Subtotal				*$2,916,355*	
				Subtotal	***$6,391,534***	Total for 3 years

Subtotal, Water Removal and Treatment **$7,817,986**

Thermal Treatment		Unit	Quanitity	Unit Cost	Total	Notes
1	Thermal Treatment	ton	90018	$100	$9,001,800	Bid of $80/ton plus misc items $20/ton = $100/ton

Table F3-12. Alternative 5B: Dry Excavation of all Sediments > PRG, Thermal Treatment

Subtotal, Thermal Treatment **$9,001,800**

Sediment Transport and Disposal

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Load, Transport, Dispose Sediments	ton	64350	$46.80	$3,011,580	58,500 tons dry sediments x 10% increase to account for moisture remaining in the sediments = 64,350 tons
2	Disposal of NAPL offsite	gal	5000	$8	$40,000	Same units used in 1998 cost
3	Cut Perimeter Sheet Pile Wall and Dispose of Piling	sf	10720	$25	$268,000	Three sides of site; 4 ft x 2680 lf = 10,720 sq ft
4	Remove Asphalt Drainage Pad and Dispose	sq yd	4170	$10	$41,700	

Subtotal, Sediment Transport and Disposal **$3,361,280**

Miscellaneous

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Develop HASP	ls	1	$10,000	$10,000	
2	Health & Safety Personnel	wk	120	$1,440	$172,800	Once a week for duration of project; 3.8 years of work * 52 wks / yr * 7/12 (working 7 months of the year)
3	24 hr Security of Site	wk	200	$2,695	$539,000	$15/hr X 24 hr X 7 days + $25/day (expenses); 3.8 years of work * 52 wks / yr

Subtotal, Miscellaneous **$721,800**

Subtotal:	$52,457,608
Engineering @ 15%:	$7,868,641
Oversight @ 15%:	$7,868,641
Subtotal:	$68,194,891
Contingency @ 25%:	$13,114,402
TOTAL:	**$81,309,293**

Post-Construction

Item No.	Item	Unit	Quamtity	Unit Costs	Total	Notes
1	Monitoring	yr	30	$40,000	$1,200,000	Monitor locations with PRG for length determined by US EPA
2	Reporting	yr	30	$12,000	$360,000	Post-Closure Reporting
3	O&M	yr	30	$10,000	$300,000	

Subtotal, Post-Construction **$1,860,000**

Present worth @ 7% discount factor **$715,090**

GRAND TOTAL: **$82,024,383**

APPENDIX G

WAVE HEIGHT ANALYSIS

Appendix G - Wave Run-Up Analysis for CDF

A wave run-up analysis has been completed to determine the required height of the CDF wall such that wave overtopping is limited to a minimal amount. The design period for the analysis is a 100-year return period and the methods used provided in the U.S. Army Corps of Engineers Coastal Engineering Manual (CEM) and Automated Coastal Engineering Software (ACES). The analysis requires as input estimates of the 100-year wave height and period, 100-year still water level, and water depth and bottom slope.

The 100-year wave height and period have been determined as part of the Site Sediment Stability Assessment (URS 2007). In summary, a 24 year hourly wind record was used to estimate wave conditions at the Site using a wind-wave transformation that accounts for fetch, water depth wind speed and duration. The wave height and period determined form the transformation were then analyzed to determine wave heights and periods for 1 through 24 year return periods. Then the Generalized Extreme Value Distribution was fit to the return period data to estimate the 100-year event. The 100-year wave height and period were determined using this approach are 1.04 meters and 4 seconds.

The 100-year still-water elevation at the project site was taken from information published by the Federal Emergency Management Agency (FEMA) in Flood Insurance Rate Maps and Flood Insurance Studies for the area. The 100-year still-water elevation was reported as 604.5 feet NGVD.

The bottom slope in the vicinity of the proposed CDF wall was estimated from local bathymetry data collected as part of the SSA and the data is available in the SSA Report (reference). The water depth was estimated to be 6 feet, based on the 100-year still water elevation, local bathymetry and the proposed location of the CDF wall.

Two methodologies were used to estimate the top of wall elevation needed for the proposed seawall. The first methodology utilized a nomograph relating wall height and overtopping rate. The allowable overtopping rate was estimated using guidance provided in the CEM and is dependent on the land surface condition landward of the seawall. For vegetated or bare ground, the allowable overtopping rate was estimated as 0.005 m^3/s cubic meters per second (cms). If a concrete-paved or riprap apron (3-6” stone size at least four feet wide) is placed immediately landward of the seawall, the allowable overtopping rate was estimated to increase to 0.05 m^3/s cms.

For the estimated allowable overtopping rates above, the required top of seawall elevation was calculated using a nomograph solution from the CEM. The minimum top of seawall elevations for the vegetated and apron configurations were calculated as 608.9 and 606.2 feet NGVD, respectively. These elevations correspond to 4.4 feet and 1.7 feet respectively.

Reference

URS. 2007. Sediment Stability Assessment for the Ashland/Northern States Power Lakefront Superfund Site.

APPENDIX H

SUMMARY OF CAPPING PROJECTS

Summary of Contaminated Sediment Capping Projects

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
Puget Sound/Washington										
1	Duwamish Waterway Seattle, Washington (CAD)	Heavy metals, PCBs	Existing 6-ft. deep subaqueous depression; Waterway depth 70 ft.	3 ft. design target; 2 ft. actual average after consolidation (21)	Sand (4,000 cy)	1.3 acres estimated [(a)] 0.7 acre original cap size (21)	1984	• Functionally no erosion (a small amount of cap eroded from one side to another, but was then covered by natural sedimentation) (21) • No chemical migration observed in second and third coring operations (21) • Concentrations of heavy metals and PCBs were at least an order of magnitude lower in the sand cap than in contaminated material below (22) • The 18-month and 5-yr sediment chemistry sand-cap concentrations matched almost exactly (22) • Interface between contaminated and cap sediments was sharp and relatively unmixed (22)	• First capping project (a "learning experience") in EPA Region 10 • Led by the USACE with limited involvement from EPA (21) • Key lessons learned: relationship between contaminated sediment fill volumes, CAD cell size, and rate of CAD filling (21) • Split-hull dump barge placed sand over relocated sediments in CAD cell (A) • Maximum sustained bottom currents: 0.2 ft/sec (occasional readings in the upper water column approaching 1.0 ft/sec) (23)	A, E, F, 21, 22, 23
2	One Tree Island Olympia, Washington (CAD)	Heavy metals, PAHs	Marina; 14.8 ft. deep	4 ft. (in order to obtain a consolidated cap of 3 ft.) (21)	Sand Clean sediment (E)	0.5 acres	1987	• Applied lesson from Duwamish: allow contaminated material to consolidate on barge and then to settle in CAD cell (1 - 2 weeks) (21) • Little prop scour; recreational divers said that cap appeared to be intact (21) • No chemical migration (A) • No erosion of cap (A)	• First permitted CAD project (21) • Maintenance dredging of a marina; top 2-3 ft. of contaminated sediments were dredged and placed in "overbuilt" (or "very deep") CAD cell in marina (21) • No ongoing monitoring required (21) • Last monitoring occurred in 1989 and showed that sediment contaminants were contained (A)	A, C, E, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
3	St. Paul Waterway (Simpson Tacoma Kraft Superfund Site) Tacoma, Washington (ISC and habitat restoration)	Phenols, PAHs, dioxins, furans	Shallow, near shore sediments, 11.5 ft. deep Depth now is -20 ft. MLLW at extreme (21)	2-12 ft. 4.9-19.7 ft. actual (B, E) 3.9 ft. design (E) 3 - 13 or 14 ft. (36)	Coarse sand from Puyallup River	17 acres (11 acres of marine sediments capped; 6 acres of new intertidal habitat built along shoreline) (32)	1988	• Intensive monitoring conducted annually for 10 years (36) • Monitoring recently scaled back; cap will be checked every other year to ensure that it is still in place and that the elevation has not changed substantially; cap will be checked after any major storm or earthquake (36) • Everything is working fine; no chemical migration; cap still within specifications (A,21,36) • PRP won environmental award for habitat creation (21) • > 10 years of chemical and biological monitoring show contaminated sediments have remained confined and isolated beneath cap and cap is providing good habitat for estuarine biota (32) • St. Paul Waterway was delisted from the NPL on 10/29/96 (32)	• First designed and permitted capping project under Superfund regulatory process (21) • Some redistribution of cap materials occurred, but overall design level met (36) • C.californieus (typical deep burrowers that can cause bioturbation) found in sediments, but never at depths >1 m (3.3 ft.) (A); bioturbation would have been limited (21)	A, B, C, E, 21, 32, 36
4	Pier 51 Ferry Terminal Elliott Bay Seattle, Washington (ISC)	Mercury, heavy metals, PAHs, PCBs, PCDF	Docks at 20-25 ft. 60 to 100 ft. (at approx. 150 ft. from shore)	Docks: 4 ft. design (to achieve 3 ft. consoli-dation) (at water depths of approx. 35 ft. Rest of Site: 1.5 - 2 ft. design (to achieve 1 ft. consolidated)	Coarse sand	4 acres (2 acres with thick cap; 2 acres with thinner cap)	1989	• No chemical migration (A) • Cap within specifications (A) • Recolonization observed (A) • As recent as 1994, cap thickness remained within design specifications (A) • While benthic infauna have recolonized the cap, there is no indication of cap breach due to bioturbation (A) • For 1 or 2 years, the thinner cap was not as clean as the original cap, possibly due to mixing; the thicker cap remained clean (21) • No ongoing monitoring required (21) • Caps worked very well (21)	• Project was primarily an experiment to see if ferries would blow the cap away (hence thicker cap employed at the ferry area) (21) • During reconstruction of ferry terminal, a piling was pulled up, recontaminating the cap with creosote - cap was repaired (21) • Cap was recontaminated in top ~2cm with metals; fate and transport study demonstrated that ferry terminal was at nexus of two gyres (from north and south); this knowledge partially dictated subsequent cleanup efforts (21)	A, E, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
5	Denny Way CSO Elliott Bay Seattle, Washington (ISC)	Heavy metals, PAHs, PCBs	Water depth 18-50 ft.	2-3 ft.	Sand Sandy sediment from Duwamish Waterway	3 acres	1990	• 1994 cores showed recontamination in cap surface, but no migration of chemicals through cap (A) • Recontamination likely from CSO (21)	• CSO once discharged primary sewage; now discharges storm water and wastewater from some wastewater treatment plants (21) • An original project goal was to study rate of recontamination at cap surface using a mass balance approach; found not to be possible (21)	A, B, C, E, 21
6	Piers 53-55 CSO Seattle, Washington (ISC)	Heavy metals, PAHs, PCBs	Similar to those at Pier 51 (21)	1.3-2.6 ft. (A) Similar to those at Pier 51 (21)	Sand Material from Duwamish Waterway (E)	4.5 acres	1992	• No chemical migration • Cap stable, and increased by 15 cm (6 in.) of new deposition • Gyre caused sediments to erode from cap, but remaining cap seemed stable (although materials were spread around a lot) (21) • Accretion zone (21) • Difficult to discern volumes from consolidation vs. erosion (21) • Infaunal communities returned changed; much more shading after cap placement (21)	• Material sprayed under existing piers to form cap (21) • Pre-cap infaunal communities were destroyed in the rapid burial associated with cap construction (A) • Constituents from adjacent sediment site have been deposited in cap surface (E) • The amount of sediment accumulation was not anticipated; the ferry terminal creates a quiescent area, causing sediment dropout (21)	A, E, 21
7	Pier 64 Seattle, Washington (ISC)	Heavy metals, PAHs, phthalates, dibenzofuran	Water depth 20-59 ft.	0.5-1.5 ft.	Sand	32.1 acres (E) 4 acres (NN)	1994	• Some loss of cap thickness in western portion; reasons unclear (erosion or consolidation/settling) • Reduction in surface chemical concentrations noted • Post capping water column monitoring showed concentrations of metals and organics to be below pre-capping concentrations (NN)	• Thin-layer capping used to enhance natural recovery and reduce resuspension of contaminants during pile driving (A) • A pier expansion project; old creosote-covered wood pilings replaced with concrete pilings, which are further spaced, allowing more light and more habitat (although still have issues with shading) (21) • Capping placed under and in front of pilings (21)	A, E, NN, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
8	GP Log Pond Whatcom Waterway Bellingham, Washington (ISC and beneficial habitat creation)	Mercury, phenols	Conversion of deep subtidal, shallow subtidal mudflat/debris and low intertidal riprap ; -5 ft MLLW (31)	Phase 1: 0.5 to 3 ft. Phase 2: 0 - 6 ft. Total: 0.5-10 ft. (31)	Phase 1: Coarser sand dredged material Phase 2: Finer-grained navigational dredge material (31)	5.6 acres (31)	Nov. 2000 to Feb. 2001 (31)	• No chemical migration at 3 months (A) • Cap successfully placed (A, 31)	• Interim Remedial Action under authority of State Model Toxics Control Act • Cap surface constructed using substrates and elevations to create beneficial use habitat • Full sediment removal was not practical because: (1) dredging with high amounts of debris would cause significant impacts to the water column, (2) dredging could have compromised integrity of containment structures (nearshore fill) for other hazardous substances, and (3) existing docks, dolphins, and shoreline structure present within or adjacent to the Log Pond would likely have been adversely impacted by a full removal action (31)	A, M, 21, 31

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
9	East Eagle Harbor/Wyckoff Bainbridge Island, Washington (ISC and intertidal habitat creation)	PAHs (36)	Phase I: contaminated subtidal harbor sediments capped Phase II: contaminated nearshore sediments capped Water depths 0-45 ft. (36)	Phase I: 3 ft. (36) Phase II: 3 ft. (36)	Phase I: Clean river sediment (275,000 cy) Phase II: Upland fill (clean sand) (120,000 cy) (28) Phase III: upland fill (80,000 cy) (36)	Phase I: 54.4 acres (E) Phase II: 15 acres (36) Phase III cap on Phase II area (slightly smaller footprint) (36)	Phase I: 1993-1994 Phase II: 2000-2001 Phase III: 2001-2002	• No chemical migration • Cap erosion measured within first year of monitoring in area near heavily used Washington ferry dock • After Phase I cap placement, pools of creosote were observed at cap edges; pools likely migrated from Phase II/III area, which was not contained at the time; divers extracted the pools regularly (36) • Ongoing monitoring planned for another 10 years; then, more monitoring likely (36) • Ongoing releases from ferry parking lot and other upland sources (36) • Cap is working very well; monitoring shows that cap is staying in place and is preventing chemical migration; the agency is very happy with the cap (36) • NOAA study documented rapid and substantial increase in quality of habitat (36)	• Phase I objective: reduce immediate risk (28) • Additional remediation delayed until upland source control achieved (the fall 2000 installation of sheet pile wall) (28) • Phase II objective: extend cap from 1994 cap's approx. 2-ft. thickness contour (about 900 ft. offshore) to northern shoreline of Wyckoff facility (and to coordinate with construction of new intertidal habitat area on western portion of site) (28) • Phase III objective: place 80,000 cy clean sediment to build an intertidal area connecting Phase II area to north shoal (28) and to add more confinement material to the cap (36) • Just finished placing the Phase III material in mid-February 2002 (36) • There is now a huge area that provides intertidal habitat for endangered species (36)	A, B, D, E, 28, 36
10	West Eagle Harbor/Wyckoff Bainbridge Island, Washington (ISC)	Mercury, PAHs	Water depth 0-45 ft.	Thin cap (0.5 ft.) over 6 acres Thick cap (3 ft.) over 0.6 acres	Quarry sand (22,600 tons for thin cap and 7,400 tons for thick cap)	6.6 acres	Partial dredge and cap 1997	• No chemical migration • Post-implementation surveys identified 16 discrete cap areas lacking in minimum thickness, so another 1,000 cy added (NN) (EPA will check this statement)	• To date, post-verification surface sediment samples have met the cleanup criteria established for the project • Ongoing monitoring • Cap has achieved its intended function and is doing well (36)	A, NN, 36

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
11	Middle Waterway Commencement Bay Nearshore/Tideflats Superfund Site (CB/NT SS) Tacoma, Washington	Mercury, PAHs, PCBs (21)	Original shoreline and mudflats; completely intertidal; high tide depths: about 13-15 ft. where capped (21)	2-3 ft. (related to habitat design) (21)	To be determined (48)	3.95 acres of thin layer cap and 0.24 acres with 3 ft. cap (per draft 8/01 document) (30)	Scheduled for early 2003		• April 1997 Consent Order • The project just entered the "Remedial Design Phase", a significant portion of which will involve capping (21) • A few portions will be dredged because of navigation requirements (21) • Remedy includes dredging with near-shore-confined disposal, monitored natural recovery, thin-layer capping and thick capping (30)	GG, 21, 30, 48
12	Thea Foss Waterway CB/NT SS Tacoma, Washington	PAHs, phthalate esters, trace metals, PCBs (46), dioxins (21)	8000-ft. waterway; depth is about 15 ft. now; depth in main channel may be restored to 20-25 ft.	3 ft. for thick caps (50) possibly 0.5 to 1 ft. for thin caps	To be determined	Approx. 20 acres (46, 50)	To be constructed (EPA's selected remedy)	• The in-situ cap will be thick enough to contain and isolate contaminated sediments in situ from the overlying water column and habitat, and will be thick enough to resist erosion from vessel scour, wave action, or penetration by burrowing organisms (46) • 100% design expected to be complete in March 2002 (50)	• 1994 EPA Consent Decree with City of Tacoma • Project focus is not on habitat, although benefits to endangered species habitat will be considered (21); 14 acres of intertidal habitat are proposed (46) • A portion of each of the project's 8 sediment management areas (SMAs) will be thick-capped; the SMA at the head of the waterway will also employ sorbent capping to control oil seepage (46) • Enhanced natural recovery to be used at mouth of waterway (50) • Majority of sediments in navigation channel will be dredged (50)	21, 46, 50

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
13	Olympic View Resource Area CB/NT SS Tacoma, Washington	Dioxin	Intertidal area with a small subtidal area; water depth is -15 ft. MLLW	4 ft.	Erosion protection layer over 43 in. clean sand over geotextile barrier over 6 in. TOC material	1.0 to 1.6 acres	Construc-tion began in June 2002		• Approved non-time critical removal action (no ROD) • Highest dioxin concentrations in area • Site covers 12 acres, but 2.2 acres (review with EPA) will be remediated • Approximately 51,000 sq.ft. will be excavated down 1.1 ft and backfilled with clean material. The other portion (1.0 acres or 68,290 sq. ft.) will be capped (review with EPA)	10
14	General Metals of Tacoma Hylebos Waterway CB/NT SS Tacoma, Washington (ISC)	Metals, PAHs		3 ft.	Sand, gravel, geotextile liner	800 feet along shoreline under piers	Late 1990s	• Recent monitoring indicates that cap is functioning as designed	• Capping conducted in conjunction with repair work on dock/bulkhead structure by General Metals • Capping selected because dredging presented concerns about undermining dock structural integrity	49
15	Occidental Chemical Removal Action Hylebos Waterway CB/NT SS Tacoma, Washington (trial cap)								• Message left with EPA Region 10	49
16	Asarco Sediments/ Groundwater Operable Unit 06 CB/NT SS Tacoma, Washington (pilot)	Arsenic, lead, copper	Near old smelter site	30 cm and 60 cm (side by side)	Clean river sediments			• Pilot cap was very successful	• Pilot study was conducted to determine if cap would remain in place and become recolonized with healthy biological communities	51

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
17	Asarco Sediments/Ground water Operable Unit 06 CB/NT SS Tacoma, Washington (full-scale)	Arsenic, lead, copper	Near old smelter site; cap will be 0 - 60 ft. deep	3 ft.	To be determined	18 acres	To be constructed (ROD signed in July 2000)		• Entire yacht basin will be dredged (about 20 acres) • Offshore contaminated sediments will be capped • Draft 30% design completed • Cap will integrate into armored shoreline (2/3 of armor has been placed) • Entire peninsula created by pouring arsenic-containing slag into the water, (slag is 100 feet thick in places); dredge volumes would have been too great so it was determined to isolate contaminants from benthic organisms by using a 3-foot-thick cap	51
18	Lockheed Shipyard Duwamish River/Elliott Bay Seattle, Washington	Primarily arsenic, lead, mercury, zinc, copper; some PCBs and PAHs	Navigable river; major salmon route; water depth ~ 20 ft.	2 ft. minimum (ROD) 3.5 ft. currently under consideration	To be determined	Approx. 15 acre (based on 3.5 ft. cap and 85,210 cy of cap material)	Possible pier removal this winter; dredging and capping may begin in the fall or winter of 2003		• A huge pier will be removed; that area will be dredged and then capped to prevent contaminant migration and to improve aquatic habitat • Area beyond current pier will be dredged but not capped • Design has not been finalized • Capping is part of remedy per ROD	58
19	Todd Shipyard Duwamish River/Elliott Bay Seattle, Washington	Primarily arsenic, lead, mercury, zinc, copper, TBT; some PCBs, PAHs	Navigable river; major salmon route; very steep slopes (drops from 30 to 50 depths rapidly)	To be determined	To be determined	To be determined	Dredging and capping may begin in the fall or winter of 2003		• A more involved project than Lockheed; this is still a working shipyard and site has steep slopes • Design has not been finalized • Capping is part of remedy per ROD	58

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
20	Puget Sound Naval Shipyard Bremerton, Washington (CAD)	PCBs, mercury (48)	Depth varies; approx. 30 ft. at CAD (48)	Approx. 1 ft. (interim cap) and approx. 3 ft. (second cap), for total of 4 ft. before consolidation (48)	CAD cap: clean dredged material from turning basin (48)	CAD: approx. 10 acres (48)	Dredging completed in June 2000 Final CAD cap placed in Sept. or Oct. 2001 (48)	• Pit CAD sized properly (deep and wide) but experienced some "slop" (2-3 cm extending 20-50 ft. out) (21) • Key lesson learned: awareness of differences between "production" project and "environmental" project; apparently the project experienced bucket overfilling, overdredging, and underdredging, possibly causing problems with water quality (turbidity) (X) • The project went very well (48) • Monitoring plan is being developed now (48)	• Project involved dredging of channel and turning basin, and pier extension and reconstruction • Remedy included dredging, on-site disposal in CAD, thick and thin-layer capping, and natural recovery (29, 48) • Project unique because of significant volume of contaminated sediment (>390,000 cy), tight schedule, significant daily tidal exchange, water depth and CAD pit volume constraint (required precision dredging) (X)	X, 21, 29, 48
21	Pacific Sound Resources Seattle, Washington	PAHs, mercury, PCBs (33)	Old creosote plant located at mouth of Duwamish River; intertidal area to depths >240 ft. (33)	5 ft. in intertidal areas to -10 ft. MLLW (33) Other areas: to be determined (33)	Navigational dredged material or upland borrow intended (33)	Capping selected for 50-65 acres in remedial design (33)	ROD signed; pre-work (e.g., pilings removal, small dredge area) likely in 2003; capping possibly in 2003	• Approximately 20 acres of cap are on an 18-21% slope (33) • Cap likely designed to require repair after a significant earthquake (33)	• Remedy is mostly capping • In navigation channel, a depression to the lone dock (at area near former plant outfall) will be dug; those spoils will be consolidated onshore (21) • A beach will be built, with 5 ft. cap to tie into shoreline structure and habitat and to sequester contamination; thinner cap (6 inches) may be used away from shore (21)	21, 33
California, Oregon, and other Western States										

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
22	Port of Los Angeles Shallow Water Habitat (PSWH) Los Angeles, California (CAD and habitat creation) (the “Pier 400 project”)	Heavy metals (esp. copper), PAHs, DDT, PCBs; a "historic soup"; large storm drain discharges to the area (38)	Bay not used for navigation; depth reduced from 40 ft. to 15 ft. to create habitat	15 ft.	13 ft. clean harbor material; 2 ft. clean sand (latter was habitat-driven)	94 acre CAD (FF) within 192-acre site	1995	• Project performance fine to date (27, 37, 38) • Recent discussions about possible expansion (27); expansion does include capping of any other contaminated sediments, but rather entails creation of 54 more acres of habitat (38) • No long term monitoring required (38) • 1993/94 monitoring showed that the cap was still in place (38)	• Overall effective cap was >15’. The thick cap was a result of site geometry and dredging volumes and was not required to prevent contaminant migration (FF, 38) • First CAD project in California for contaminated sediments (27) • A perimeter subaqueous berm was placed prior to placement of 5 million cy of contaminated sediments (27) • Provides habitat for endangered species (California lease tern) (27, 38) • Cap covered a designated "hot spot" (38)	A, FF, 27, 37, 38
23	Port of Los Angeles Shallow Water Habitat (PSWH) Los Angeles, California (pilot CAD)	Lead, zinc, copper		12 ft. (OO)	Sand cap over 44 geotextile containers filled with contaminated sediments	est. 10 acres[(b)]	Dredging from Nov. 10, 1994 to Dec. 18, 1994		• 66,000 cy contaminated maintenance dredged material from Marina del Rey and Ballona Flood Control channels were placed in geotubes	O, FF, OO, 27

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
24	Convair Lagoon San Diego Bay San Diego, California (ISC with foraging habitat creation)	PCBs	Water depth 10-18 ft. 10-acre site	2 ft. sand over 1 ft. rock	Sand over crushed rock and geogrid	5.7 acres	Oct. 1996 to mid-1998	• No chemical migration • Cap successfully placed in very shallow water • Some chemicals observed in cap • Could expect to see some chemicals in cap because of high energy environment (similar to Elliott Bay experiences) (27)	• State-ordered remediation of PCBs (27) • Ongoing monitoring for 20 to 50 years (includes diver inspection, cap coring, biological monitoring) • Designed to withstand a significant seismic event • 4 acres by shore and outfall had high localized concentrations of PCBs, so agency did not want to dredge, but instead required a cap (thin enough to preserve salt water habitat but thick enough to withstand high energy environment) • EPA wanted geotextile layer to stop burrowing shrimp; somehow, geogrid was installed instead (27) • Some disagreement on PCB action level between agencies; EPA convinced project team to cap greater area with clean sand (27)	A, E, 27

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
25	North Energy Island Borrow Pit Capping Pilot Study Long Beach Harbor, California (pilot CAD)	DDT, metals, PAHs, others (47)	Borrow pit created as result of construction of energy islands (47) Flat pit bottom, 52 to 66 ft. deep 0.5 mile offshore of Long Beach (47)	3 ft. minimum required (47) 4.9 ft. max. (47)	Clean silty sand dredged from entrance to Long Beach Harbor (47) 100,000 cy of contaminated sediment from the LA River estuary were deposited (37) in one segment of the pit that was already segmented by berms from a water line (47)	9.9 acres (47) Entire Pit: 220 acres approx. [c]	disposal in Aug. 2001 (47) cap construction completed in Dec. 2001 2-3 more years to study the pilot CAD cell (37, 47)	• Construction phase report expected in March • Pilot CAD cell to be closely studied (e.g., coring, benthic, bathymetry) over next 2-3 years • One of the biggest questions is the degree of bioturbation that will occur (37) • Fine silts in the pit bottom and clays consolidated very quickly, making it difficult to account for all material (47) • Monitoring plan is being developed now (47)	• The LA Contaminated Sediments Task Force is evaluating several contaminated sediment disposal options for the region, including use of CAD cells; no judgement has been made to date and will not for at least another 2-3 years (37, 47) • USACE is performing an EIS for this 1st multi-user CAD site, which will cap up to 7 million cy of contaminated sediments with clean sediment; several engineering issues being considered (e.g., separate cells vs. layering of project sediments); several other issues being considered (contaminant limits, maximum duration of exposure) (27) • One pilot study was conducted that pertained to capping; other pilot studies were conducted that address other engineering topics (47)	P, 27, 37, 47

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
26	Palos Verdes Shelf San Pedro, California (pilot ISC)	DDT and PCBs	17-sq.mi. continental shelf and slope (34)	Cell LU: 15-45 cm Cell LD: <10 cm Cell SU: 15 cm	Clean sediments (two types)	135 acres (made up of three 300 x 600 m areas)	Aug. 2, 2000 to Sept. 14, 2000	Preliminary Results (Ref. H): • Disturbance of contaminated sediments was relatively localized and decreased substantially after the initial load was placed • Sediment plumes caused by capping did not pose a risk to near shore kelp beds • Spreading was less disruptive than conventional placement • There were no indications of mass sediment movement (such as mud waves or turbidity flows) as a result of capping • The pilot study went well; all indications show cap was successfully placed; monitoring continues, and indicates possible transport of contaminated sediments to cap from uncapped areas; more coring will be conducted to study this (34)	• The final report for study may be issued in March, 2002 (34) • 9/28/01 Action Memorandum (Ref. I) proposes establishing institutional controls (outreach & education, monitoring and enforcement) associated with consumption of contaminated fish • EPA continues to evaluate in-situ capping and other remedies and may issue proposed alternatives by year-end, 2002 (34)	G, H, I, 34
27	McCormick and Baxter Old Mormon Slough Stockton, California	Dioxins, PAHs	Dead-end waterway; 10 ft. deep; maintenance-dredged for barge access; tidally influenced	2 ft.	Sand	8.8 acres	Construction may begin in 2002 (35)		• ROD signed 4/99 • Capping selected because site is at the end of a dead-end slough, so cap is unlikely to wash away (35)	AA, 35
28	McCormick and Baxter Willamette River Portland, Oregon (ISC)	Heavy metals, PAHs	15 acres of near shore sediments and soils; depths to 35 ft.	3 ft.	Sand	15 acres (S) Cap may take 17 to 22 acres, depending on how thickness will vary (21)	Aiming for construction in 2004 (21)		• Long-term monitoring, OMMP, and institutional controls were also specified (A) • Cap being redesigned now (recently decided to install a piling wall around upland site to contain NAPL on site, thereby preserving treatment options in the future -waiting to see how Eagle Harbor wall performs) (21) • Habitat will be considered, particularly for juvenile salmon (21)	A, E, S, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
29	Ross Island Lagoon/ Port of Portland Portland Oregon (CAD)	Metals, TBT, PAHs, PCBs (41); some COCs more prevalent in certain cells (57)	lagoon; no significant current (57); first CAD cell depth: ~80 ft.; other CAD cell depths: 0-30 ft. (57)	1 ft. (41) 1 ft. minimum for Cells 1-4; 2 to 10+ ft. for Cell 5 (61) Some discussion in late 1990s about increasing cap thickness; details not provided (57)	Fine-grained material derived from on-site sand and gravel washing and processing operations (39) Material from Ross Island rock crushing settling pond (61)	8.4 acres[d]	Dredging from 1992 to 1998 Cell 5 was first to be constructed	• OR DEQ accepted a Dec. 2000 study showing that contaminated sediments from Port facilities in capped disposal areas do not pose a threat to human health or the environment (40) • CAD cells are working well; model developed from data predicts no exceedances of any water quality criteria in the next 500 years (57) • A barge tipped over in 1998; the spilled material was covered with a 1-ft cap; a portion of the Cell 5 cap was breached and repaired in 1998 (57, 61)	• In five Port dredging events from 1992 to 1998, ~160,000 cy of dredged material were transported to the lagoon for permitted confined disposal; RIS&G accepted, placed and capped the in-water containment cells (39) • 4 cells accepted material from navigational dredging; 1 cell accepted material from the Port of Portland's Pencil Pitch spill (57) • Some discussion about lowering dike between two islands; current hydrology study is studying possible effects on cap integrity (57)	D, T, 39, 40, 41, 57, 61
30	Inlet Basin Soda Lake, Wyoming (case study)	PAHs, benzene, metals, NAPL	Natural playa basin, 2-12 ft. deep; recharges each year by runoff and dries later in the year (H)	1.5 ft.	Native sand	5.6 acres	Before June 15, 2000 and Aug. 31, 2000	• After 3 months, the upper 2 feet of cap contained no organic contaminants in excess of screening levels • Short-term effects from cap placement were minimal • Long-term integrity also evaluated	• The Draft Final Remedy Decision dated Oct. 29. 2001 does not propose capping, but instead proposes excavation • The WY DEQ concluded that the best alternative would be to excavate the sludge and place it in a lined corrective action management unit. Capping was not implemented. (17)	H, L, 17
Great Lakes										
31	Upper River section Sheboygan River, Wisconsin (pilot)	PCBs	9 hotspots totaling 1,200 sq. yds.	1 ft. of coarse material and upper geotextile over lower geotextile fabric	Armored stone composite	0.25 acre	1989-1990	• No monitoring data • Cap appears to be intact with significant silting-over and thus additional stabilization • Undetermined cap effectiveness • Some erosion of fine-grained material	• Composite armored cap required because of location in high-energy river environment. Gabions placed at corners for anchoring. Additional course material placed in voids and gaps. • A 1990 bench-scale armoring study by Enseco, Inc. indicated that capping had a significant effect on reducing PCB concentration measured in exposed aquatic organisms (E).	A, E, D

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
32	Areas C and D Manistique, Michigan	PCBs		2.7 ft.	Composite	17 acres	Planned, but not implemented (site remediation was dredging)	• Project not built	• Composite cap over a 17-acre site includes armoring and geotextiles	A
33	Manistique Capping Project Michigan (ISC)	PCBs	Shoal in river with depths of 10-15 ft.	40-mil (0.1 ft.)	HDPE	0.6 acre	1993	• Physical inspection of temporary cap approximately 1 year after installation showed cap to be physically intact with most anchors in place	• A 240 ft. by 100 ft. HDPE temporary cap was anchored by 38 2-ton concrete blocks placed around the perimeter of the cap • This temporary cap was installed to prevent erosion of contaminated sediments within a river hotspot with elevated surface concentrations	A, B
34	Hamilton Harbor Ontario, Canada (ISC demonstration)	PAHs, metals, nutrients	Lacustrine waterbody	1.6 ft.	Clean sand	2.5 acres	1995	• Significant reductions in the flux of site contaminants were observed after capping (D)	• Capping selected because of impracticality of dredging and upland disposal due to large sediment volumes (E)	A, B, D, E
35	Madison Metropolitan Sewerage District Lagoons Madison, Wisconsin	PCB (greater than 50 mg/kg)	2 sludge lagoons in wetlands 141-acre site	1 ft.	Geotextile and lightweight soils			• Planned in ROD	• According to the ROD (dated March 31, 1997), the final site remedy includes the segregation and in-situ containment of sludge with PCBs > 50 mg/kg. The soil will be seeded.	E
36	Oxbow Lake near Rib River Wausau, Wisconsin (ISC) (“Snow Cap” project)	Lead	Shallow, 4-acre oxbow lake at former battery reclaiming site; important breeding habitat for small fish		4-layer composite cap (geotextile and sand blanket, w/ 2nd layer of geotextile and rock “islands”); then snow		Winter, 1997, to take advantage of snow and ice	• Data from 5 locations during Mar. 1999 found current lead concentrations in the water column to be at background or non-detect levels • Benthic organism populations noted in shallow water; vegetation becoming established on the new substrate	• This new method cost significantly less than “conventional (and environmentally invasive) sediment dredging in terms of both funding and time resources” • The technique offers the advantage of providing a safe habitat for existing fish populations • The approach costs one-third the cost to remove sediments	V

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
37	Ottawa River Toledo, Ohio (ISC Demonstration)	PCBs	0.2 mile stretch; estuary with low flows; 8 ft. deep	0.33 to 0.66 ft.	AquaBlok™ (clay-mineral aggregate), with or without geotextile	2.5 acres	1999	• Monitoring results limited (E) • Ohio EPA completed a benthic community study before AquaBlok™ application and found the site to be sterile; there are plans to conduct a follow-up study in 2001, but improvements may not be seen because of ongoing contamination from a nearby Superfund site (45)	• The goal of the demonstration was to assess application methods, not necessarily provide permanent remediation (45) • The Ottawa River has a 100-year flow velocity of 4.8 ft/sec for approx. 1 hour. Flume tests of similar AquaBlok ™ compositions withstood water velocities of 6 ft/sec for 50 hours with an approximate 10% loss. (45)	E, 45
38	Triangle Pond Tommy Thompson Park Downsview, Ontario	Lead, iron, oil & grease	Man-made water body in park	1.6-9.8 ft. design 6.6-13.1 ft. actual	Clean sand and fill	2 acres	1999			C, O, U
New England/New York										
39	Stamford-New Haven-N New Haven, Connecticut (Central Long Island Sound (CLIS) area)	Metals, PAHs	Flat bottom ~65 ft. deep	1.6 ft. (A) Up to 7-10 ft. (F)	Sand		1978	• No chemical migration • 11 years of monitoring show this to be one of the most stable mounds	• Cores collected in 1990 • Contaminated sediment from Stamford Harbor was capped with slightly less contaminated material from New Haven Harbor (FF)	A, F, FF
40	Stamford-New Haven-S New Haven, Connecticut (CLIS area)	Metals, PAHs	Flat bottom ~70 ft. deep	1.6 ft. (A) Up to 13 ft. (F)	Silt		1978	• No chemical migration • 11 years of monitoring show this to be one of the most stable mounds	• Cores collected in 1990 • Contaminated sediment from Stamford Harbor was capped with slightly less contaminated material from New Haven Harbor (FF)	A, F, FF

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
41	New York Mud Dump Disposal Site (a.k.a. "New York Bight" or "Long Island Bight")	Metals in silt and clay dredged from 6 projects in NY Harbor (E)	Flat bottom 80-90 ft. deep (F)	3-4 ft. avg. 5-9 ft. max.(F)	Mud (120,300 cy) Sand (1,200,700 cy) (E)		1980	• No chemical migration	• Cores taken in 1993 (3.5 years later) showed cap integrity over relocated sediments in 80 ft. of water (A) • Simultaneous with the Mud Dump Site closure, the site and vicinity will be redesignated as the Historic Area Remediation Site (HARS) • A portion of HARS will be remediated, with approximately 1 m of capped clean dredged material (E)	A, E, W
42	New York Mud Dump Capping Project New York, New York (CAD)	Trace dioxin	Open water sediment disposal site (500,000 cy)	3.2 ft.	Clean sand		1993-1994	• Long-term monitoring being conducted • Engineering of cap construction considered a success		D
43	Historic Area Remediation Site (HARS) (former Mud Dump region)	PAHs, PCBs, DDT, dioxin, metals	HARS is 15 sq. nautical miles; water depths: 40 - 138 ft.	3.2 ft.	Relatively clean dredged sediments	9.0 square nautical miles (7638 acres)	To be constructed		Required under proposed rule in 40 CFR 228	LL, MM
44	Mill-Quinnipiac River (MQR) Connecticut (CLIS area)	Metals, PAHs	Flat bottom ~65 ft. deep	1.6 ft. (A) 6-10 ft. avg. (F) 4.9 ft. as of 8/91 (PP) 9.8 ft. as of 9/93 (RR, SS)	Silt	10.7[(e)]	1981-1982 1982-1983 1993-1994 (SS)	• Due to slow, retrograde recolonization rates, cores were collected in 1991 -showed presence of PAHs in the cap (PP) • One year later, benthic improvements were noted (QQ) • In Sept. 1993, more cap material was placed. July 1994 monitoring showed that the mound height had increased by another 1.5 m, the diameter had not changed, and recolonization rates met or exceeded the targeted rates (RR) • Small to moderate pockets of consolidation near the apex and SW flank were noted (SS)	• PAHs were not included in the protocols in 1982 when the first cap was placed. (PAHs were included in the protocol starting in 1989).	A, F, PP, QQ, RR, SS
45	Norwalk, Connecticut (CLIS area)	Metals, PAHs	Flat bottom ~65 ft. deep	1.6 ft. (A) up to 6-7 ft. (F)	Silt		1981	• No problems	• Routine monitoring	A, F

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
46	Central Long Island Sound Disposal Site (CLIS) Long Island, New York	PCBs metals, oil & grease	Multiple sediment disposal mounds	20 -41 cm (A) 0.5 - 3 ft. typical (PP, QQ, RR, SS)	Course sand and shell fragments	Varies	1979-1983 (A) Continued well into the 1990s (SS) and probably still active	• Some cores show uniform structure with low-level chemicals and others show no chemical migration • Some slumping noted (A) • As of 1996, no evidence of particle re-suspension or cap erosion; stable benthic communities over the majority of stations sampled; effects of seasonal hypoxia recognized at other stations (SS)	• Extensive coring study at multiple mounds showed cap stable at many locations • Poor recolonization in many areas • Most cap elevation changes due to consolidation, not erosion • Early 1990 coring results indicate that the cap layers continue to isolate contaminants from water column (B)	A, E, PP, QQ, RR, SS
47	Cap Site 1 Connecticut (CLIS area)	Metals, PAHs	Generally flat ~60 ft. deep	1.6 ft.	Silt		1983	• No chemical migration	• Cores collected in 1990	A, F
48	Cap Site 2 Connecticut (CLIS area)	Metals, PAHs	Generally flat ~56 ft. deep	1.6 ft. (A) 0.6-4.5 ft. (F)	Sand		1983	• Required additional cap • One of the more successful mounds	• Cores collected in 1990	A, F, FF
49	Experimental Mud Dam New York (CAD)	Metals, PAHs		3.3 ft.	Sand		1983	• No chemical migration; minor cap erosion (FF)	• Cores collected in 1990	A, FF

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
50	New Haven Harbor New Haven, Connecticut NHAV 93 (CLIS area)	Metals, PAHs	Generally flat 60 ft. deep; part of a large-scale CAD project	1.6 ft. (A) 1.6 - 3.2 ft. (TT)	Silt	50.0 acres (UDM deposit itself) and 70 - 124 acres (total mound) (estimated from Ref. TT)	1993-1994	• No chemical migration (A) • July 1994 monitoring noted no major topographic changes and maintenance of minimum required thickness of 0.5 m (average thickness was 0.75 m along margins of the UDM deposit, and 1.25 m at center (RR) • Target recolonization rates were met or exceeded in most areas, except for three; Sept. 1994 tests demonstrated that cap supplementation was not required (RR) • Aug. 1995-Sept. 1995 monitoring showed moderate amounts of consolidation (0.25 m over most of cap, and 0.5 m near center); 1996 monitoring noted 0.25 to 0.75 m of consolidation over majority of mound with little change in size or shape, and that benthic community continued to recover (SS)	• From 1984 to 1992, contaminated sediments were disposed in 7 separate mounds that were located to form a ring (UU) • In 1993, sediments from New Haven Harbor and five private marinas were placed in the middle of the ring and later capped. Significant consolidation was noted before capping took place(TT) • Capping was completed by Mar. 1994 (RR)	A, FF, RR, SS, TT, UU
51	CLIS 94 Mound CLIS Area			1.6 to 3.2 ft.	Dredged material	43 acres[f]	Jan. 1995 to May 1995 (UU)	• Sept. 1995 monitoring showed good benthic recovery despite added stress of seasonal hypoxia and recent impact of disposal (UU) • July 1996 monitoring showed continued benthic recovery, higher dissolved oxygen and several pockets of consolidation at apex (0.25 to 0.5 m) (SS)	• This mound forms the beginning of the second placement ring which will eventually become a CAD • This mound completely envelopes the CS-90-1 mound (UU)	SS, UU
52	CLIS 95 Mound CLIS Area		Small, capped, dredged disposal mound	5.2 ft. (estimated from volume and area) (SS)	Dredged material	7.8 acres[g]	Sept. 1, 1995 (SS)	• Rapid recolonization of sediments observed (SS)	• Slightly irregular shape, due to bottom slope and distribution of capping material (SS) • The CDM:UDM ratio is 3.1:1.0 (SS)	SS
53	Port Newark/Elizabeth Project New York	Metals, PAHs, low levels of dioxin (FF)		5.3 ft. 1 m design(FF)	Sand	198[b]	1993	• No chemical migration	• Extensive coring study	A, FF

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
54	52 Smaller Projects New England	Metals, PAHs		1.6 ft.	Silt		1980-1995	• No chemical migration	• Routine monitoring	A
55	New London Disposal Site, Thames River, Connecticut		49 ft. deep	Irregular, 10 to 70 cm	Clean sediment		1988-1989			C, FF
56	S-90-1 Harbor Village/Branford River (CLIS area)		Generally flat 60 ft. deep	Incomplete coverage; several distinct cap mounds 0.6 to 2 ft. thick			1989-1990			FF
57	Massachusetts Bay Disposal Site Massachusetts (Demonstration)		90 miles deep; 22 naut. mi ENE from Boston		Clean sediment					C
58	Portland Disposal Site Yarmouth, Maine	Metals, PAHs	177 ft. and deeper		Fine-grained dredged sediment & sandy material		Oct. 1991 to June 1992	• Sediment chemistry data showed that the cap effectively isolates contaminants		VV
59	Portland Disposal Site Yarmouth, Maine (Demonstration Project)	Metals, PAHs	Deep water ocean disposal site; 210 ft. deep	1.6 ft. 0.7 ft. (WW)				• Project showed that dredged material may be effectively placed, capped, and monitored at deep water disposal sites (WW)	• "A tightly controlled, closely monitored deep-water demonstration capping project in which clean sediment was capped with 20 cm of clean sediment" (WW)	II, WW
60	General Motors Superfund Site St. Lawrence River Massena, New York	PCBs	11-acre near shore site; depth of river at cap no deeper than 4 ft. (XX)	1.5 ft.	Sand, gravel and armor stone	1.7 acre	1995	• In 1999, armored cap appeared intact with minimal disturbance; no routine maintenance required; however, additional armor material added in 1998 to restore minor nearshore areas (D) • The cap is working very well, based on yearly inspections. In the first year, minor repairs were required (more fill rock) (XX)	• Capping used where repeated dredging failed • As of 1996, cap has maintained its integrity as a whole. Direct comparison of pre-remediation fish data with post-remediation data is complicated by uncertainties about collection locations for the pre-remediation fish. There are data anomalies. (Z) • Water velocities in the River range from 2.75 to 4.42 ft/sec (D) • Cap consisted of sand, activated carbon and gravel (24)	B, E, Z, XX, 24

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
61	Reynolds Metals Co. Massena, New York	PCBs, PAHs, lead, other organics, other metals (60)					Nov. 2001 (59)		• Message left with EPA Region 2 • ROD abstract states that untreated sediment and treated residuals will be disposed onsite in the Black Mud Pond and that the Pond will be capped	59, 60
62	ALCOA Grasse River Massena, New York (Pilot study)	PCBs	Backwater to St. Lawrence River; approx. 20 ft. deep; study covered 750 ft. section (26)		Test materials: • 1:1 sand/topsoil mixture • granulated bentonite (clay) material • AquaBlok ™ (these 3 test materials were used alone or in combination) (26)	Approx. 7.5 to 8 acres (25)	July 9, 2001 to Oct. 19, 2001	• Extensive monitoring conducted prior to, throughout, and after the capping pilot study work(26) • The study concluded that a cap to cover the PCB-containing sediments can be successfully constructed in the Lower Grasse River (26) • Optimal results achieved with a 1:1 sand/topsoil cap applied via a clamshell attached to a barge-mounted crane (26) • Little apparent short-term impacts noted during pilot project; negligible water quality impacts; monitoring will continue in 2002 (26) • Capping will be carried into the Feasibility Study, both singly, and in combination with other remedies (25)	• Capping is one of the cleanup alternatives being evaluated for remediation of contaminated sediments in the Lower Grasse River • The study was conducted to better understand how different capping materials could be installed on the river bottom using various placement techniques (26) • Capping was performed in two phases: initial "Test Cell " to test potential materials and placement techniques; real-time results from the Test Cells were evaluated and select capping techniques and materials were then used in larger "Pilot Cells" (26) • Steep side slopes were a particular concern (25)	15, 25, 26

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
63	Marathon Battery Superfund Site East Foundry Cove Marsh Cold Spring, New York (cap and habitat restoration)	Cadmium, nickel, cobalt	Shallow estuarine	1-2 ft. cover soil (11)	BentoMat (1 in. Bentonite clay between 2 layers of geotextiles, material expands when wet); 1 -2 ft. of clean fill on top (11)	12 acres (11)	April 1995 (AA)	• Increases in sediment Cd concentrations probably due to cyclic flooding of marsh during high tide (D) • Several problems experienced (e.g., replanting difficulties due to ice (in first year, bad ice flow destroyed cattails), geese (which eat the young shoots), tidal velocities that prevent seed settling) (11) • Snow fences and other measures implemented (11)	• Highest contamination levels in East Foundry Cove Marsh near the plant's former outfall: 171,000, 156,000 and 6,700 mg/kg for Cd, Ni, and Co, respectively (12) • Mean Cd concentration: 27,799 ppm (D) • Sediments were excavated (average post-excavation concentration was approx. 25 ppm for Cd, with no sample exceeding 100 ppm cleanup goal) • The area was subsequently capped to isolate residual Cd from hydrologic and biologic processes, and to restore habitat (11, 13)	D, AA, 11, 12, 13
64	Rhode Island Sound		108-115 ft. deep; <0.5 ft/s bottom currents	Irregular, with some bald spots <17.4 ft.	Compacted silts and sand					C
65	Boston Harbor Navigation Improvement Project Massachusetts (CAD)	Multiple	Mystic River: 40 ft. MLLW Chelsea Creek: 38 ft. MLLW 8+ ft. tide (8)	3 ft. for each CAD cell (8)	Clean sand from Cape Cod Canal	2.4 acres [(h)]	1997: 1 CAD Cell at Conley Terminal 1998-2000: 7 CAD cells in Mystic River, including one "Super Cell" 2000-2001: 1 CAD cell in Chelsea Creek (8)	• Key lesson learned: allow the contaminated materials to consolidate for several months or more before capping (CC) • Longest consolidation period was 200 days (8) • Other lessons learned: how far cells could be filled before causing "slop out" (8) • Corps originally planned to have 60 shallow cells, no deeper than 20 ft. each, but modified plan to have fewer, deeper cells (some as deep as 80 feet) (8)	• 40 to 60 ft. deep pits dug to contain contaminated sediments • The Conley Terminal CAD cell was a test case and Boston's first capping project • Because benthic community returned without cap, that CAD cell was not capped • Lessons learned from that site were applied to subsequent CAD cells (8) • Chelsea Creek CAD cell still has 50,000 cy capacity to be filled, so will probably remain uncapped for 5 years • A vessel passage study was conducted to ensure that the deepest and most powerful ships in channel would not pull silt out- CAD cells performed quite well in tests (8)	J, T, CC, HH, JJ, 8

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
66	Upper Acushnet River Estuary/ New Bedford Harbor Massachusetts (pilot CAD)	PCBs, heavy metals	Estuary; pilot test site was small cove north of Coggeshall St. Bridge; depth ranged from 0.0 to 0.5 ft. (MLW)	2 ft.	Clean sediment produced during pilot study	CAD cell measured 180 ft. by 140 ft. (25,200 sq. ft., 0.6 acre)	Jan. 1989 to Feb. 1989	• Analysis of six sediment cores taken on June 22, 1989, revealed elevated levels of PCBs in the surface layers of sediment, indicating that capping efforts were unsuccessful. The results pointed out the need for a high degree of control on the positioning and movement of the discharge point within the CAD cell. The position of the diffuser within 2 feet of the contaminated sediment layer may have resulted in a mixing of sediments. A deeper CAD cell would allow the diffuser to be separated from the contaminated sediment layer while still remaining within the confines of the cell.	• The pilot study evaluated three types of hydraulic pipeline dredges, and two types of disposal methods (CADs and CDFs) • The bottom elevation of the CAD cell was approx. -6 ft. MLW; Within the 180 ft. by 140 ft. cross section, a 50 ft. by 50 ft. section had bottom elevation of -8 ft. MLW • Suspended sediment and contaminant levels were elevated in the vicinity of the CAD cell compared to background conditions and other phases of the study (a silt curtain was not in use during monitoring) • A statistically significant increase in contaminant levels was not detected at the Coggeshall Street Bridge	7
67	Providence River and Harbor Maintenance Dredging (CAD)	Various (6)	Channel depth 35 to 43 ft. now (6)	Target thickness 1 ft. minimum; 3 ft. desired (6)	Suitable sediments from lower in the channel (6)	308 acres (6)	Possibly Nov. 2002 or spring or summer 2003 (6)		• Five CAD cells currently designed for the Upper River to contain 1.2 million cy of dredged material (subject to change) • EPA is “on-board” with the project • EPA comments of 10/01 pertaining to dilution and mixing zone water quality requirements (Ref. K) have been addressed; final Water Quality Certification is pending	K, 6
68	Pine Street Barge Canal Burlington, Vermont (ISC)	PAHs, metals, VOCs	Northern end (turning basin) depth is 8-10 ft.; Southern end depth is 2-3 ft.; possibly 2 ft. higher in spring (5)	Possible thickness is 1.5 to 2 ft. if sand is used; if geotextile is also used, thickness may be less (5)	Sand/silt, with or without geotextile (5)	5-6 acres of affected canal sediments and 2-3 acres of wetlands	To be constructed ; may be complete in 2003 (5)	• ROD specifies a cap (5)	• Original remedial action required dredging; local opposition, then public consensus, led to development of in-situ capping remedy	E, T, 5

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
69	Housatonic River, Upper 1/2 Mile General Electric Site Pittsfield, Massachusetts	PCBs	Water depth typically 3-4 ft. (can range from 2-10 ft.) (YY); average flow 105 cfs (AA)	1 ft. silty sand; 1 ft. armor stone (62)	Multi-layer river cap: geotextile, silty sand with >0.5 % TOC, geotextile, GeoGrid, armor stone (62)	possibly 2-3 acres, based on drawings in Work Plan (62)			• Purpose of cap/armor is to provide a chemical and physical barrier between the residual PCBs (after removal of contaminated sediment) and the overlying water (62) • A 12-inch thick silty sand layer with a 0.5% TOC concentration is proposed for the majority of the area; in certain areas, a 6-inch thick silty sand layer will be installed where 1.5 ft. sediment removals is proposed; an 18-inch thick silty sand layer will be used in one area where deeper excavation is proposed (62)	Y, AA, YY
70	Messer Street Gas Plant Winnipesaukee River Laconia, NH	PAHs	Depth at underground phone cables 10-15 ft.	1 ft.	Course gravel, similar to on-site conditions	<0.1 acre	2000-2001	• Project went well • Too early to identify any issues • Monitoring will be conducted where free product was removed and sediment excavated	• Overall design relied more on excavation than capping (“stabilization”) • Stabilization was used primarily in one area where buried telephone cables cross the river • Stabilization specifically not used if free product was present, area was subject to scour, or depth was less than 10 ft. • Other isolated portions of the 18 separate remediation areas may have used stabilization	4

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
71	Rahway River Linden, New Jersey	DDT, metals	RCRA Corrective Action at industrial facility		Nonwoven geotextile, native sediment, sand filter material, second geotextile layer, rip rap armor	0.5 acre		• Cap construction is complete and has received final closure approval	• Message left with the NJDEP	E
Other Domestic Projects										
72	Lower Mobile Bay Alabama (ISC) pilot		Open ocean thin layer disposal	1 ft. maximum	Silt maintenance dredged material	<10 acres	1988	• Pre-, during, and post-project monitoring was conducted by the Mobile District (of US ACE), WES, and EPA • Motile and non-motile organism impacts and recolonization and water quality were monitored • Minimal impacts resulted, and organism levels were at pre-project levels in 6 months • Project considered a success (16)	• Energy sources: long wind fetch across Mobile Bay and surface wave energies from boats and natural conditions (16)	W, 16
73	Anacostia Watershed Prince George's County, Maryland (pilot)	PCBs, PAHs, pesticides, metals	15-20 ft. depths; near shore site with heavy propeller wash			10,000 sq.ft.	To be constructed (design should start this summer)	• Full commitment made to conduct pilot study	• Because there are a number of contaminated sediment sites on the Anacostia River, the entire watershed will be addressed in its entirety, with stakeholder input • Final remedy anticipated to be reactive cap	14

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
74	Koppers Superfund Site Charleston, South Carolina (ISC)	PAHs, pentachoro- phenol, trace dioxin, lead, arsenic	Ashley River; intertidal system; 1,500 ft. reach; cap mostly in intertidal zone; under 6 ft. of water at high tide (18)	1.5 ft. minimum	Geotextile and minimum of 18 in. sand (18)	3 acres (18)	Dec. 2001 (18)		• Originally, only sediments in the Barge Canal were to be capped, and enhanced natural sedimentation was to be used in the Ashley River • Due to public concern with sheet piles surrounding property access, and agency's desire to avoid delays, EPA decided to cap the Ashley River • Approx. 2 ft. of sediment has already naturally deposited on the Barge Canal, but EPA will continue to evaluate the remedy for the Barge Canal (18) • Sediments in the Barge Canal are "marginally toxic" (AA)	AA, 18
75	Calhoun Park/Aquarium Charleston, South Carolina	PAHs (former coal gas manufactu-ring plant)	Cooper River intertidal area; portion above water line at low tide; a portion continually submerged (19)	3 ft.	Clean sand	0.5 - 0.75 acre, estimated (19)	1996	• Sand cap an interim measure, not a formal remedy • Some scouring and mounding noted • Very dynamic environment (19)	• An aquarium was proposed to be built on the site. To avoid resuspension of PAHs during construction of 300 pilings, 3 ft. of clean sand was first laid (without geotextile) (18) • Ecological risk assessment warrants further evaluation of formal remedy, although aquarium and National Park Service boat dock present physical constraints (19)	18, 19

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
76	Ward Cove Ketchikan, Alaska (thin-layer capping)	Ammonia, sulfide, and 4-methylphenol (AA) (generated in place from existing contami-nation)	Deep estuary, 1 mi. long & 0.5 mi wide; water depth at proposed capping areas: -10 to -110 ft. MLLW (AA) Very soft organic sediments; 80-acre AOC (X)	0.5 - 1 ft. 0.5 -0.75 ft. (X)	Clean sand from upland borrow source (10)	27 acres (10)	Feb. 2001	• All sediment targeted for capping was covered by a thin-layer cap (10) • The project went very smoothly; the AOC will be sampled every third July or until remedial objectives are achieved (1) • Contractor had to verify that cap was properly placed (10) • First monitoring event will take place in 2004 (chemical monitoring and bioassays will be conducted) (10) • Lessons learned: (1) possible to place uniform cap on soft sediments with clamshell, (2) use a trial and error approach, (3) success when a close owner/contractor/regulator working relationship is in place to allow field modifications to meet clean-up objectives (X)	• Originally, 21 acres were going to be covered by a thin cap and 5 ft. of mounding would be used on another 6 acres. The mound capping was not required since thin-layer caps could be supported by the sediment. • Natural recovery was used where capping was infeasible, on 53 acres of the site (10) • The thin layer cap provides a clean substrate for recolonization of the benthic community (10)	X, AA, 1, 10
77	Eagle River Flats Fort Richardson Army Base Anchorage, Alaska (pilot and follow-up study)	White phosphorus	Estuarine salt marsh next to former army firing range	3 to 4 inch layer (42)	Hydrated AquaBlok™	1.2 acre (1994 study)	1993 (pilot) 1994 (definitive study)	• The AquaBlok™ immediately and significantly reduced the mortality of the duck test population (42) • After one year, the treated area became revegetated and supported benthic life (42) • After four years of exposure to extreme temperature and tidal influences, the treated area remains capped (42) • Data collected to date indicates that AquaBlok™ shows promise for reducing waterfowl mortality from white phosphorous poisoning (43)	• High waterfowl mortality was observed in early 1980s and traced to ingestion of white phosphorus-impacted sediments • 1993 pilot study indicated that the system could reduce mortality of foraging waterfowl (43) • Definitive study conducted in 1994 to evaluate the longevity of the system and measure its effects on waterfowl foraging behavior and mortality (43)	42, 43

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
78	Eagle River Flats Fort Richardson Army Base Anchorage, Alaska (full-scale)	White phosphorus	Estuarine salt marsh next to former army firing range						• Preferred remediation method in Oct. 1998 ROD is to temporarily drain ponds to allow the pond sediments to dry out and allow white phosphorous to sublimate and oxidize over a five year period, and then cap and fill area with AquaBlok™ where white phosphorous exposure remains a concern (44) • AquaBlok™ would only be applied to small, deep portions of pond bottoms and would not significantly change overall pond depths or feeding habitat (44)	44
79	Nome, Alaska (CAD)		Harbor depth 20 ft.	4 ft.		1 acre			• Small project similar to One Tree Island, in which contaminated surface layer was dug up and deposited in CAD cell. • Approx. 35,000 cy of material placed in CAD cell	21
80	ALCOA (Point Comfort)/Lavaca Bay Site Point Comfort, Texas (thin layer capping)	Mercury	Tidal-estuarine; always underwater; water depth approx. 6-8 ft.	0.5 ft.	Hoping to find a new clay material; possible use of dredge spoils from federally maintained channel	50 acres estimated	ROD signed in Dec. 2001; construction may start in Dec. 2002		• Remedy will include dredging, capping, and natural recovery • Thin layer cap will be used to accelerate natural sedimentation • Final design not complete • Modeling of Category 5 hurricane indicated wet deposition, not exposure of deeper sediment	20
81	Homestead Air Force Base Outfall Canal (OU-11) Florida	PAHs, metals (2)	Canal approx. 40-50 ft. wide, 1 mile long and 10 ft. deep (2)	Possibly 2 ft. (2)	Possible: concrete-injected fabric, under geotextile mat, under clean sediment for plant growth (2)		In the Proposed Plan stage of Superfund (2)	• The capping remedy has been approved by the Air Force, EPA, the State and Durham County (3)	• Extensive storm water conveyance system of canals and swales transports the contaminants to the Canal • Canal discharges storm water to Biscayne National Park, hence the urgency to address the sediments which appear to have damaged flora and fauna adjacent to the mouth of Outfall Canal (2)	2, 3
International Projects										

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
82	Rotterdam Harbor Netherlands (CAD)	Oils	Water depth 16 - 39 ft. (A)	2-3 ft.	Silt/Clay sediments	Est. minimum of 16.3 acres[(i)]	1984	• No available monitoring data	• Groundwater pollution was a potential concern so site was lined with clay prior to sediment disposal and capping	A, F, FF
83	Amsterdam Netherlands (CAD)		Harbor basins; multiple CADs							KK
84	Ijmuiden (Averijhaven) Netherlands (CAD)		Tidal waters at entrance to the North Sea; 1 CAD							KK
85	Ijmuiden (Amerikahaven) Netherlands (CAD)		Non-tidal waters in main port area; 1 CAD							KK
86	Julianakanaal Netherlands (CAD)		Shipping channel						• Deep pits in this channel were used for disposal of contaminated sediments from the River Maas	KK
87	Eitrheim Bay Norway	Metals	Water depth up to 10 m		Geotextile and gabions	100,000 m^2				B
88	Kihama Inner Lake Japan (ISC)	Nutrients	3 sites	5 and 20 cm	Fine sand	3,700 m^2				B, C
89	Akanoi Bay Japan	Nutrients	3.9 ft. deep; 2 sites	20 cm	Fine sand	20,000 m^2				B, C
90	Hiroshima Bay Japan (ISC)		Water depth 70 ft.	5.3 ft.	Sand with shell		1983	• No available data		A
91	Hiroshima Bay-Phase 1 Japan			50 cm	Sand	19,200 m^2	1979			B
92	Hiroshima Bay-Phase 2 Japan			30 cm	Sand	44,160 m^3	1980			B
93	Lake Biwa Japan			20 cm	Sand	22,000 m^2				B
94	Matsushima Bay Japan		Included dredging	30 cm	Sand	675 m^2				B

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
95	Minami-ko Japan			20 cm	Sand					C
96	Uranouchi Bay Japan		20-60 ft. deep	15-20 cm	Sand	17,400 m^2				B
97	Suonada Bay Japan		3-16 ft. deep	30-50 cm	Sand	15,900 m^2	1986-1987			B
98	Mikawa Bay Japan			40-100 cm	Sand	14,100 m^2				B
99	Tsuda Bay Japan		33-49 ft. deep	50 cm	Sand	418,000 m^2	1991-1993			B
100	Gokasho Bay Japan			20 cm	Sand	106,900 m^2				B
101	Uwajima Bay Japan			20 cm	Sand	46,800 m^2				B
102	Minimata Site Japan	Mercury		2.8 m	Geotextile sheets, two types of sand					B
103	Belgium (CAD)									T

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
104	East Sha Chau Contaminated Mud Pits Hong Kong (CAD)	Varied domestic and industrial pollutants, particularly metallic radicals (copper and chromium)		3 m minimum	Pits I-III: Initial placement: ~1m sand, then ~2m clean capping mud One year later after pit infill settling: another 1-2m clean mud to bring cap back to level of surrounding seabed (55) Pit IV: 6m - 8m	Pits I-III: 570 acres[j] Pit IV: 500 acres[j]	Pits I-III: Dec. 1992 to Dec. 1997 Pit IV: beginning in Dec. 1997	• Independent reviews of results indicate absence of adverse and/or cumulative impacts, including risks to public health and ecology, and conclude that the disposal program has effectively isolated contaminants from the marine environment (55) • The Environmental Impact Assessment study for CMP- IV determined that even though the pit would have larger surface area than previous CMPs, unacceptable environmental impacts would be unlikely as long as the maximum backfill level is limited to -14m PD. While a cap of 3m would be resistant to erosion under extreme storm events, there is space above the 3m cap for placement of about 5 m of additional clean material giving a final cap thickness of 6-8m (55) • Usefulness of sand cap layer as part of CMP-IV was re-assessed and determined to be unnecessary because the mud cap layers will be placed by hydraulic methods and because costs don't appear to be warranted - earlier caps always a revealed a distinct boundary between clean and contaminated mud (55)	• Pits designed to maximize capacity while minimizing affected seabed area (55) • Dec. 1992 to Dec. 1997: three pits used [CMP I, CMP IIa-d, and CMP IIIa-d] - these pits were dredged to base of the soft marine deposits, normally about 15 m below seabed (55) • Design process evaluated effects of storm-induced shear stress during a seasonal typhoon for uncapped pits and completed cap; possibility of remobilization and loss of contaminated sediment was very low if filled depth was limited to 9m below sea level; geophysical surveys showed maximum natural scour to be ~1m, so 3m cap thickness used (55) • Design cap also precludes burrowing organisms and anchors of shallow draft ships from breaching the cap (55) • After Dec. 1997: CMP-IV used; these were exhausted marine sand borrow pits with estimated volume of 30 Mm^3 expected (55) • Capacity in the 4th pit will be exhausted in late 2007 (56) or 2003 at least (55) • New CAD sites are being considered (BB, 56) • 22 Mm^3 disposed of from Dec. 1992 to approx. Jan. 2001 (BB); 40 Mm^3 expected by 2003 (55)	T, BB, 55, 56
105	Lake Schwelvollert Trebnitz, Germany (ISC)	Phenols, ammonium, PAHs	Former open mining pit; 89 ft. deep max.; 9 hectares							DD, EE
106	Sweden (ISC)									T

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
107	Lake Turingen Sweden (pilot ISC)	Mercury	197 acre lake, with maximum depth of 10 m	3 cm gel (Vattenresurs AB process)	Proprietary gel material ("artificial sediment")					52
108	Lake Turingen Sweden (full scale)	Mercury (from paper mill releases from 1946-1966)	197 acre lake, with maximum depth of 10 m (52)	Phase 1: cap - not specified Phase 2 cap: 5 cm (~2 in.) (52)	Phase 1 cap: geotextile and "suitable clean technological material" (53) Phase 2 cap: proprietary gel material ("artificial sediment") (52)	Phase 1 cap: not specified Phase 2 cap: 198 acres (52)	Phase 2 cap: to be completed in late autumn 2002 (52)		• Phase 1: dredge sediments from the final reaches of River Turingen channel and section of Lake Turingen just outside of mouth of river; "clean" several shallow areas of the lake near river mouth; spoils to be redeposited underwater in the southern part of the lake; cap non-dredged areas of the lake near the river mouth (53) • Phase 2: cap the "remaining accumulation in the lake bottoms with artificial gel" (53) • Vattenresurs AB in Sweden patented the Phase 2 capping method (52) • Raceway testing shows Phase 2 cap can manage current of 0.3 m/s (52)	52, 53
109	Sørfjorden Site Norway	Zinc, lead (54) (Concentra-tions of metals in sediment exceeded 10% zinc and 0.9% lead) (54)	Small bay near zinc factory; water depth < 33 ft.	30-60 cm (B) 30 cm sand over permeable membrane (54)	Nonwoven geomembrane and woven polyester geotextile and sand (B)	17.3 acres (54)		• Capping was selected because of fears of gross contamination during dredging and lack of safe areas to deposit spoils; the industrial waste in bay is a very significant source of pollution; the contaminated material at the shoreline is exposed to tides and waves and is continually eroded and resuspended; during stormy weather the entire bay has been colored red (54)	• The cap will be used in combination with a piled wall near shore (54) • The sandy layer on top of the membrane is meant to protect the membrane, to adsorb some of the contaminants that are transported through the membrane, and to arrange for recolonization of organisms; the membrane will prevent bioturbation into the contaminated sediments and erosion of the sediments during stormy weather (54)	B, 54

NOTES

A. References in the Draft Feasibility Study Version (Ref. A):

EPA, 1998, Manistique River/Harbor AOC Draft Responsiveness Summary, Section 4: In-place Containment at Other Sites. Sent by Jim Hahnenberg of United States Environmental Protection Agency Region 5 and Ed Lynch of Wisconsin Department of Natural Resources on September 25, 1998.

SAIC, 1996. Year 11 Monitoring of the Duwamish CAD Site, Seattle, Washington. Report prepared for the United States Army Corps of Engineers, Seattle District by Science Applications International Corporation, Bothell, Washington.

Sumeri, A., 1984. Capped in-water disposal of contaminated dredged materials: Duwamish Waterway site. In: Proceedings of the Conference Dredging '84, Dredging and Dredged Material Disposal, Volume 2. United States Army Corps of Engineers, Seattle Washington.

Truitt, C.L., 1986. The Duwamish Waterway Capping Demonstration Project: Engineering Analysis and Results of Physical Monitoring. Final Report. Technical Report D-86-2. United States Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi, March.

B. References:

A: Appendix D of the *Draft Fox River Feasibility Study*, ThermoRetec, October 2001. At www.dnr.state.wi.us/org/water/wm/lowerfox/rifs/fs/appendixd.pdf

B: *Assessment and Remediation of Contaminated Sediments (ARCS) Program, Guidance for In-Situ Subaqueous Capping of Contaminated Sediments*, U.S. EPA, December 1998. At www.epa.gov/glnpo/sediment/iscmain/index.html

C: Internal summary table provided by D. Reible and G. Kirkpatrick

D: Appendix B of the *Draft Fox River Feasibility Study*, ThermoRetec, October 2001. At www.dnr.state.wi.us/org/water/wm/lowerfox/rifs/fs/appendixb.pdf

E: Appendix C (Considerations for Developing the Submerged Sediment Capping Alternative) of the *Draft Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site RI/FS Feasibility Study Report - Phase 1*, BBL, October 2000. At www.deq.state.mi.us/erd/downloads/Kzoo/FS-Pieces/FS-apend-c.pdf

F: *Environmental Effects of Dredging, Technical Notes*, U.S. Army Engineer Waterways Experiment Station, EED P-01-3, February, 1987. At www.wes.army.mil/el/dots/pdfs/eedp01-3.pdf

G: *EPA Region 9: Cleaning Up the Palos Verdes Shelf, Pilot Capping Project: Summary of Activities*. At www.epa.gov/Region9/features/pvshelf/pilot.html

H: U.S. EPA Technical Support Project Semi-Annual Meeting, Technical Sessions Summary, May 7-10, 2001, San Diego, CA. At www.epa.gov/tio/tsp/download/finaltechsummary.pdf

I: Action Memorandum for Palos Verdes Shelf, September 2001. At www.epa.gov/region09/features/pvshelf/actionmemo0901.pdf

J: *Dredging Harbors and Disposing of Contaminated Sediments*, A. Cohen, MIT Sea Grant College Program, September, 2000. At www.oar.noaa.gov/spotlite/archive/spot_dredge.html

K: Letter from U.S. EPA Region 1 to U.S. Army Corps of Engineers Re: Final Environmental Impact Statement for the Providence River and Harbor Maintenance Dredging Project, October 1, 2001. At www.epa.gov/region01/nepa/f_prov_ltr100101.pdf

L: *A Remedy Decision for the Former BP Casper Refinery, Soda Lake Area*, WY DEQ, Draft Final, October, 2001. At http://deq.state.wy.us/shwd/RD3/rd3.pdf

M: Exhibit A - *Statement of Work, Interim Remedial Action, G-P Log Pond, Whatcom Waterway Site*, Bellingham, Washington, May 2000. At www.ecy.wa.gov/programs/tcp/sites/whatcom/ww_sow.pdf

N: *Post-Remedial Monitoring and Sediment Cap/Confined Aquatic Disposal (CAD) Site Monitoring*, SEA. At www.striplin.com/monitor.html

O: *The Capping Proposal for Cell 1, Tommy Thompson Park - A Wetland Creation Opportunity on the Toronto Waterfront*, L. Field, G. MacPherson, and K. Lundy. At http://massbay.mit.edu/marineCenter/conference/abstracts03.htm

P: *Predicting mound placement and stability for the Energy Island borrow pit*, J. Gailani, Dredging Research, June/Sept. 1998. At www.wes.army.mil/el/dots/pdfs/drv1n2_3.pdf

Q: Port of Oakland Press Releases. At www.portofoakland.com/globals/news_press_37a.html

R: Meeting Minutes, December 2000. At www.bcdc.ca.gov/nam/comm/2000/122100cm.htm

S: Record of Decision System, McCormick & Baxter Creosoting Co. (Portland Plant). At www.epa.gov/superfund/sites/rodsites/1000339.htm

T: *Subaqueous Capping of Contaminated Sediments: Field Experiences*, Dr. M.R. Palermo. At www.epa.gov/tio/tsp/download/palermo-jointsession.pdf

U: *Tommy Thompson Park Public Urban Wilderness Habitat Creation and Enhancement Projects 1995-2*000. At www.trca.on.ca/pdf/ttpdoc2000.pdf

V: *"Snow Cap" Used for Sediment Remedation*, L. Gutknecht and M. Warner, EPA Tech Trends, May 1999. At www.clu-in.org/PRODUCTS/NEWSLTRS/TTREND/tt0599.htm

W: *Engineered Uses, Capping*. At www.wes.army.mil/el/dots/budm/capp.html

X: *Panel #4 Remedy Effectiveness: Comparison of Remediation Technologies, Thin Layer Dredging and Capping, Recent Case Histories*, W. Elmer and J. Lally. At www.epa.gov/superfund/new/elmer.pdf

Y: *Center for Contaminated Sediments - Case Studies and Projects*. At www.wes.army.mil/el/dots/ccs/case.html

Z: *Environmental Dredging: An Evaluation of Its Effectiveness in Controlling Risks*, GEC and BBL, August 2000. At www.hudsonvoice.com/downloads/whitepaper/DREDGE.PDF

AA: *GE/AEM/BBL Contaminated Sediments Database*. At: www.hudsonvoice.com/MCSS/DOWNLOAD.htm

BB: *GEO Information Note 1/2001 Marine Fill Resources & Marine Disposal of Dredged Mud.* At www.info.gov/hk/ced/eng/publications/geonotes/inf_0101.htm

CC: *American's Green Ports, Dredged Material Disposal and Contaminated Sediments*. At www.aapa-ports.org/govrelations/resources/GreenPorts/10.Dredged Mat.18-24pp.pdf

DD: *The Lake Schwelvollert - A Carbonization Waste Water Deposit: Monitoring Bioremediation Processes by Analysis of the Degradation Potential of Heterotrophic Microbial Communities*, P.M. Becker et. al. At www.tu-berlin.de/forschung/IFV/wasser/schrift/band1/1-becker.pdf

EE: *Environment Canada, Aquatic Ecosystem Remediation Project.* At www.cciw.ca/nwri/aemrb/aerp.html

FF: *U.S. Army Corps of Engineers, Guidance for Subaqueous Dredged Material Capping*, by M. Palermo, et. al., June 1998. At www.wes.army.mil/el/dots/doer/pdf/trdoer1.pdf

GG: 2001 Environmental Surveys, Anchor Environmental. At www.djc.com/special/enviro2001/anchorsurvey.html
HH: *US Army Corp of Engineers Update Report for Massachusetts*, 10/31/0. At www.nae.usace.army.mil/news/ma.pdf
II: *Disposal Area Monitoring System (DAMOS) Contribution #123*. At www.nae.usace.army.mil/environm/sum123.htm
JJ: *Disposal Area Monitoring System (DAMOS) Contribution #124*. At www.nae.usace.army.mil/environm/sum124.htm
KK: *The Practicality of Covering Drill Cuttings In-Situ: Task 5.1*, ERM, December 1999. At www.ukooa.co.uk/issues/drillcuttings/pdfs/rd5-1c.pdf
LL: U.S. EPA Region 2, *Site Management and Monitoring Plan for the Historic Area Remediation Site*. At www.epa.gov/Region2/water/dredge/harssmmp.htm
MM: *Federal Register* dated May 13, 1997 at www.epa.gov/fedregstr/EPA-WATER/1997/May/Day-13/w12480.htm
NN: *Hudson River PCBs Reassessment RI/FS Phase 3 Report: Feasibility Study*; December 2000. At www.epa.gov/hudson/fs000001.pdf
OO: *Dewatering Sewage Sludge with Geotextile Tubes*. At www.geotecassociates.com/publications/Sludge.pdf
PP: *Disposal Area Monitoring System (DAMOS) Contribution #103*. At www.nae.usace.army.mil/environm/sum7.htm
QQ: *Disposal Area Monitoring System (DAMOS) Contribution #104*. At www.nae.usace.army.mil/environm/sum6.htm
RR: *Disposal Area Monitoring System (DAMOS) Contribution #117*. At www.nae.usace.army.mil/environm/sum117.htm
SS: *Disposal Area Monitoring System (DAMOS) Contribution #120*. At www.nae.usace.army.mil/environm/sum120.htm
TT: *Disposal Area Monitoring System (DAMOS) Contribution #111*. At www.nae.usace.army.mil/environm/sum111.htm
UU: *Disposal Area Monitoring System (DAMOS) Contribution #118*. At www.nae.usace.army.mil/environm/sum118.htm
VV: *Disposal Area Monitoring System (DAMOS) Contribution #108*. At www.nae.usace.army.mil/environm/sum2.htm
WW: *Disposal Area Monitoring System (DAMOS) Contribution #123*. At www.nae.usace.army.mil/environm/sum123.htm
XX: Personal communication with Dan Casey (BBL - at BBL's field office at the GM Site, Massena, NY)
YY: Personal communication with R. McGrath (Roy F. Weston)
ZZ: Personal communication with T. Wang (Anchor Environmental)
1: Personal communication with W. Janes (Alaska Dept. of Environmental Conservation)
2: Personal communication with J. Caspary (Florida Dept. of Environmental Protection)
3: Personal communication with J. Crane (Florida Dept. of Environmental Protection)
4: Personal communication with R. Minicucci (New Hampshire Dept. of Environmental Services)
5: Personal communication with K. Limino (EPA Region 1)
6: Personal communication with E. O'Donnell (U.S. Army Corps of Engineers - New England)
7: *New Bedford Harbor Superfund Pilot Study, Evaluation of Dredging and Dredged Material Disposal"*, May 1990. U.S. Army Corps of Engineers, New England Division.
8: Personal communication with M. Keegan (U.S. Army Corps of Engineers - New England)
9: *Monitoring of Boston Harbor Confined Aquatic Disposal Cells*, Compiled by L. Z. Hales, Coastal and Hydraulics Laboratory ERD/CHL TR-01-27, September 2001, U.S. Army Corps of Engineers, Engineer Research and Development Center at www: usace.army.mil
10: Personal communication with K. Keeley (EPA Region 10)
11: Personal communication with P. Tames (EPA Region 2)
12: *Superfund Site Close-Out Report, Marathon Battery Company Site*, Putnam County, Cold Spring, New York
13: Record of Decision, Remedial Alternative Selection, Marathon Battery Company Site, Cold Spring, Putnam County, New York, 9/30/86.
14: Personal communication with N. DiNardo (EPA Region 3)
15: Personal communication with D. Tomchuk (EPA Region 2)
16: *Proceedings: International Workshop on Dredged Material Beneficial Uses, 28 July - 1 August, 1997, Baltimore MD* at www.wes.army.mil/el/dots/budm/pdf/97workshop.pdf
17: Personal communication with C. Anderson (Wyoming Department of Environmental Quality)
18: Personal communication with C. Zeller (EPA Region 4)
19: Personal communication with T. Tanner (EPA Region 4)
20: Personal communication with G. Baumgarten (EPA Region 6)
21: Personal communication with J. Malek (EPA Region 10)
22: *Management of Dredging Projects; Summary Report for Technical Area 5*, compiled by L.Z. Hales, Department of the Army, Waterways Experiment Station, Corps of Engineers, Vicksburg, Dredging Research Program Technical Report DRP-96-2, February 1996; the report presents the same information as that in *Dredging Research Technical Notes; Sediment Chemistry Profiles of Capped Dredged Sediment Deposits Taken 3 to 11 Years After Capping*, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Report DRP-5-09, May 1994..
23: *Environmental Effects of Dredging Technical Notes; Fate of Dredged Material During Open-Water Disposal*, U.S. Army Engineer Waterways Experiment Station, Report EEDP-01-2, Sept. 1986.
24: *Advances in Dredging Contaminated Sediment; New Technologies and Experience Relevant to the Hudson River PCBs Site*, Scenic Hudson, April 1997.
25: Personal communication with Mary Logan (EPA Region 2)
26: *Alcoa Inc. - Massena West Facility, Grasse River Capping Pilot Study Fact Sheet*, provided by EPA Region 2
27: Personal communication with B. Ross (EPA Region 9)
28: *Wyckoff/Eagle Harbor Superfund Site; Harbor Remediation* at http://wyckoffsuperfund.com/harborremediation.htm

29: *Puget Sound Naval Shipyard Complex* available at http://yosemite.epa.gov/region10
30: *DRAFT Explanation of Significant Differences Middle Waterway Commencement Bay Nearshore/Tideflats Superfund Site*, August 2001; downloaded from Internet
31: *Productive Reuse of Dredge Material, Capping of a Mercury Contaminated Sediment Site*, by J.R. Verduin, C. Hilarides, B. Langdon, and C. Patmount at www.wesda.org/environ_commission.htm
32: *Commencement Bay, Nearshore/Tideflats* available at http://yosemite.epa.gov/r10/nplpad...
33: Personal communication with S. Thomas (EPA Region 10)
34: Personal communication with F. Schauffler (EPA Region 9)
35: Personal communication with M. Lacey (EPA Region 9)
36: Personal communication with K. Marcy (EPA Region 10)
37: Personal communication with M. Lyons (LA Regional Water Quality Control Board)
38: Personal communication with R. Appey (Port of Los Angeles)
39: *Site Investigation Report Summary*, Hart Crowser, November 30, 2000, at www.deq.state.or.us/nwr/ri_Summary_final.pdf
40: News Release *DEQ Accepts Results of Port of Portland Study on Confined Disposal at Ross Island*, at www.deq.state.or.us/news/releases/129.htm
41: Letter from NOAA National Marine Fisheries Service to L. Evans, Corps of Engineers, Portland District, May 1, 2000 at www.nwr.noaa.gov/1publcat/2000/osb2000-0073.PDF
42: *AquaBlok™ Project*, by J. Hull, P.E., Hull & Associates, Inc., at www.epa.state.oh.us/dsw/rap/mau_profott3.pdf
43: *Evaluation of AquaBlok™ on Contaminated Sediment to Reduce Mortality of Foraging Waterfowl (1995)*, P. Pochop, J. Cummings, and C. Yoder, Abstract, at www.crrel.usace.army.mil/erf/bibliography/contracts/contract33.html
44: ROD Abstract (EPA/541/R-98/182, dated 9/30/98) for Operable Unit C at www.epa.gov/superfund/sites/rodsites/1001455.htm
45: *Summary of the Remediation Technologies Development Forum Sediments Remediation Action Team Meeting*, Cincinnati, Ohio, May 8, 2000, at www.rtdf.org/public/sediment/minutes/050800/may8rvd.htm
46: *Thea Foss Waterway Remediation: Design Status Report, Proceedings of the Western Dredging Association 20th Technical Conference and 32nd Annual Texas A&M Dredging Seminar*, June 25-28, 2000, Warwick, Rhode Island, R. Randall, Ed., CDS Report No. 372
47: Personal communication with J. Fields (U.S. Army Corps of Engineers)
48: Personal communication with N. Harney (EPA Region 10)
49: Personal communication with P. Contreras (EPA Region 10)
50: Personal communication with P. Peterson-Lee (EPA Region 10)
51: Personal communication with L. Marshall (EPA Region 10)
52: Personal communication with S. Carlsson (Vattenresurs AB, Sweden)
53: "Lake Turingen remedial project: isolation of mercury-contaminated sediments", *LIFE - Environment in action; 56 new success stories for Europe's environment* at http://europa.eu.int/comm/life/envir/successstories2001.PDF
54: "A review of assessment and remediation strategies for hot spot sediments", *Hydrobiologia*, 235/236: 629-638, 1992., J. Skei, Norwegian Institute for Water Research
55: "Contaminated Mud in Hong Kong: A Case Study of Contained Seabed Disposal", *Proceedings of the 15th World Dredging Congress*, Volume 2, by J. Shaw, P. Whiteside and K. Ng, Las Vegas, Nevada, June 28-July 2, 1998, published by the World Organization of Dredging Associations, pp. 799-810.
56: *Strategic Assessment and Site Selection Study for Contaminated Mud Disposal*, Hong Kong Environment and Food Bureau, ACE-EIA Paper 4/2001, June 2001 at www.info.gov.hk/efb/board/eia/paper042001.html
57: Personal communication with J. Sutter (Oregon Department of Environmental Quality)
58: Personal communication with L. Priddy (EPA Region 10)
59: Personal communication with R. Santiago (Environment Canada)
60: Reynolds Metals Co ROD Abstract at www.epa.gov/superfund/sites/rodsites/0201465.htm
61: Faxed excerpts from *Site Investigation Report, Confined Dredge Facility, Ross Island Facility*, November 30, 2000, by Hart Crowser
62: *Appendix F to Consent Decree, Removal Action Work Plan for Upper 1/2 Mile Reach of Housatonic River, dated August 1999, and EPA approval letter dated August 5, 1999*, October, 1999, Blasland, Bouck & Lee, Inc., Syracuse, NY

C. Abbreviations:

AOC	Area of Concern
CAD	Confined Aquatic Disposal
CB/NT SS	Commencement Bay Nearshore/Tideflats Superfund Site
Cd	Cadmium
CDF	Confined Disposal Facility
CDM	Capping Dredged Material
cfs	Cubic Feet Per Second

CLIS	Central Long Island Sound
CMP	Contaminated Mud Pit
COC	Chemical of Concern
CSO	Combined Sewer Overflow
cy	Cubic Yards
DDT	Dichloro-diphenol-trichloroethane
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
HDPE	High Density Polyethylene
ISC	In-Situ Capping
MLW	Mean Low Water
MLLW	Mean Lower Low Water
NAPL	Non-Aqueous-Phase Liquid
NPL	National Priorities List
NUAD	Not Suitable for Unconfined Aquatic Disposal
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCDF	Polychlorinated Dibenzofuran
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
TBT	Tributyl Tin
TOC	Total Organic Carbon
UDM	Unacceptably Contaminated Dredged Material
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound
WES	Waterways Experiment Station (USACE)

D. Footnotes:

(a) Estimated by dividing the 0.6 m thickness into the 3100 m3 volume (Ref. E). According to J. Malek (Ref. 21), the initial cap area was approximately 0.7 acres. Because too much material was placed in too small a hole, too quickly, there was “slopping out”, so the actual cap feathered out to an area of approx. 1.3 acres.

(b) Estimated from diagram provided at http://www.wes.army.mil/el/dots/doer/pdf/trdoer1.pdf (Ref. FF). B. Ross (EPA Region 9) believes that the calculated area could be correct for the LA project.

(c) Estimated from diagram provided at http://www.wes.army.mil/el/dots/pdfs/drv1n2_3.pdf (Ref. P). Approx. 0.25 by 1.4 miles

(d) Estimated from diagram provided at http://www.epa.gov/tio/tsp/download/palermo-jointsession.pdf (Ref. T)

(e) Estimated by dividing the 1.5 m thickness (Ref. PP) into the volume of capping sediments, 65,000 cu m (Ref. RR)

(f) Estimated based on mound diameter of 470 meters (Ref. UU)

(g) Estimated based on mound diameter of 200 meters (Ref. SS)

(h) Estimated based on diagram provided (Ref. 9) for the Mystic River CAD cells

(i) Estimated from one (out of three) pit dimensions of 550 by 120 meters (Ref. EE)

(j) Estimated based on diagram provided (Ref. 55) for the East Sha Chau mud pits

APPENDIX I

SUMMARY COST FOR SITING, CONSTRUCTING, AND OPERATING A LANDFILL IN ASHLAND

APPENDIX I

Off-site Landfill Siting, Permitting, Construction Requirements and Estimated Costs Ashland/NSP Lakefront Site Feasibility Study

The following assumptions were made to develop a conceptual design and cost estimate for an off-site ch. NR 500 permitted landfill. It is assumed that the off-site landfill would be of substantial capacity to support a "remove all" remedy that includes all sediment from the dredge-all remedies (SED-4 and SED-5) as well as all impacted soils from the upper bluff and Kreher Park.

Assumptions

- Landfill is located within five miles of the Site.
- Volume of waste = 300,000 cu yd +/-
- Landfill perimeter berms 3 horizontal to 1 vertical
- Landfill cover slope varies from 5 to 2 percent
- The perimeter berms of the landfills shell will be constructed of sand and plated with cover soil upon completion of the landfill cover.
- Ground water estimated to be 10 ft below existing ground surface (regulations require bottom of cell to be a minimum of 10 ft above groundwater table landfill).
- Waste will be trucked to site and will be of a consistency (pass a paint filter test) that will allow placement with a dozer in the landfill.
- Trucks loaded with waste will initially drive into the landfill to deposit their load.
- One-way traffic will be allowed on the egress/ingress ramps to the landfill.
- Truck ramp slope is 3 percent
- The information provided below presents the tasks and requirements provided by the WDNR landfill regulations associated with landfill siting through post-closure monitoring.

General Landfill Siting Process

All Wisconsin landfills must obtain both state licensing and any applicable local approvals prior to construction. The landfill licensing process is administered by the WDNR. The local approval process is overseen by the Wisconsin Waste Facility Siting Board. The following sections summarize the tasks and requirements provided by WDNR landfill regulations associated with siting through post-closure monitoring. The costs developed assume completion of these tasks and requirements (Table I1).

Initial Site Inspection (Wisconsin Regulations chs. NR 29 and NR 504, WAC)

The WDNR must first perform an initial inspection of the proposed site to determine if the site has the potential to comply with landfill location criteria and performance standards. An initial

site inspection is also required for all non-commercial soil borrow sources designated to be used for the landfill.
A separate written request must be submitted to the WDNR to arrange for each of the inspections and they both must include:

- A cover letter identifying the applicant, proposed type of landfill and, property ownership, location, and present land use;
- A letter from the WDNR's Bureau of Endangered Resources addressing the known presence of critical habitat areas and state or local natural areas within one mile of the proposed landfill;
- A letter from the Wisconsin State Historical Society identifying the presence of any historical, scientific or archaeological areas within the vicinity of the proposed landfill;
- A map depicting existing conditions within one mile of the proposed boundaries of the proposed landfill; and,
- A preliminary identification of all potential conflicts with the location criteria and performance standards.

The soil borrow source written request also includes preliminary identification of all potential adverse effects on wetlands, critical habitat areas or surface waters.

During the inspection, WDNR staff will evaluate if the proposed landfill is within a floodplain, wetlands, a critical habitat area, or an area with historical / archaeological features. The WDNR will also evaluate the setback distances from the anticipated landfill footprint to navigable waters, state and federal highways, public parks, airports and water supply wells.
It is estimated that one month will be required to complete the initial site inspection process.
The WDNR estimates that their review and analysis of the proposed site will be completed two to four weeks after the initial inspection has been performed if no follow up evaluations or studies are necessary.

Initial Site Report (NR 509)

The next step in the landfill licensing process is to submit an Initial Site Report (ISR), which allows for an opinion from the WDNR on whether a proposed property has potential for development as a landfill before a more extensive feasibility report is prepared. The following landfill information must be determined and submitted with the ISR:

- A description of the proposed property and the anticipated limits of filling;
- Proposed landfill life and disposal capacity;
- Industries to be served;
- Anticipated waste types, characteristics and amount of waste to be handled;
- Anticipated cover frequency;
- Mode of operation;
- The anticipated landfill subbase, base and final grades; and,
- A thorough discussion of the land uses which may have an impact on the suitability of the property for waste disposal or on groundwater quality, including a summary of the

available published information concerning the regional geotechnical characteristics of the proposed location.

The WDNR will review the ISR and write an opinion letter on the proposed property's potential for development as a landfill.

It is estimated that the report can be completed in one to two months. The WDNR estimates that their review and analysis of the ISR will take three months (one month to determine if the initial site report is complete and two additional months to determine if the proposed property has potential, limited potential, or little or no potential for development as a landfill).

Local Approval Process

Any applicable permits or approvals required by pre-existing local ordinances to construct or operate a landfill must be obtained during the WDNR technical decision-making process. These approvals vary from one municipality to another, but typically include such items as zoning variances and building permits. If a negotiated agreement cannot be reached between the local governing bodies and the landfill owner regarding the local approvals, arbitration between the parties, performed by the Wisconsin Waste Facility Siting Board, may be necessary.

The local approval process, if started early enough, should not greatly delay landfill construction because it can be performed simultaneously with the more time-intensive WDNR technical decision-making process.

Pre-Feasibility Report (NR 510)

Performing a pre-feasibility investigation and report is not required. However, it is recommended that this step because it allows the WDNR to make an opinion on the site based on geotechnical information prior to performing the larger scope feasibility study investigation.

The following must be performed and submitted in the feasibility report:

- A site-specific geologic and hydrogeologic investigation and reporting; and,
- A field investigation and soil test results for any non-commercial soil borrow source.

The cost estimate is based on the following scope of work, which includes approximately one-third of the soil borings and monitoring well installations that are required for the feasibility report investigation:

Site Investigation

- Five site borings would be advanced to approximately 25 feet below ground surface;
- Three observation wells and two piezometers would be installed;
- Laboratory tests would consist of two hydraulic conductivity test, five Atterberg limit tests, and five grain size / hydrometer tests;
- Slug testing would be performed in each well to determine the in-situ hydraulic conductivity; and,

- Water level measurements would need to be obtained on a monthly basis for six months (prior to submittal of the feasibility report) from all observation wells, piezometers and from all surface water bodies located within 1,000 feet of the proposed limits of filling until the pre-feasibility report is submitted.

Borrow Source

- Four test pits would be excavated at the clay borrow source; and,
- Laboratory tests would consist of one Modified Proctor test for compaction effort and optimal moisture content, one hydraulic conductivity test (for the Proctor test at or above optimal water content), eight Atterberg limit tests, and eight grain size / hydrometer tests.

It is estimated that four months are needed to complete the pre-feasibility investigation and report.

Feasibility Report (NR 512)

The extensive feasibility investigation and report provides all data necessary for the WDNR to determine if the proposed landfill can be developed from a technical standpoint.
The following must be performed and submitted in the feasibility report:

- A comprehensive and detailed site-specific geologic and hydrogeologic investigation and reporting that includes baseline groundwater quality data;
- A field investigation and soil test results for any non-commercial soil borrow source;
- A preliminary engineering design;
- An environmental assessment, including the existing environment, proposed site physical changes, environmental consequences from landfill operation;
- Waste characterization, as well as leachate characterization and generation estimates;
- An analysis and discussion if conditions are favorable or unfavorable for the development of the proposed landfill, including location criteria and performance standards, site geotechnical information, and construction and operation requirements;
- Documentation of the need for the proposed landfill; and,
- An analysis of the alternatives to landfilling.

It is assumed the following scope of work would be performed for the above ground landfill and borrow site field investigation:

Site Investigation

- Eleven site borings would be advanced to approximately 25 feet below ground surface;
- Five observation wells and six piezometers would be installed;
- Laboratory tests would consist of six hydraulic conductivity test, 15 Atterberg limit tests, and 15 grain size / hydrometer tests;
- Slug testing would be performed in each newly installed well to determine the in-situ hydraulic conductivity;

- Water level measurements would need to be obtained on a monthly basis (for a minimum of 6 months prior to submitting the feasibility report) from all observation wells, piezometers, and from all surface water bodies located within 1,000 feet of the proposed limits of filling. After the feasibility report is submitted, quarterly water level measurements would be obtained for at least one additional year; and,
- Four rounds of baseline groundwater monitoring would be performed on all installed observation wells and piezometers (will be submitted with the feasibility report).

Borrow Source

- Ten test pits would be excavated at the clay borrow source; and,
- Laboratory tests would consist of two Modified Proctor tests for compaction effort and optimal moisture content, two hydraulic conductivity tests (one for each Proctor test at or above optimal water content), 20 Atterberg limit tests, and 20 grain size / hydrometer tests.

The proposed preliminary design included in the feasibility report must include preliminary materials balance calculations for the necessary volume of clay, proposed methods for leachate and gas control, proposed operating procedures including the general sequence of filling, a description of the proposed groundwater, leachate, surface water, gas, air, unsaturated zone and other monitoring programs, proposed methods for storm water control, proposed final site use, and preliminary engineering drawings.
It is estimated that 8 to 10 months will be required to complete the feasibility investigation and report.

WDNR Environmental Analysis and Public Hearings (NR 150)

After reviewing the feasibility report, the WDNR hydrogeologist prepares an analysis of any impacts the proposed project would have on the public's health, welfare and the environment and recommends whether or not an Environmental Impact Statement (EIS) should be completed. If an Environmental Impact Statement (EIS) is completed, the WDNR feasibility completeness determination is delayed until the EIS is finished and a public hearing on its completeness is held. Due to the uncertainty of what the WDNR may be required for the EIS, a range of costs are provided on Table 1C for performing the EIS.

A public notice is published and an informational public hearing can be requested or a contested case hearing be held on the technical feasibility of any landfill. If no hearing is requested, the plan review team considers the public comments received before writing the feasibility determination.
The WDNR estimates that the completion of the associated public hearing could take up to a year. The WDNR also estimates that their review and overall completion of the feasibility step may range from six months to more than three years, if an EIS is required.

Plan of Operation Report (chs. NR 514, NR 507)

After the WDNR has approved the feasibility report, a plan of operation report can be completed. There is usually at least one meeting between the applicant and the WDNR to discuss the feasibility conditions of approval prior to the submittal of the plan of operation report.
The following must be submitted in the plan of operation report:

- Final engineering design of the landfill;
- Design calculations;
- Details and specifications for the construction;
- Proposed construction documentation;
- Sequencing of filling operations;
- Daily landfill operations;
- Site monitoring during filling;
- Cover design;
- Long-term care and monitoring of the proposed landfill after closure; and
- A detailed estimate of the costs for construction, operation, closure and long-term care of the landfill.

It is estimated that five to six months will be required to complete the plan of operation report. The WDNR estimates that their review of a plan of operation will take three to six months.

Bid Document

After the plan of operation report is approved, bid documents will be developed for the contractors bidding on landfill construction. The bid documents will include:

- Construction specifications;
- Construction drawings;
- Bid forms;
- Contract documents; and,
- All other forms and documents necessary for bidding the landfill construction.

It is estimated that the time to complete the bid documents is three to four months.

Landfill Construction

Landfill construction will commence after all local and WDNR approvals have been obtained. Using the Wisconsin state regulations, a preliminary design was prepared for an approximate 21 acre, 300,000 cubic yards capacity above ground landfill with the following liner system (from bottom to top):

- Four foot thick barrier layer of compacted clay;
- Nominal 60−mil or thicker geomembrane liner;

- One foot thick sand leachate collection layer with leachate collection pipes no greater than 130 feet apart; and
- 12-oz geotextile layer.

Perimeter soil berms will also need to be constructed for the above ground landfill on which the 3 Horizontal to 1 Vertical (3H:1V) side slopes of the landfill can be constructed.
The estimated quantities and costs for constructing the components of the liner system are listed in the attached cost tables. This cost also includes construction oversight and quality assurance testing and construction quality control.
It is estimated that the time to construct the above ground landfill may range between eight and ten months, and will depend on the contractor's ability to haul and place large volumes of material and the weather conditions.

Landfill Liner Construction Completion Report (NR 516)

After construction, a comprehensive report containing a detailed as-built description and documentation of the construction of the landfill must be submitted, including:

- Surveys of various grades;
- Field and laboratory soil and geosynthetics test results;
- Engineering drawings documenting the constructed grades;
- The precise location of all leachate collection storage and removal structures;
- The specifications of materials; and
- Photo documentation.
- After the documentation report and the proofs of financial responsibility have been approved and a final WDNR site inspection is made, the WDNR will issue a license allowing the landfill to accept waste.

It is estimated that the time to complete the landfill construction documentation report to be three to four months. The WDNR estimates that their review of the report will take one month.

Landfill Closure and Post-Closure Monitoring Plan Report

Costs for closure and post-closure monitoring of the landfill are included with the plan of operation report. A separate closure report may be required if remediation for groundwater or surface water contamination or control gas migration is necessary. Costs for preparing a separate closure report are not included.

Landfill Cover Construction

Using the requirements of the WDNR, a preliminary design was created for the following cover system (from bottom to top):

- One foot thick sand grading layer and passive gas extraction system over the waste with passive gas collection piping lines and gas venting wells embedded within the sand grading layer;
- Two foot thick barrier layer of compacted clay;
- Nominal 40−mil or thicker geomembrane liner;
- 2.5 foot thick drainage and rooting zone layer, including a one foot sand drainage layer (hydraulically connected to perimeter drain pipes at the bottom of the cover) and a 1.5 foot thick soil rooting zone; and,
- 0.5 foot thick topsoil layer to support vegetation.

The estimated quantities and costs for constructing the components of the cover system are provided in the attached tables. This cost also includes construction oversight and quality assurance / quality control testing and construction.

It is estimated that the time to complete the cover construction range between four and six months, and will depend on the contractor's ability to haul and place large volumes of material and the weather conditions.

Landfill Cover Construction Completion Report (NR 516)

After cover construction is complete, a comprehensive report containing a detailed as-built description and documentation of the cover construction will be submitted. This report includes:

- Surveys of the final grades of the refuse material and each of the cover soil layers;
- Field and laboratory soil and geosynthetic test results;
- Engineering drawings documenting the grades of the constructed layers;
- Detail drawings and the location of gas extraction structures;
- The rates and types of fertilizer, seed, and mulch applied; and,
- Photo documentation.

It is estimated the time to complete the landfill construction documentation report to range between three to four months.

Post-Closure Monitoring (NR 507)

The plan of operation report includes a plan for post-closure monitoring of the landfill for a period of 40 years. Post-closure monitoring includes:

Inspection and maintenance of cover vegetation, storm water control structures, ground surface settlement or siltation, erosion damage, gas and leachate control features;
Gas, leachate and groundwater monitoring and reporting; and,
Other long-term care needs.

A figure (Figure I-1) depicting the conceptual landfill design is presented below.

Table I-1 Summary of Costs for Siting, Permitting, Construction and Maintenance of an Off-site ch. NR 500 Permitted Landfill

Process	Estimated Cost
Initial Site Inspection	$17,860
Initial Site Report	$27,180
Local Approvals	$16,100
Pre-Feasibility Report	$70,885
Feasibility Report	$165,790
Environmental Assessment*	$250,000
Public Hearings	$20,260
Plan of Operation Report	$286,370
Bid Documents	$87,280
Construction of Landfill/Cover	$10,311,220
Landfill Construction Completion Report	$53,340
Cover Construction Completion Report	$42,620
Load and Transport all Sediment and Soil	$2,463,615
Post Closure Monitoring (40-years)	$1,288,350
Subtotal	$15,100,870
Contingency (20%)	$3,020,174
Estimated Total Cost	$18,121,044

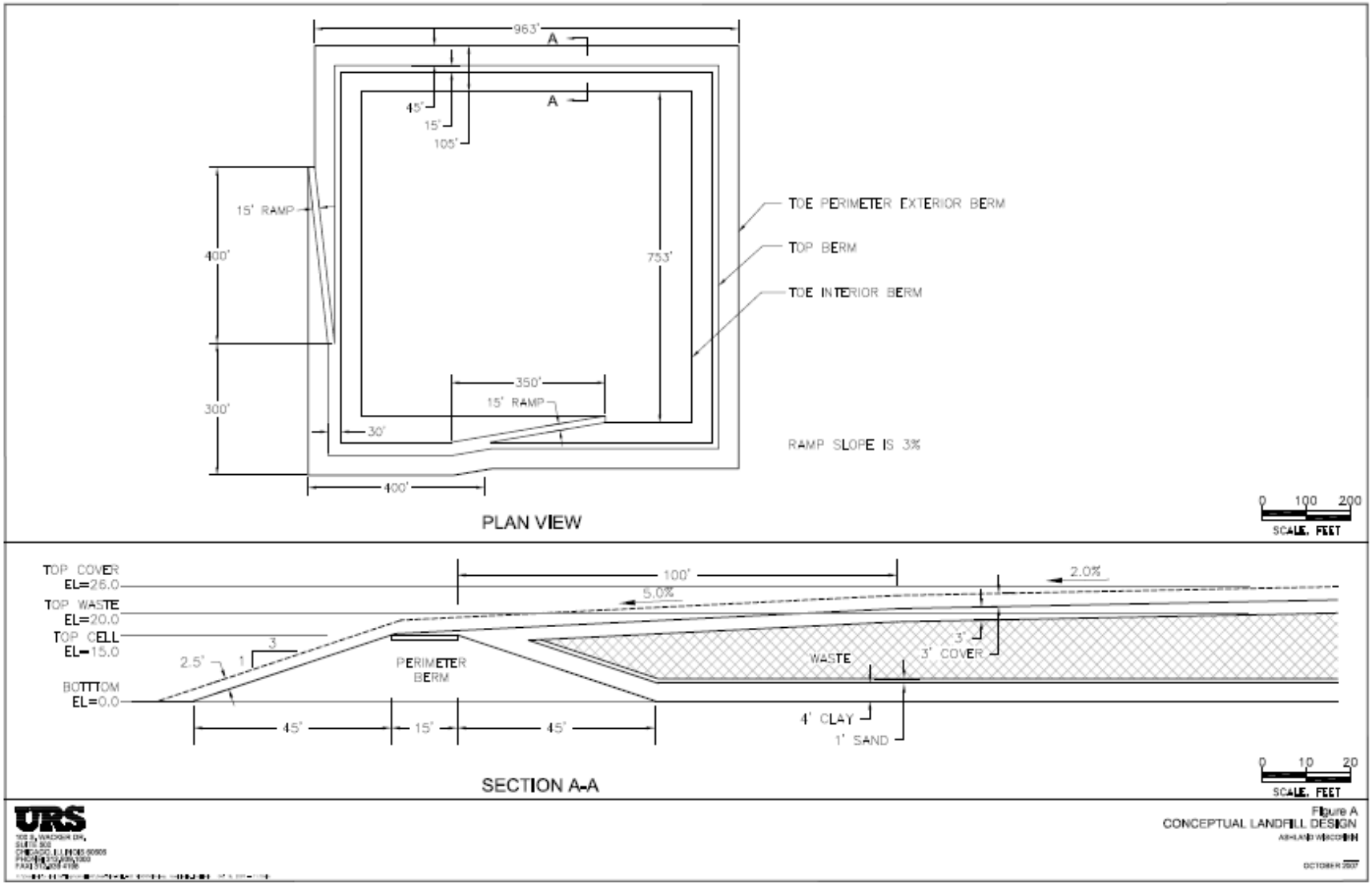


Figure 1-I: Conceptual landfill design.

BASE MAP SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, ASHLAND, WISCONSIN, DATED 1964, PHOTOREVISED 1975.

QUADRANGLE LOCATION

NORTH

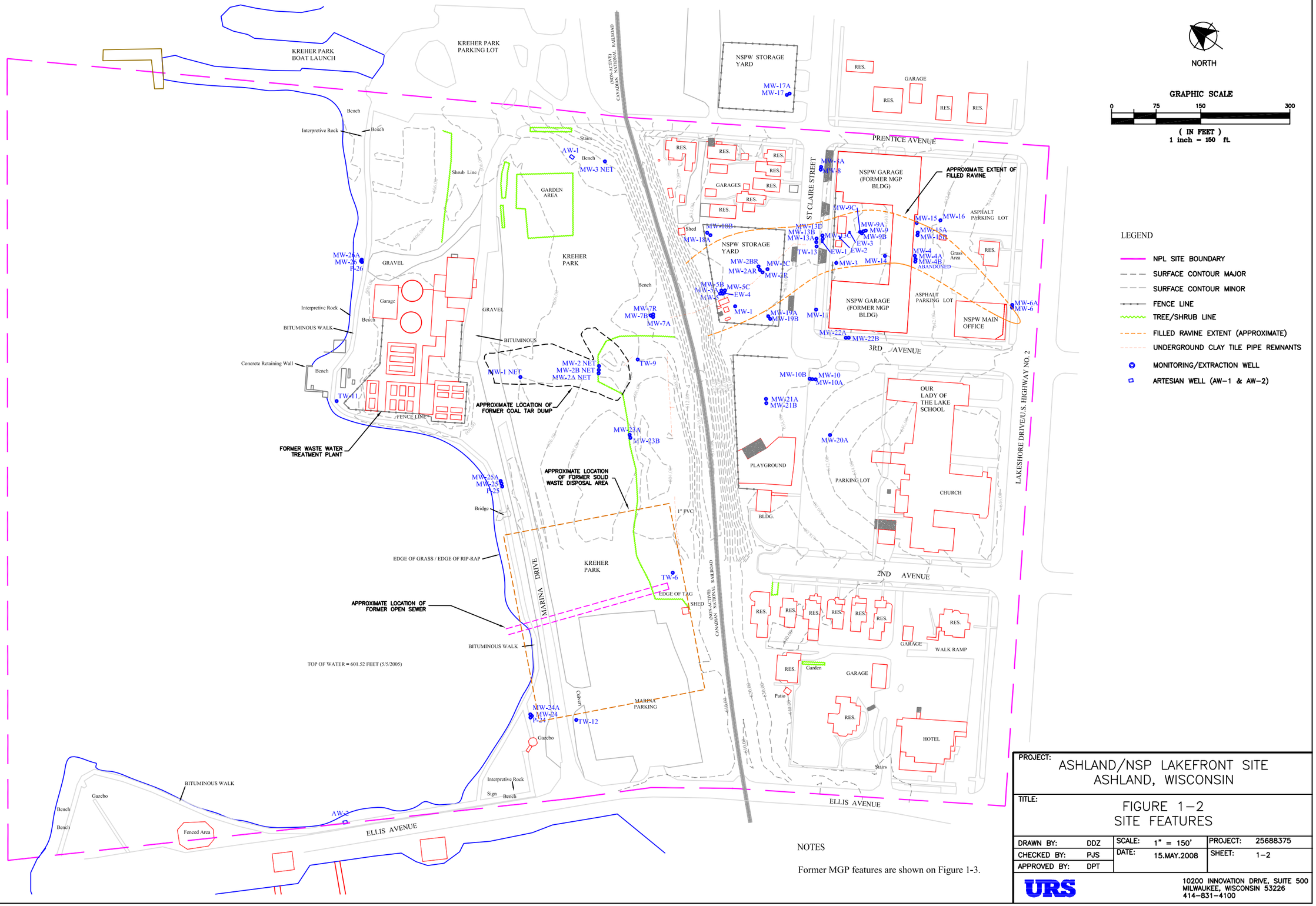
0 1320 2640 5280

SCALE IN FEET

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN		
TITLE: FIGURE 1–1 SITE LOCATION		
DRAWN BY: DDZ	SCALE: 1" = 2640'	PROJ. NO. 25688375
CHECKED BY: PJS	DATE: 15.MAY.2008	SHEET: 1–1
APPROVED BY: DPT		

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



NOTES

Former MGP features are shown on Figure 1-3.

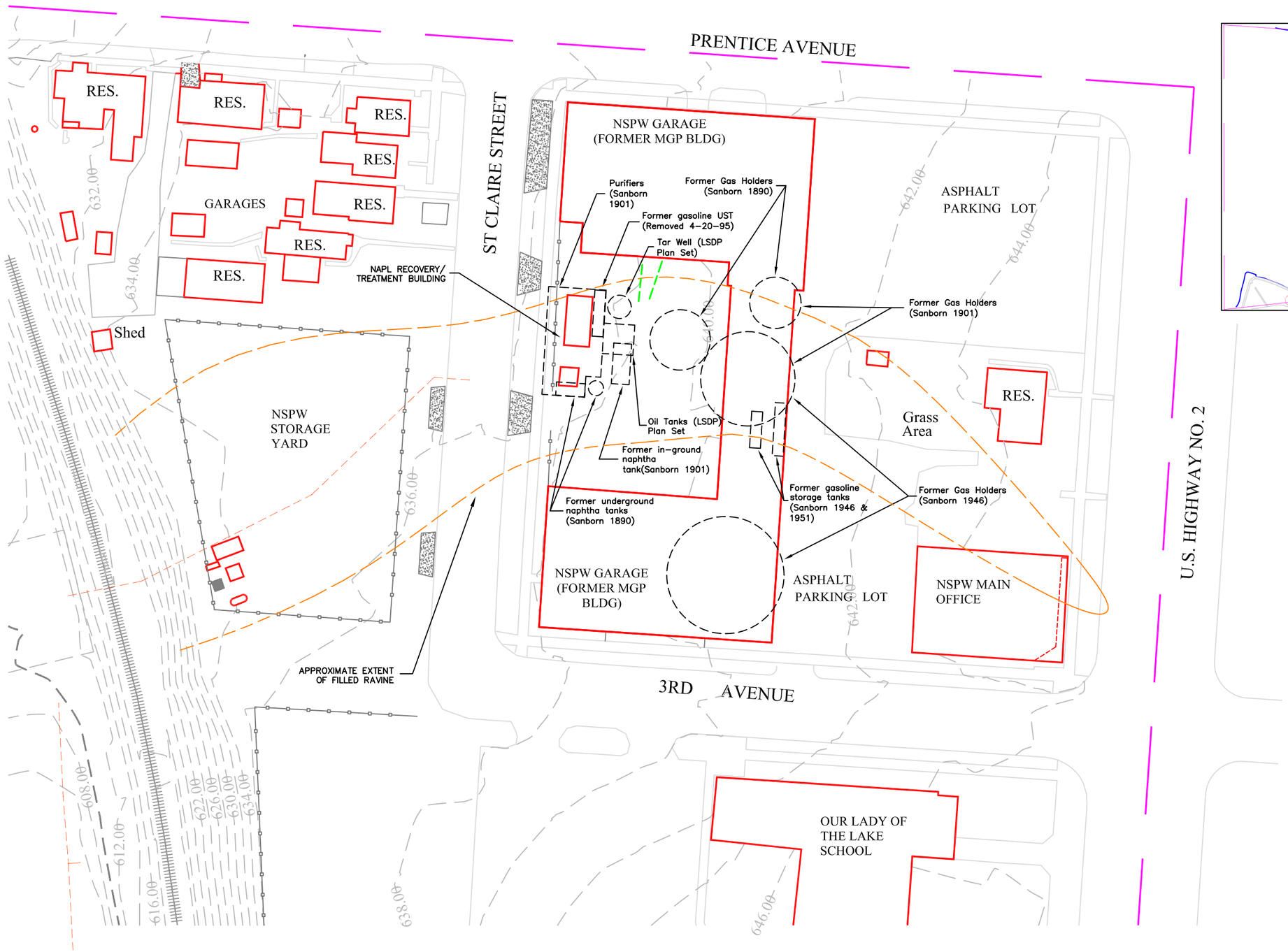
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: FIGURE 1–2
SITE FEATURES

DRAWN BY: DDZ	SCALE: 1" = 150'	PROJECT: 25688375	
CHECKED BY: PJS	DATE: 15.MAY.2008	SHEET: 1–2	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



OVERVIEW MAP

NORTH

GRAPHIC SCALE

0 30 60 120

(IN FEET)
1 inch = 60 ft.

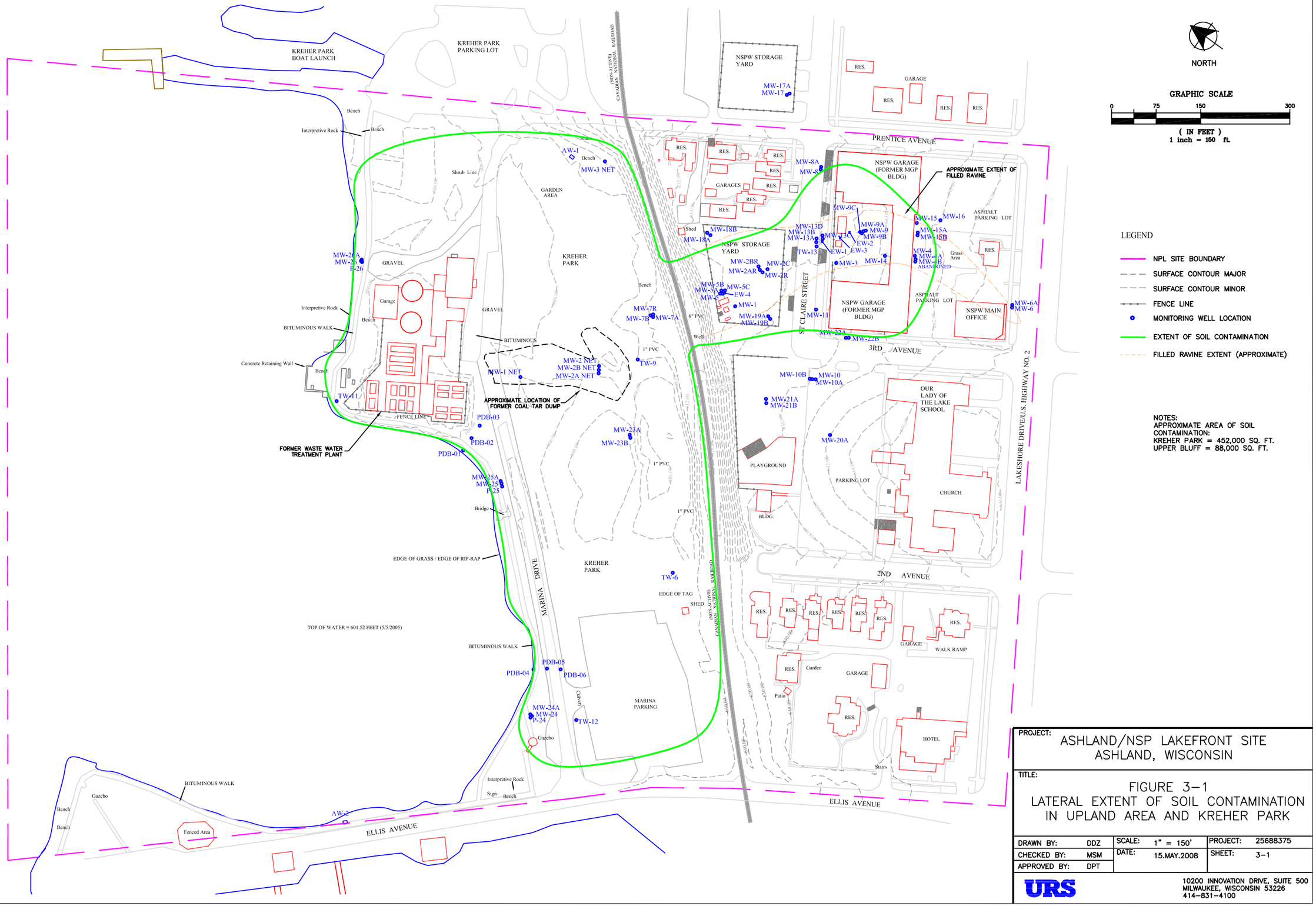
LEGEND

- NPL SITE BOUNDARY
- SURFACE CONTOUR MAJOR
- SURFACE CONTOUR MINOR
- FENCE LINE
- FILLED RAVINE EXTENT (APPROXIMATE)
- UNDERGROUND PIPE REMNANTS
- UNDERGROUND CLAY TILE PIPE REMNANTS

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: FIGURE 1-3 FORMER MGP FEATURES			
DRAWN BY: DDZ	SCALE: 1" = 60'	PROJECT: 25688375	
CHECKED BY: PJS	DATE: 15.MAY.2008	SHEET: 1-3	
APPROVED BY: DPT			

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



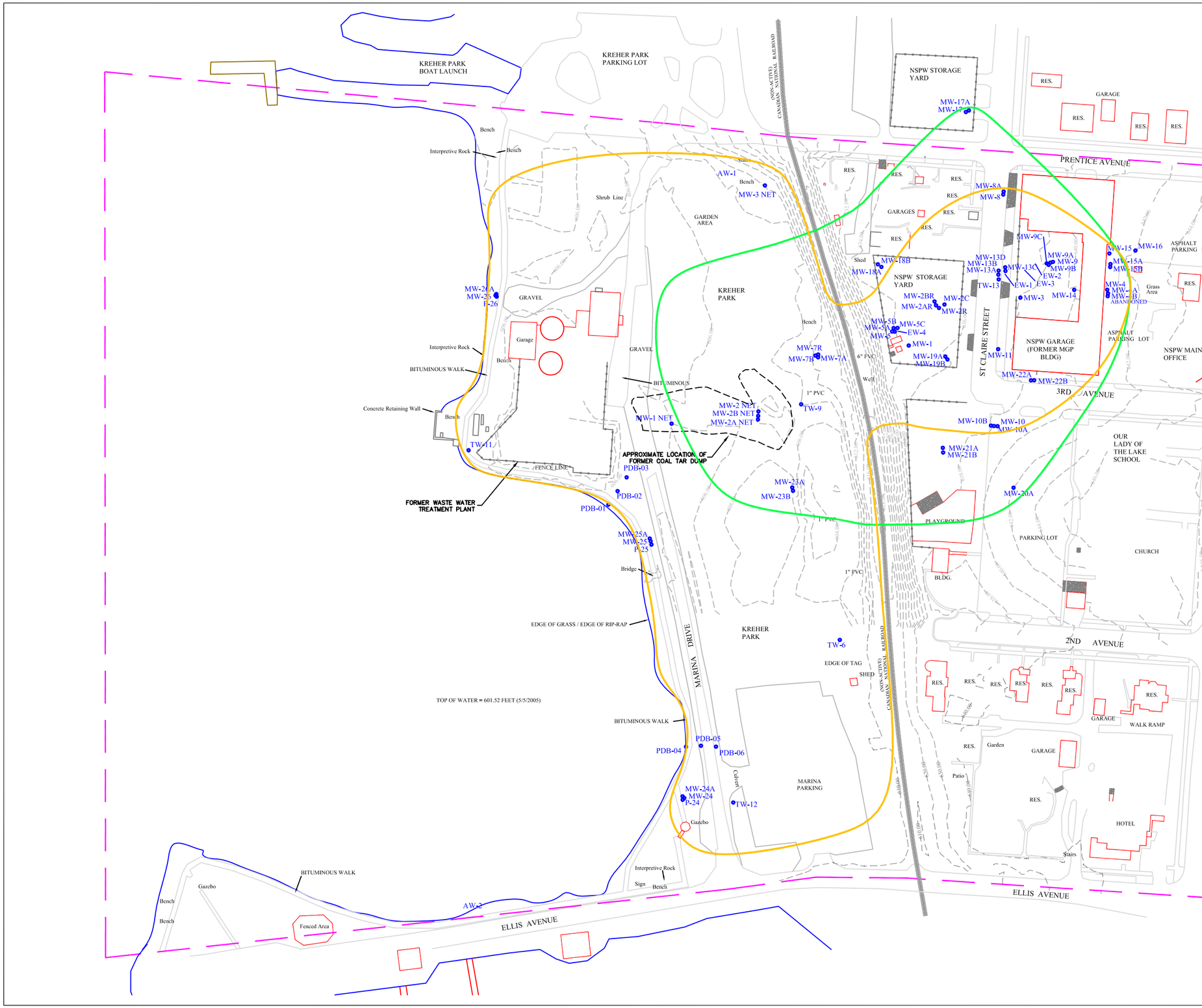
PROJECT:
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE:
FIGURE 3–1
LATERAL EXTENT OF SOIL CONTAMINATION IN UPLAND AREA AND KREHER PARK

DRAWN BY:	DDZ	SCALE:	1" = 150'	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	3–1
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100



NORTH

GRAPHIC SCALE

0 75 150 300

(IN FEET)
1 inch = 150 ft.

LEGEND

- NPL SITE BOUNDARY
- SURFACE CONTOUR MAJOR
- SURFACE CONTOUR MINOR
- FENCE LINE
- MONITORING WELL LOCATION
- EXTENT OF GROUNDWATER CONTAMINATION – SHALLOW
- EXTENT OF GROUNDWATER CONTAMINATION – COPPER FALLS

NOTES:
APPROXIMATE AREA OF GROUNDWATER CONTAMINATION FOR SHALLOW WELLS:
KREHER PARK = 452,000 SQ. FT.
UPPER BLUFF = 118,000 SQ. FT.

APPROXIMATE AREA OF GROUNDWATER CONTAMINATION FOR COPPER FALLS WELLS:
KREHER PARK = 103,000 SQ. FT.
UPPER BLUFF = 198,000 SQ. FT.

PROJECT:
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE:
FIGURE 3–2
LATERAL EXTENT OF SHALLOW AND DEEP GROUNDWATER CONTAMINATION

DRAWN BY:	DDZ	SCALE:	1" = 150'	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	3–2
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414–831–4100

Legend

All Sed Results - Total PAH ppm

Total PAH ppm

- ND
- 1 - 5
- 6 - 10
- 11 - 100
- 101 - 200
- 201 - 1000
- >1000

0 50 100 200 300 400 Feet

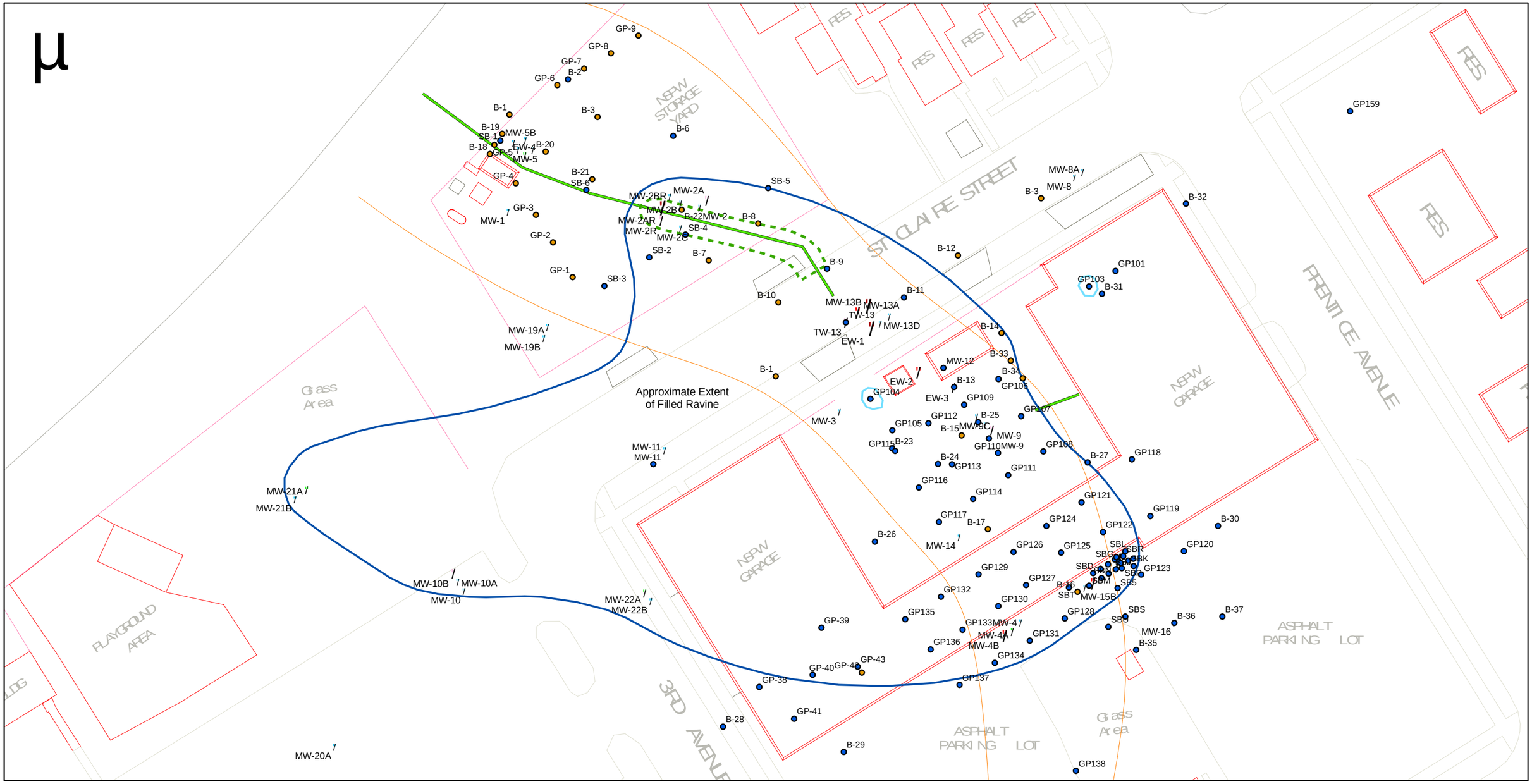
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-3
Area of Impacted Sediment

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	3-3
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

Free Product thickness (feet)
Maximum by well

- 0
- 0.1 - 1
- 1.1 - 5
- 5.1 - 10
- 10.1 - 26.3
- Historical Soil Borings
- Soil Sample Locations

Free Product Extent
Label

- April 2005 geoprobes
- Copper Falls wells
- Free Product Extent Inferred - Filled Ravine
- Free Product Extent - Filled Ravine
- 2001 Clay Tile Investigation

0 25 50 75 100 Feet

Note:
Free product extent between TW-13 and MW-2R is based on recent data, which indicates the free product plume in this area is significantly declining (dashed line where inferred).
Free product is assumed to approximate trace of clay tile which was removed in 2001.
Wells MW-2, MW-2A, and MW-2B were abandoned during the 2001 clay tile investigation.
Historical soil borings indicate locations with no associated laboratory data.

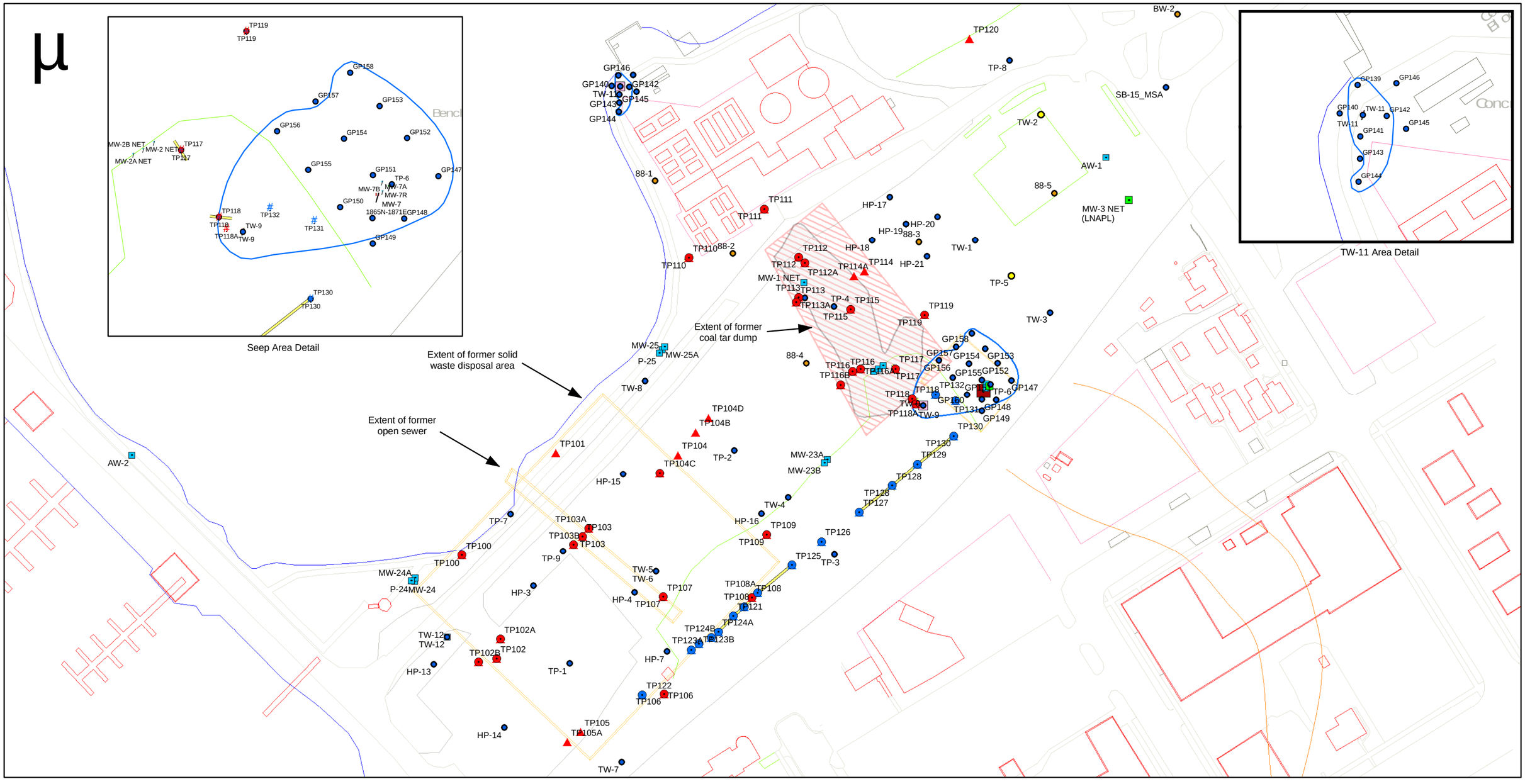
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 3-4
Extent of DNAPL in
Upper Bluff, Filled Ravine, and Copper Falls

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	3-4
APPROVED BY:	DPT				

URS

10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100



Legend

Free Product thickness (feet)

Maximum by well

- 0
- 0.1 - 1
- 1.1 - 5
- 5.1 - 10
- 10.1 - 26.3

- 2005 RI clay pipe investigation
- Free Product Extent - Kreher Park
- Removal - Soil Excavation

- Soil Sample Locations
- Historical Soil Borings
- 1994 Locations

Test Pit locations with LNAPL

Event Date

- Nov 2005
- June 2005

Test Pit locations without LNAPL

Event Date

- Nov 2005
- June 2005

0 37.5 75 150 225 300 Feet

Note:
Defined boundaries shown at seep area and TW-11 indicate probable extent of DNAPL.
Symbols denoting LNAPL where encountered in borings and test pits are shown seperately.
Well MW-7 was abandoned during the 2002 seep remediation.
Historical soil borings indicate locations with no associated laboratory data.
1994 locations shown indicated oily sheen in soil cuttings in TW-2 and oil present on wood pieces in TP-5.

PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

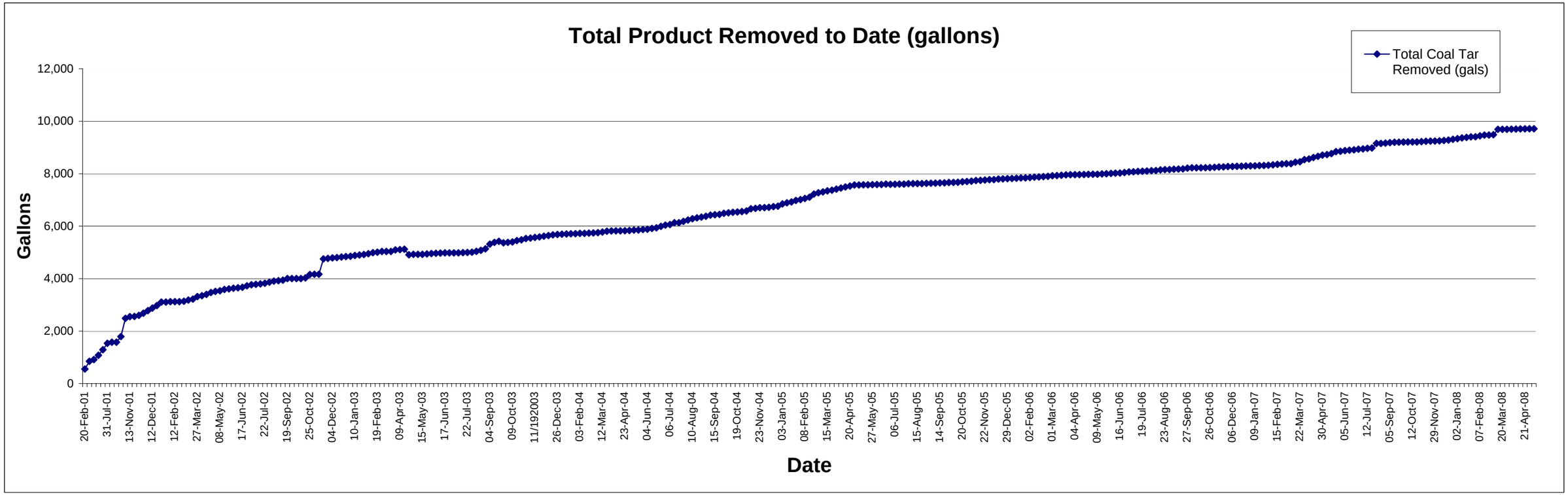
TITLE: Figure 3-5
Extent of DNAPL in Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	3-5
APPROVED BY:	DPT				

URS

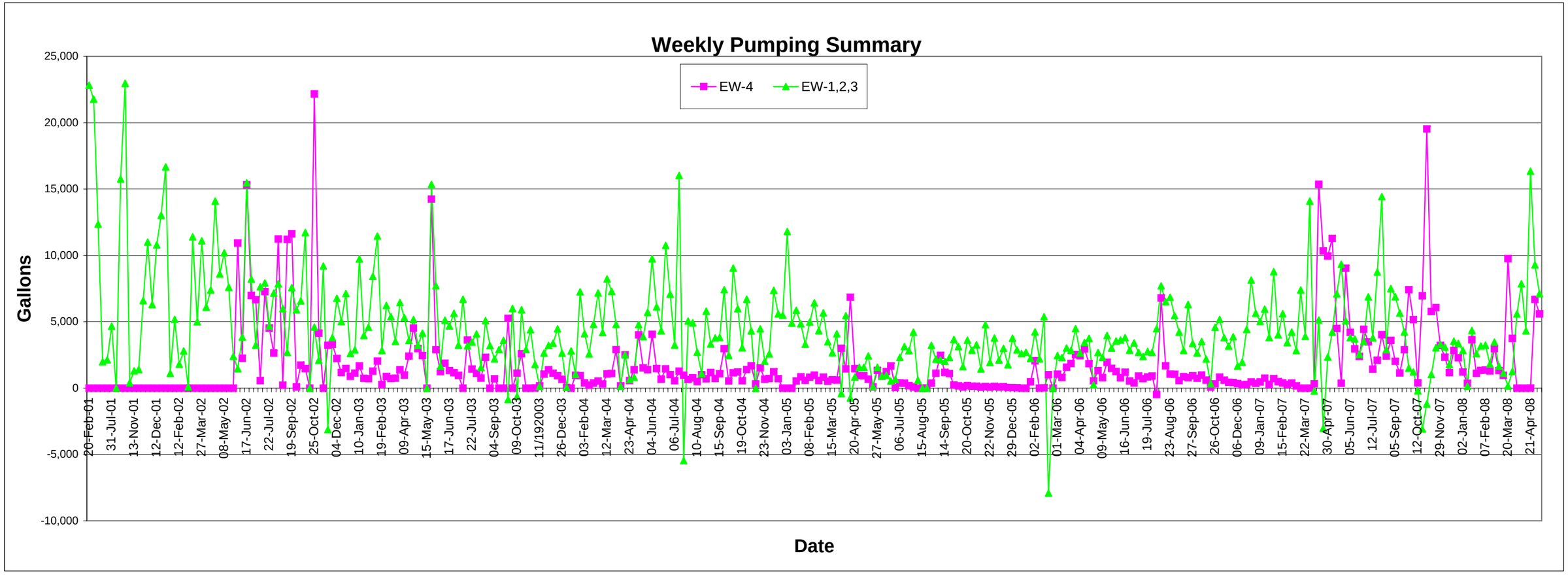
10200 INNOVATION DRIVE, SUITE 500
MILWAUKEE, WISCONSIN 53226
414-831-4100

Figure 4-1
Total Product Removed to Date
Northern States Power, Ashland, Wisconsin

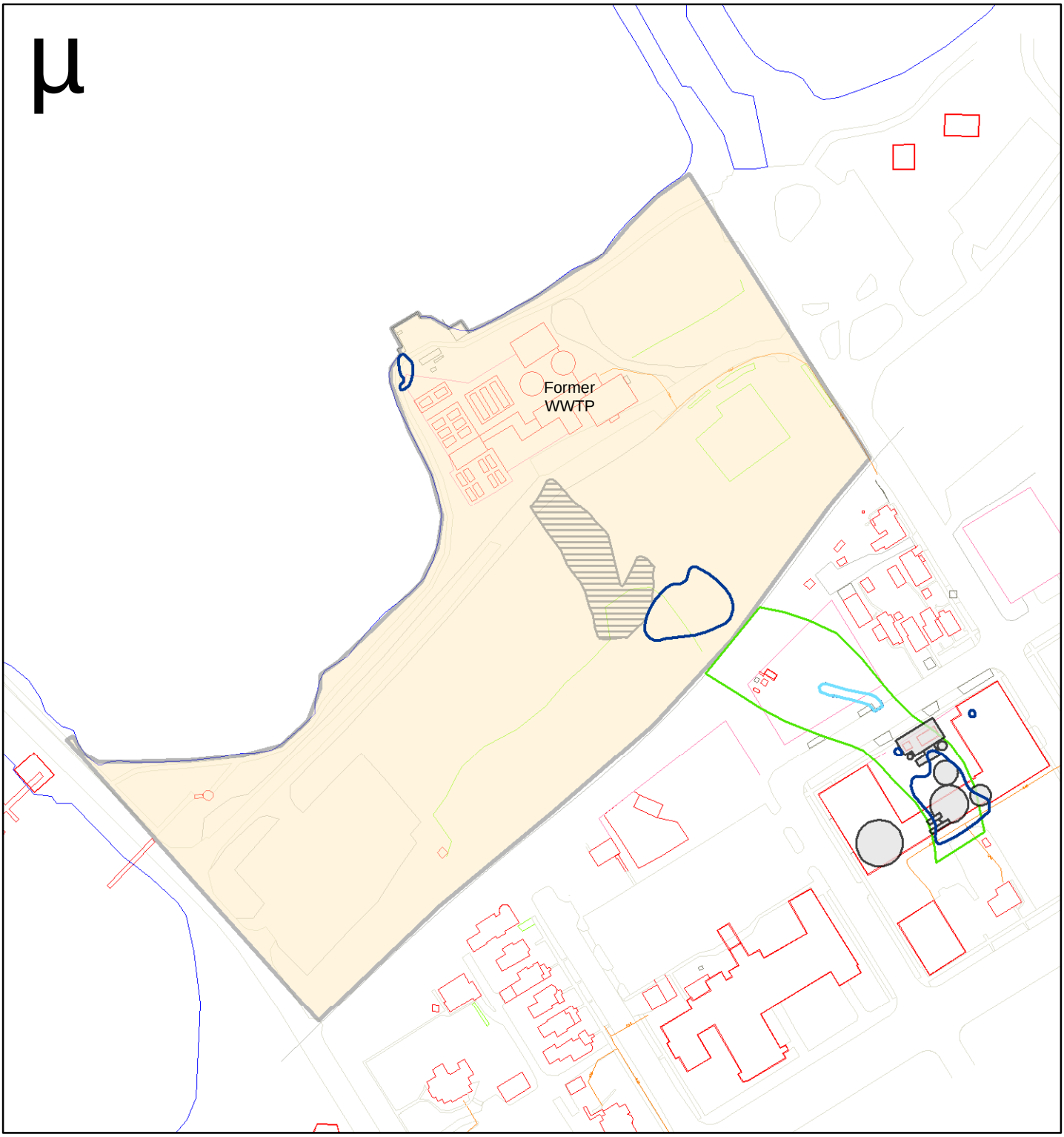


See Table 4-1 for a summary of treatment system volumes.

Figure 4-2
Weekly Pumping Summary
Northern States Power, Ashland, Wisconsin



See Table 4-1 for a summary of treatment system volumes.
Negative numbers indicate corrections made to flow readings due to system maintenance.



Legend

- Clay Tile DNAPL Area
- DNAPL Extent
- Former Coal Tar Dump Area
- Former MGP Tanks/holders
- Filled Ravine - Unlimited Removal Excavation Area
- Kreher Park - Unlimited Removal Excavation Area

0 75 150 225 300 Feet

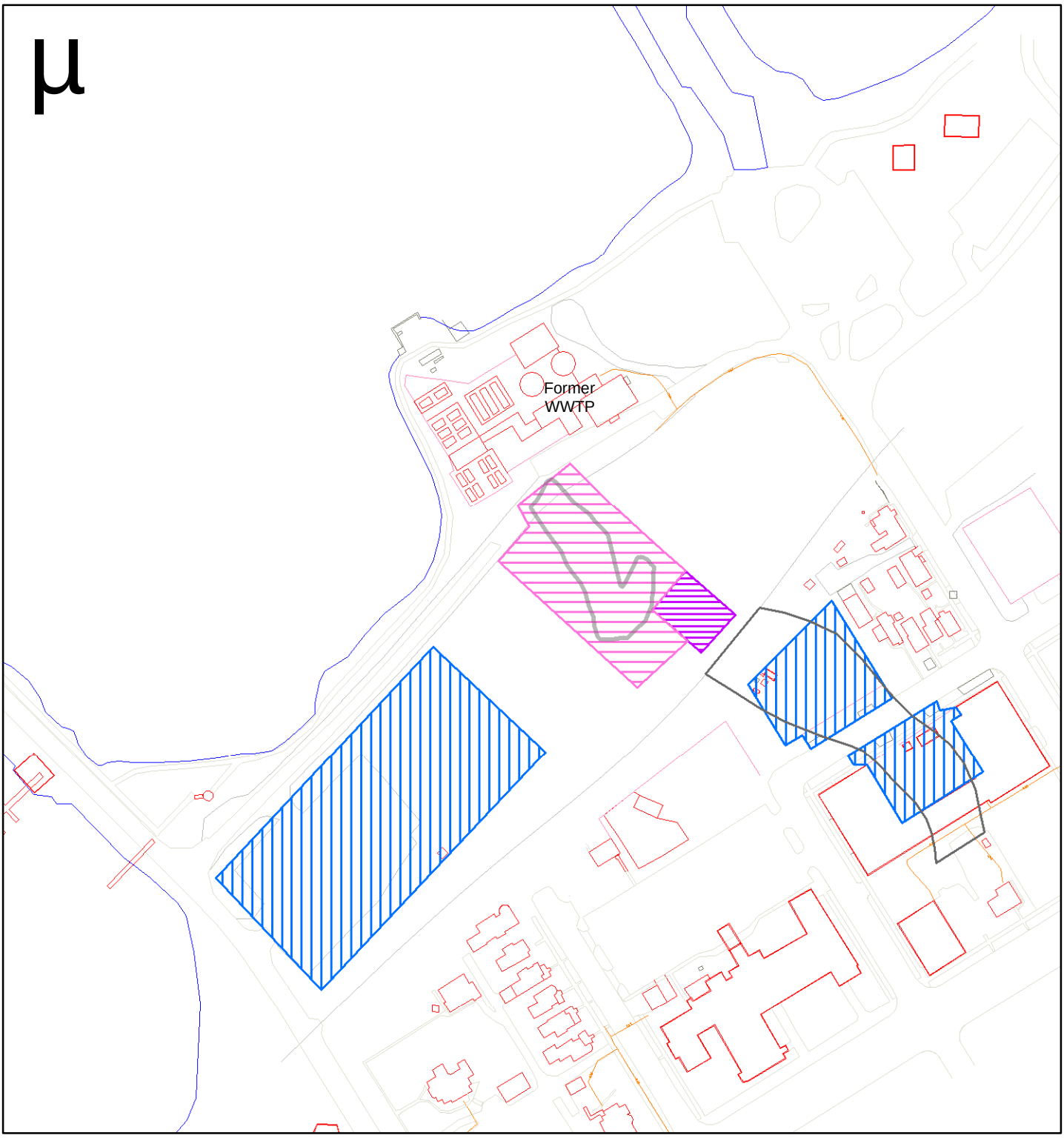
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 6-1
Existing Conditions at
Upper Bluff Area & Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	6-1
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Former Coal Tar Dump Area
- Filled Ravine
- Asphalt pavement (new)
- Low Permeability Clay Cap
- Existing Surface Barrier - Former Seep Area

0 75 150 225 300 Feet

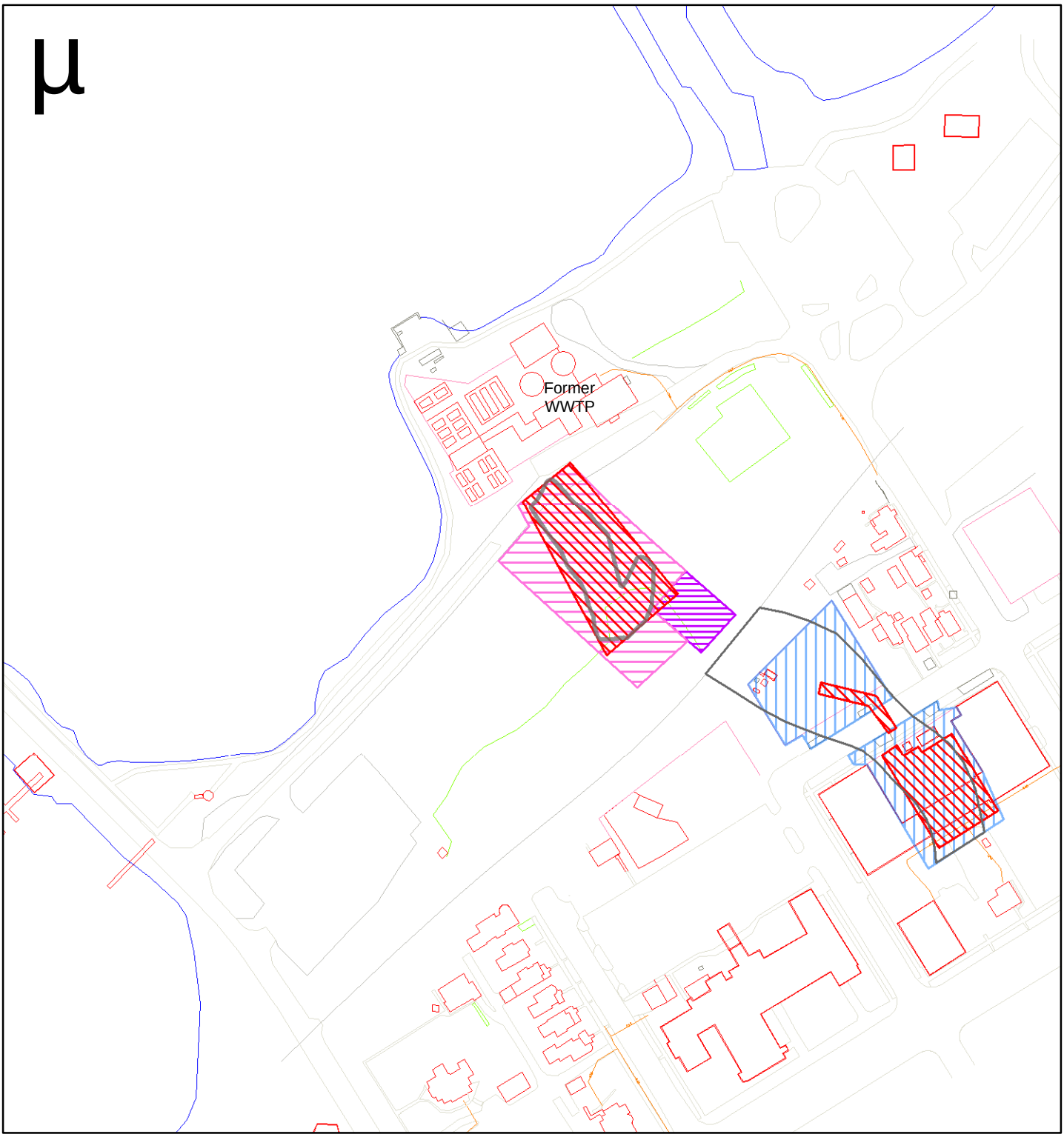
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 6-2
Engineered Surface Barriers
Upper Bluff Area & Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	6-2
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Former Coal Tar Dump Area
- Filled Ravine
- Soil Excavation Area - Limited Removal Area
- Asphalt pavement (new)
- Low Permeability Clay Cap
- Existing Surface Barrier - Former Seep Area

0 75 150 225 300 Feet

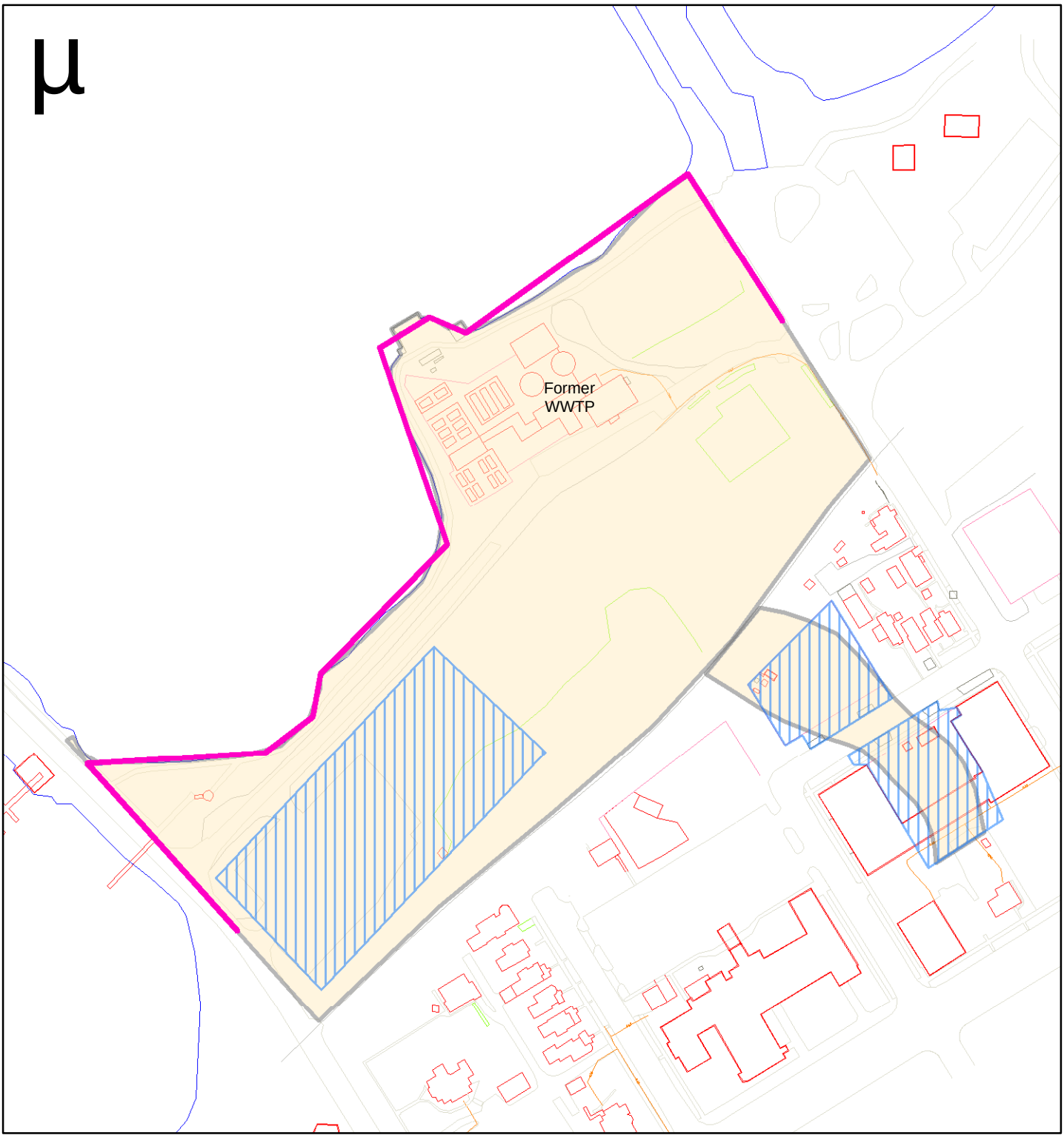
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 6-3A
Limited Removal & Off-site Disposal
Upper Bluff Area & Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	6-3A
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Vertical Barrier Wall
- Asphalt pavement (new)
- Filled Ravine - Unlimited Removal Area
- Kreher Park Extent of Fill - Unlimited Removal Area

0 75 150 225 300 Feet

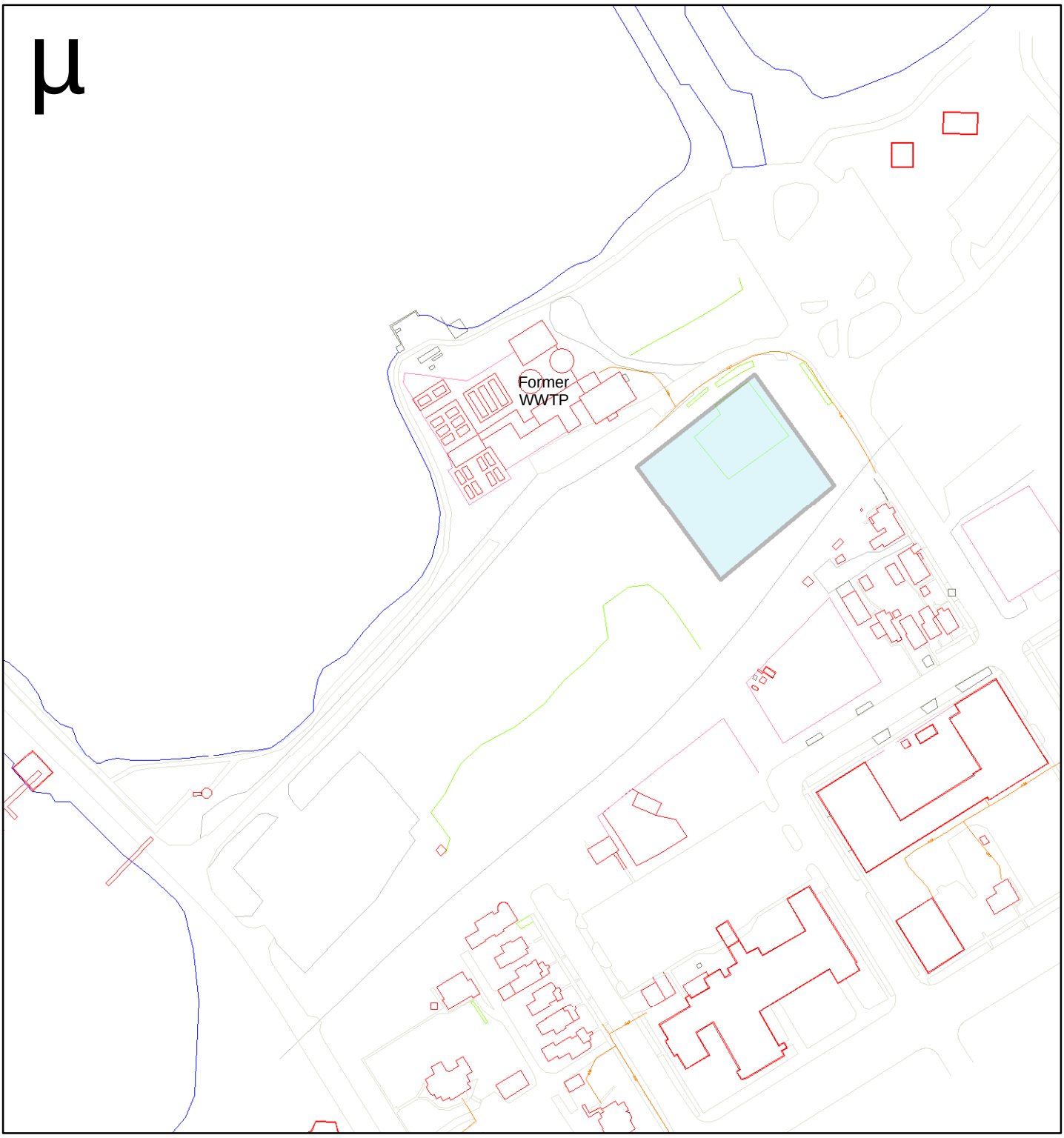
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 6-3B
Unlimited Removal & Off-site Disposal
Upper Bluff Area & Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	6-3B
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

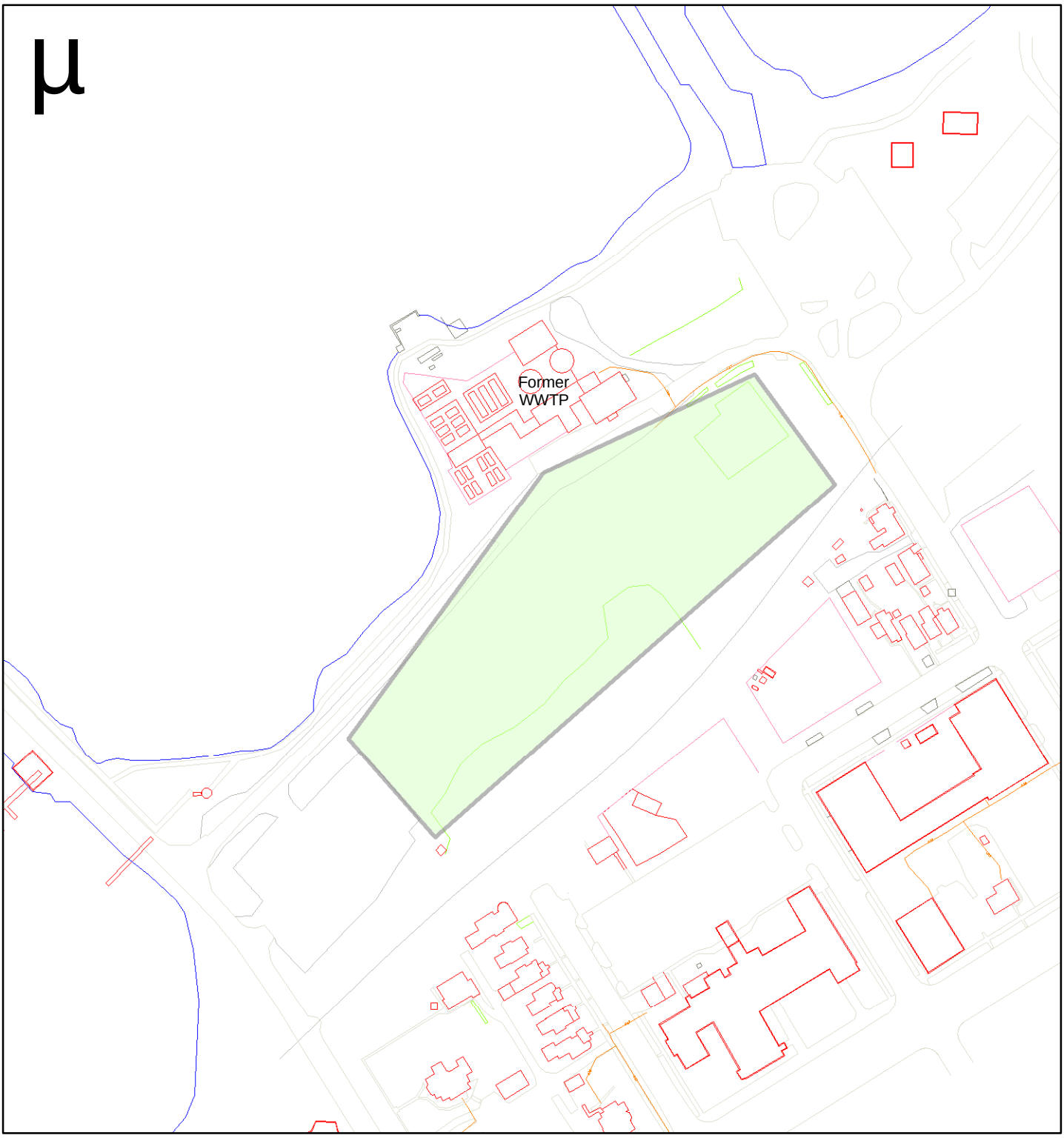
Disposal Cell - Approximately One Acre

0 75 150 225 300 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 6-4A On Site Disposal - Kreher Park One Acre Disposal Cell			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 15.MAY.2008	SHEET: 6-4A	
APPROVED BY: DPT			

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

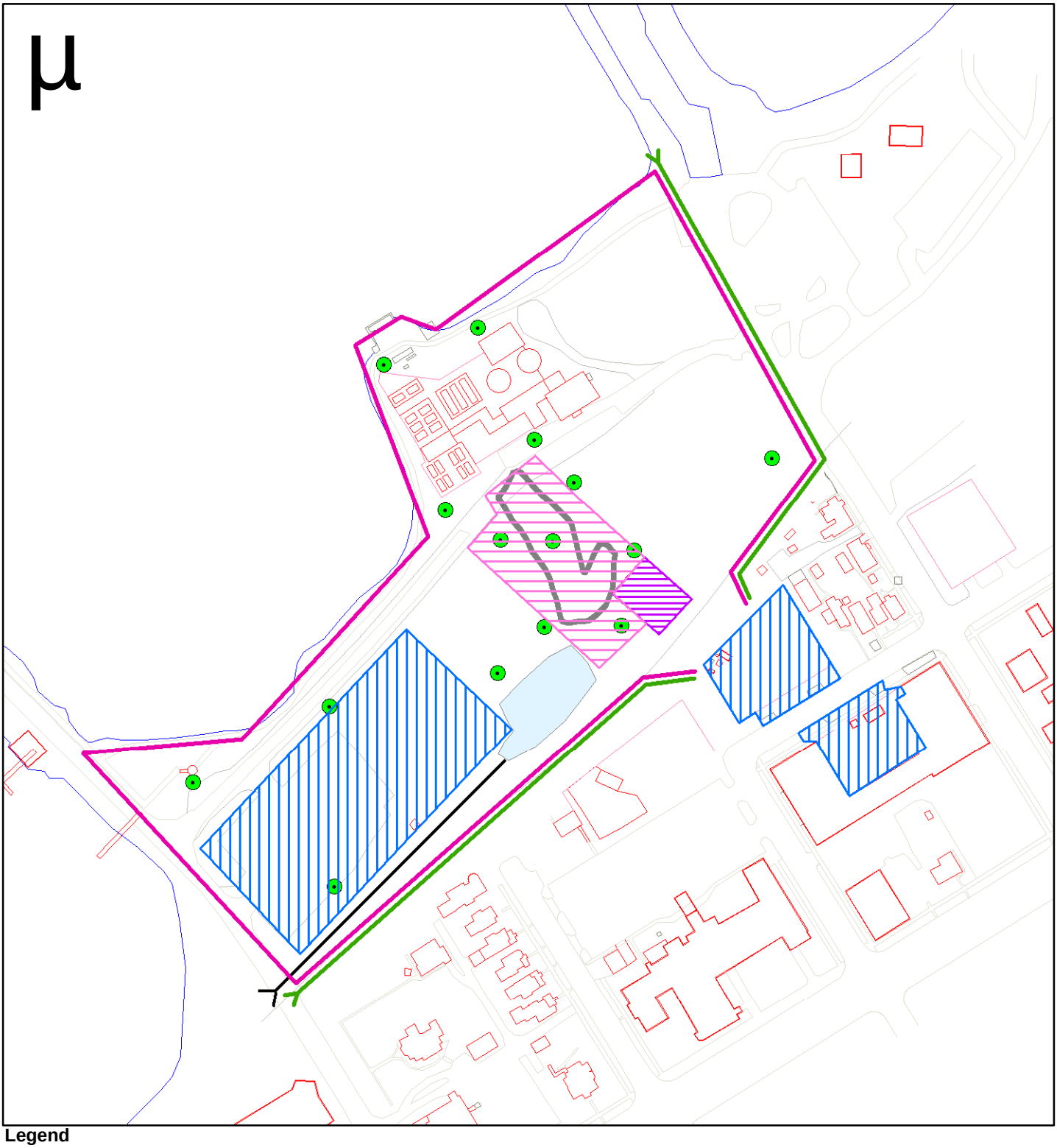
Disposal Cell - Approximately Four Acres

0 75 150 225 300 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 6-4B On Site Disposal - Kreher Park Four Acre Disposal Cell			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 15.MAY.2008	SHEET: 6-4B	
APPROVED BY: DPT			

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Asphalt pavement (new)
- Low Permeability Clay Cap
- Existing Surface Barrier - Former Seep Area
- Vertical Barrier Wall
- Pressure Relief Wells
- Stormwater Outfall
- Stormwater Basin
- Stormwater Diversion Tile
- Former Coal Tar Dump Area

0 75 150 225 300 Feet

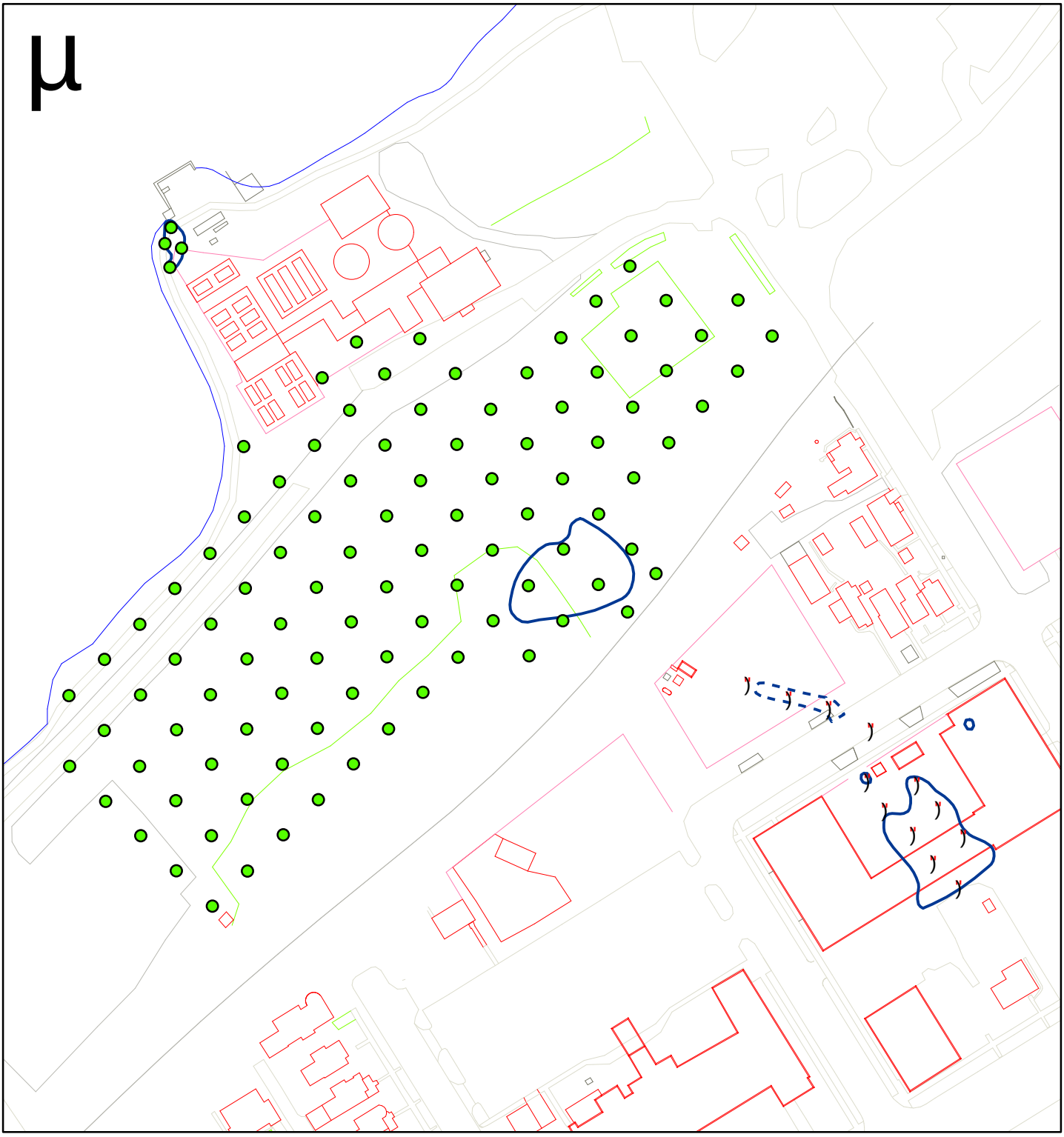
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-1
Containment Using Engineered Surface and Vertical Barriers

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-1
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Clay Tile DNAPL Area
- DNAPL Extent

Groundwater ozone sparging location

- Kreher Park
- Ravine

0 75 150 225 300 Feet

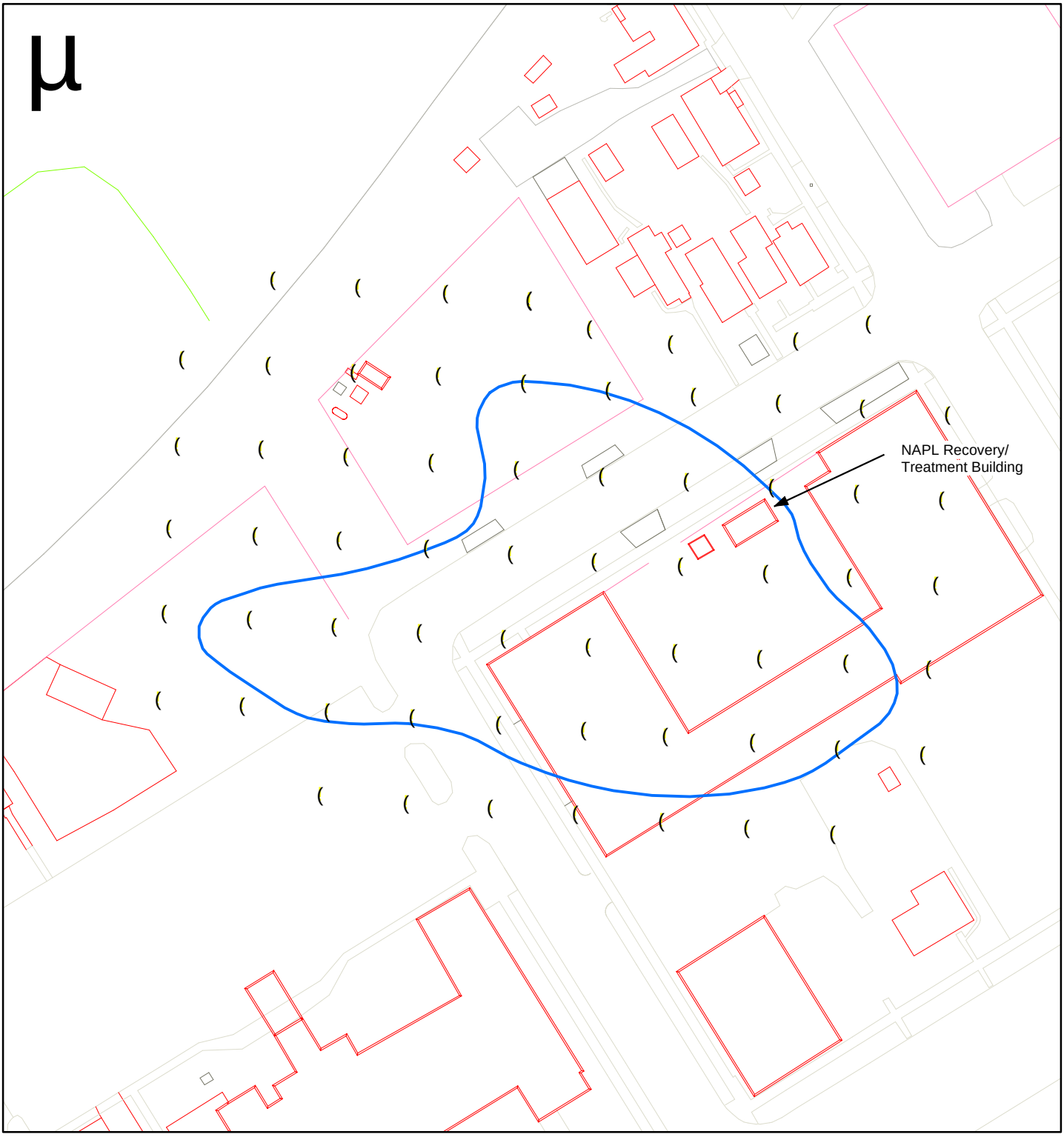
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-2A
In-Situ Ozone Sparging
Shallow Groundwater at Upper Bluff & Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-2A
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

NAPL extent - Copper Falls

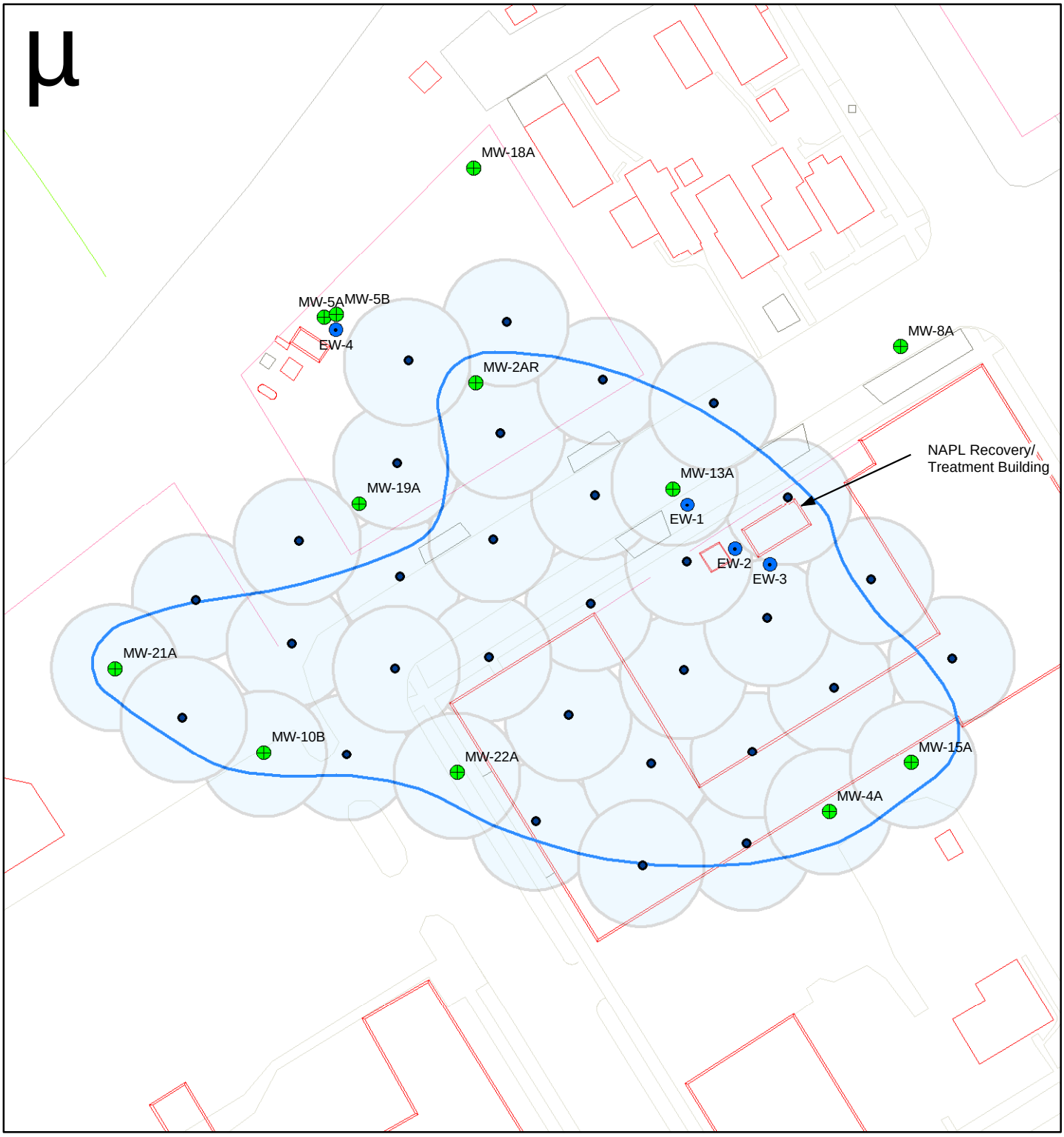
(Groundwater ozone sparge - Copper Falls Aquifer

0 30 60 90 120 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 7-2B In-Situ Ozone Sparging Copper Falls Aquifer			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 15.MAY.2008	SHEET: 7-2B	
APPROVED BY: DPT			

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Existing Piezometer
- Existing Extraction Wells
- Proposed Injection/extraction Well
- Proposed Injection/extraction Well (Area of Influence)
- NAPL extent - Copper Falls aquifer

0 25 50 75 100 Feet

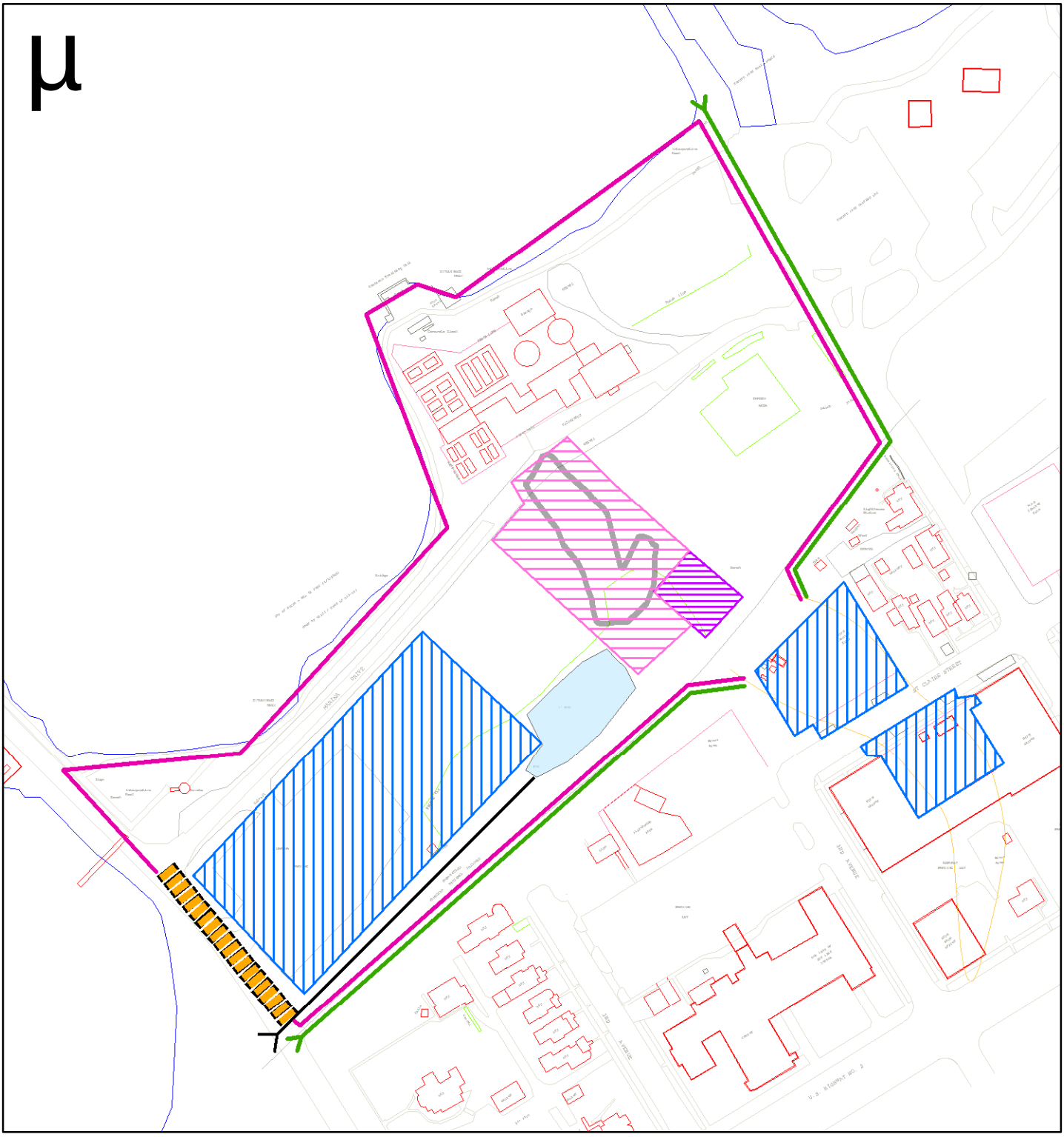
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-3
Surfactant Injection & Dual Phase
Recovery - Copper Falls aquifer

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-3
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Asphalt pavement (new)
- Low Permeability Clay Cap
- Existing Surface Barrier - Former Seep Area
- Former Coal Tar Dump Area
- PRB Wall
- Vertical Barrier Wall
- Stormwater Diversion Tile
- Stormwater Outfall
- Stormwater Basin

0 75 150 225 300 Feet

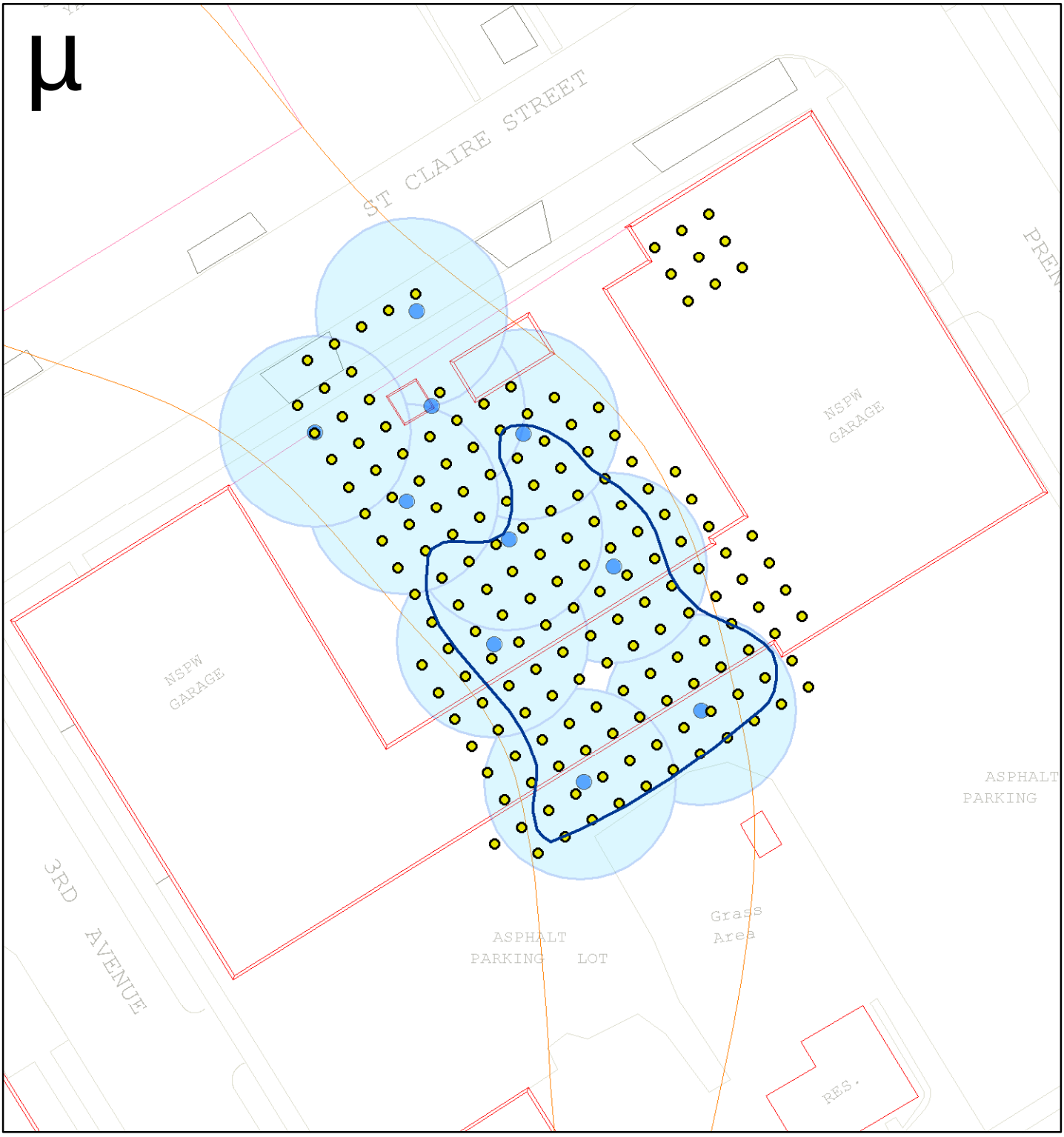
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-4
Permeable Reactive Barrier Wall & Containment Using Engineered Surface & Vertical Barriers

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-4
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- DNAPL Extent
- Chemical Oxidation Injection Borings
- Passive Vent Wells
- Passive Vent Wells (Area of Influence)

0 25 50 75 100 Feet

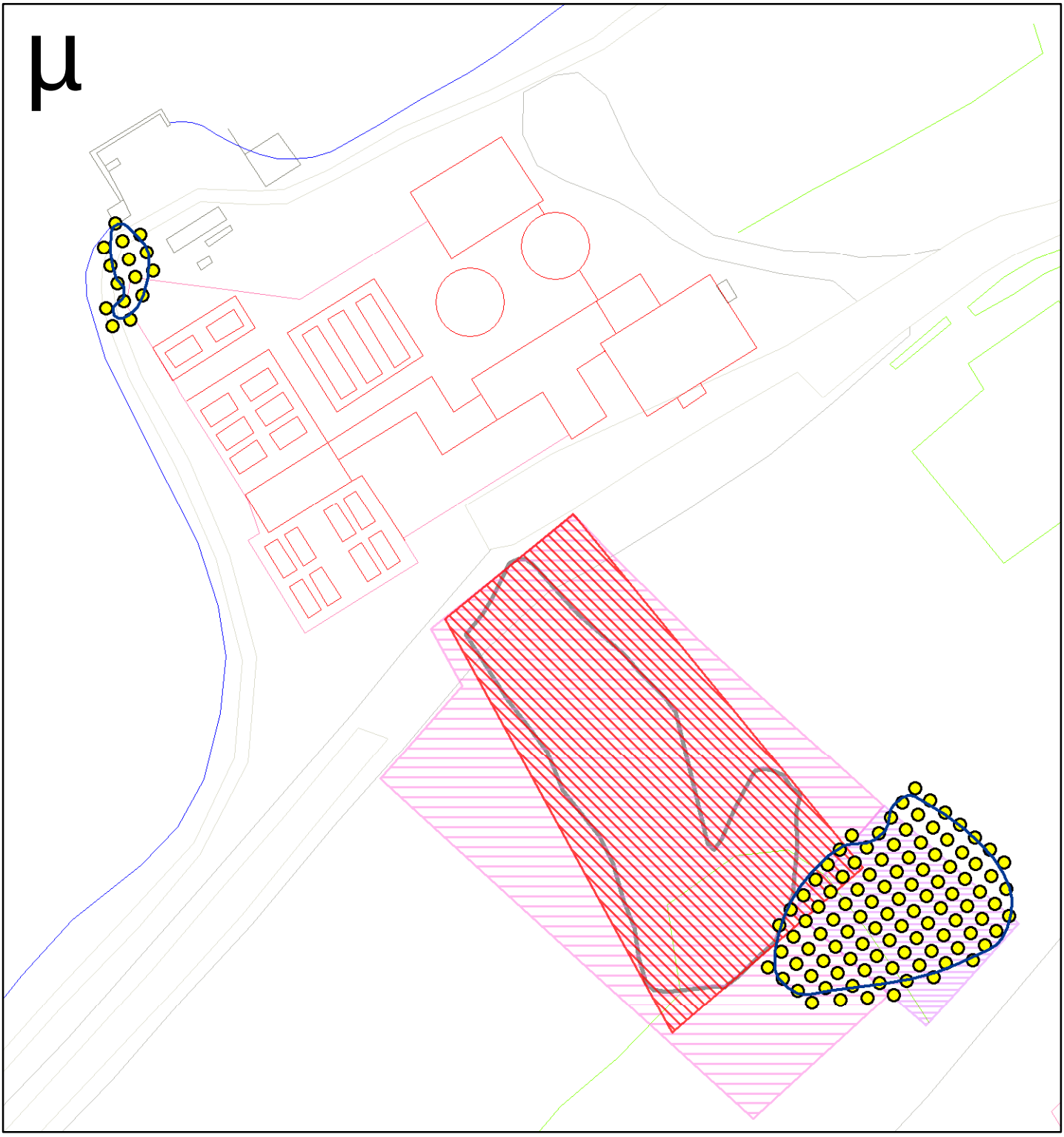
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-5A
In-Situ Chemical Oxidation -
Shallow Soil and Groundwater - Upper Bluff Area

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-5A
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- DNAPL extent - Kreher Park
- Chemical Oxidation Injection Borings
- In-situ Treatment Area - Trench Mixing
- Low Permeability Clay Cap
- Existing Surface Barrier - Former Seep Area
- Former Coal Tar Dump Area

0 25 50 75 100 Feet

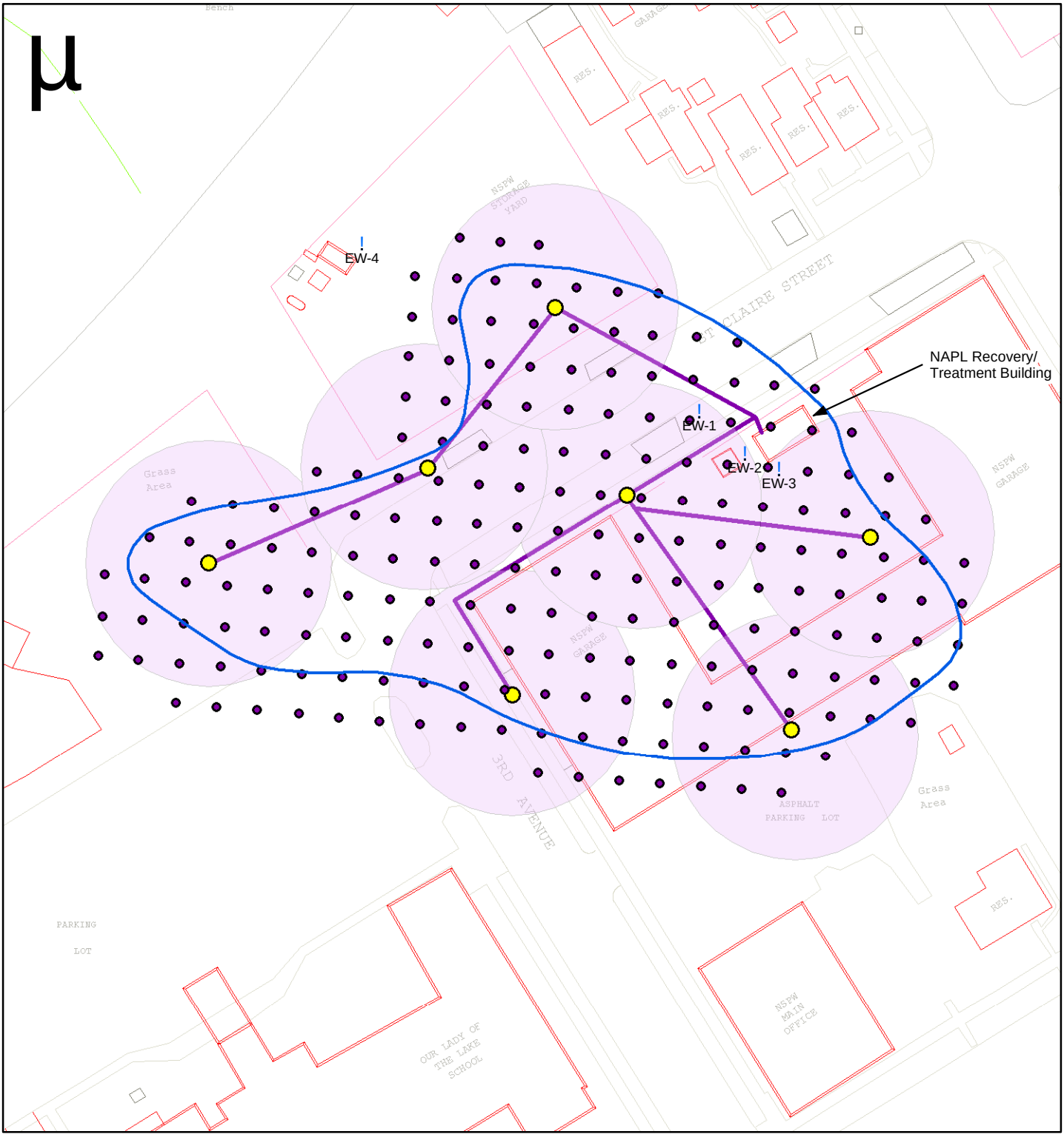
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-5B
In-Situ Chemical Oxidation -
Shallow Soil and Groundwater - Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-5B
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

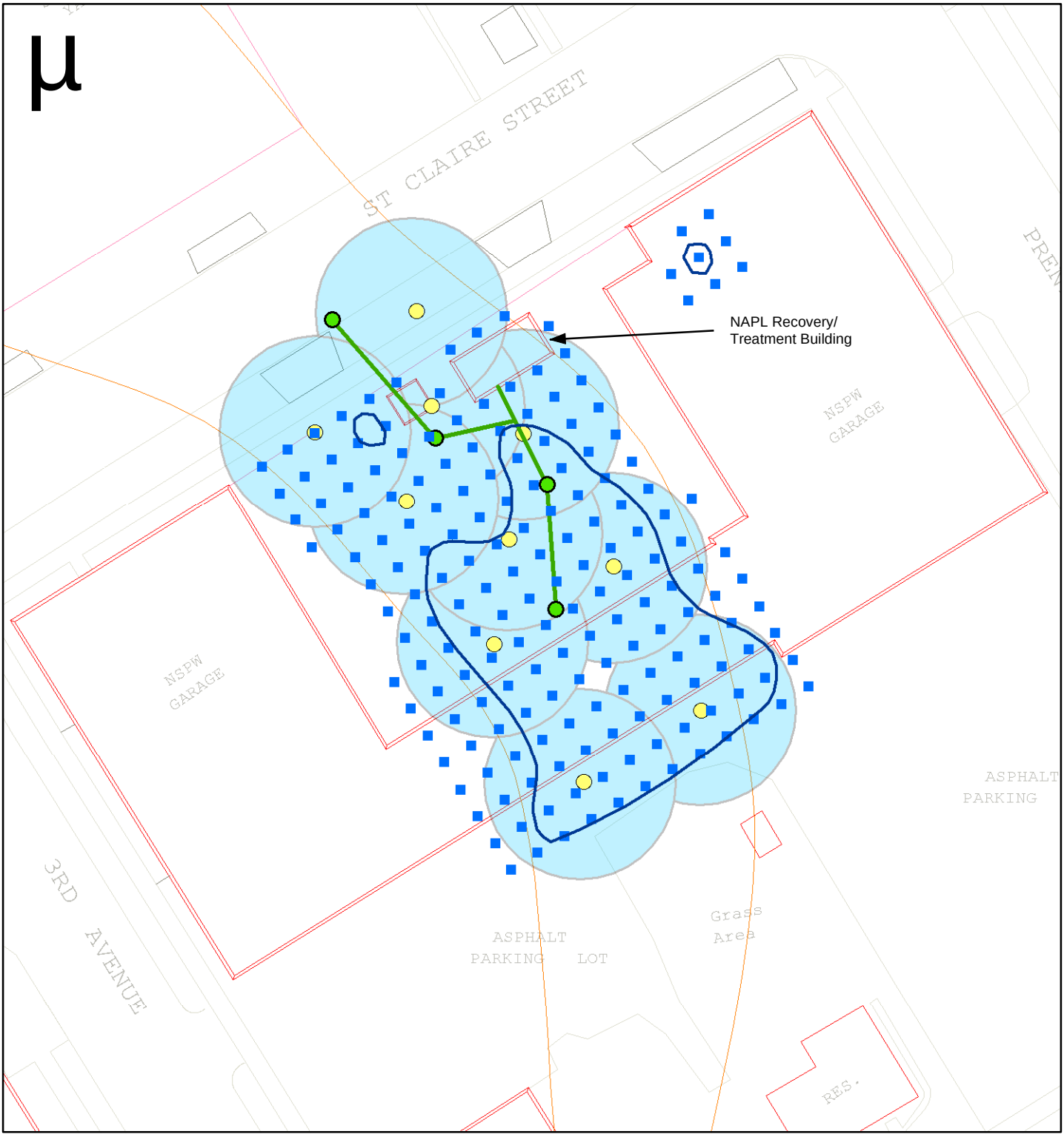
- NAPL Extent - Copper Falls aquifer
- Existing Extraction Wells
- Copper Falls Chemical Oxidation Borings
- Copper Falls Recovery Wells
- Copper Falls Recovery Wells (Area of Influence)
- Lateral Piping

0 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 7-5C In-Situ Chemical Oxidation - Copper Falls Aquifer			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 15.MAY.2008	SHEET: 7-5C	
APPROVED BY: DPT			

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- DNAPL Extent
- Electrical Resistance Heating Electrodes
- Recovery Well
- Recovery Well Lateral Piping
- Passive Vent Wells
- Passive Vent Wells (Area of Influence)

0 20 40 60 80 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-6A
In-Situ Electrical Resistance Heating -
Shallow Soil and Groundwater in Upper Bluff Area

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-6A
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100

Legend

- Former Coal Tar Dump Area
- DNAPL extent - Kreher Park
- Extraction Well
- Extraction Well Lateral Piping
- Electrical Resistance Heating Electrodes
- Passive Vent Well (area of influence)

0 25 50 75 100 Feet

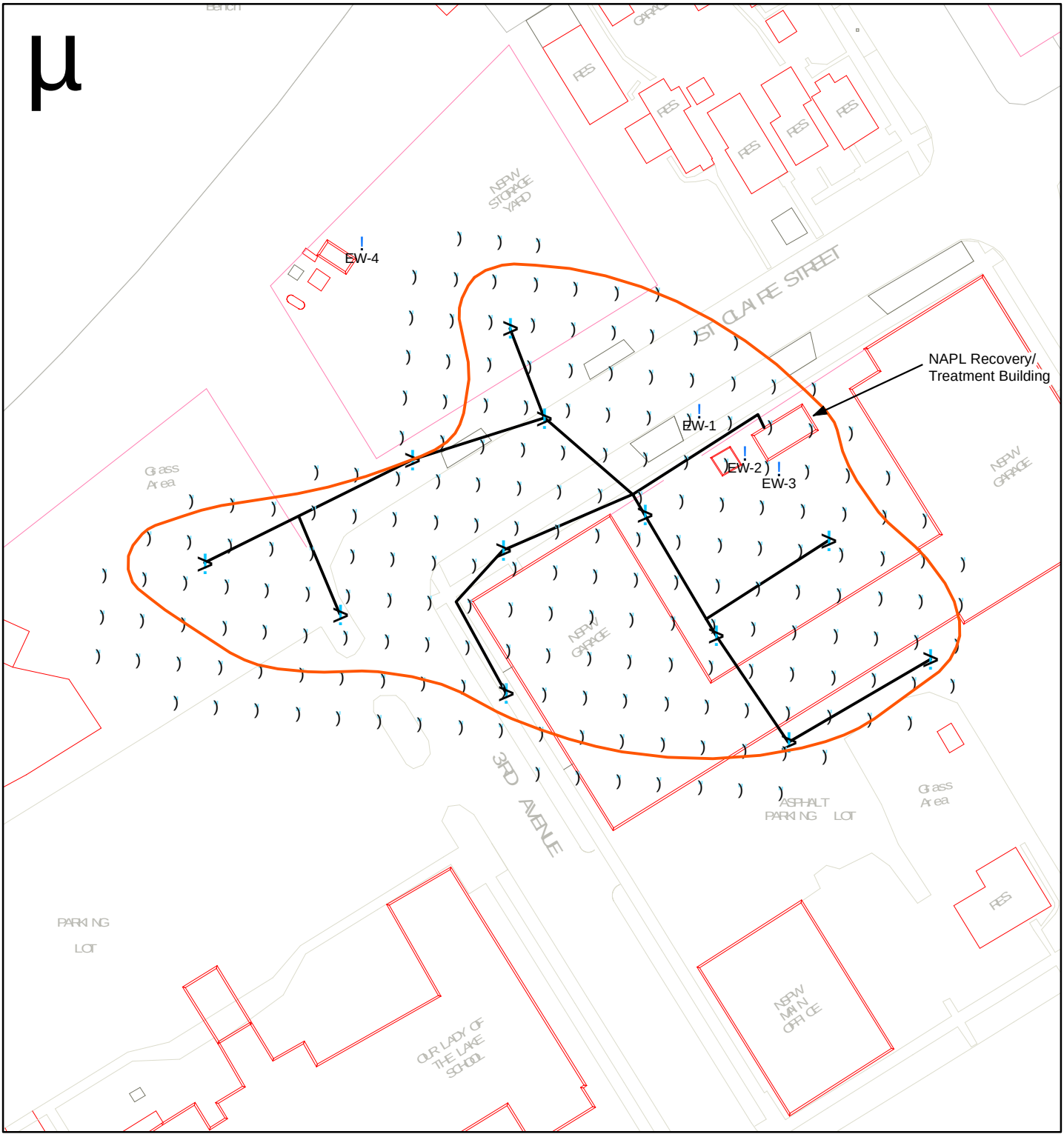
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-6B
In-Situ Electrical Resistance Heating -
Shallow Soil and Groundwater - Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-6B
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

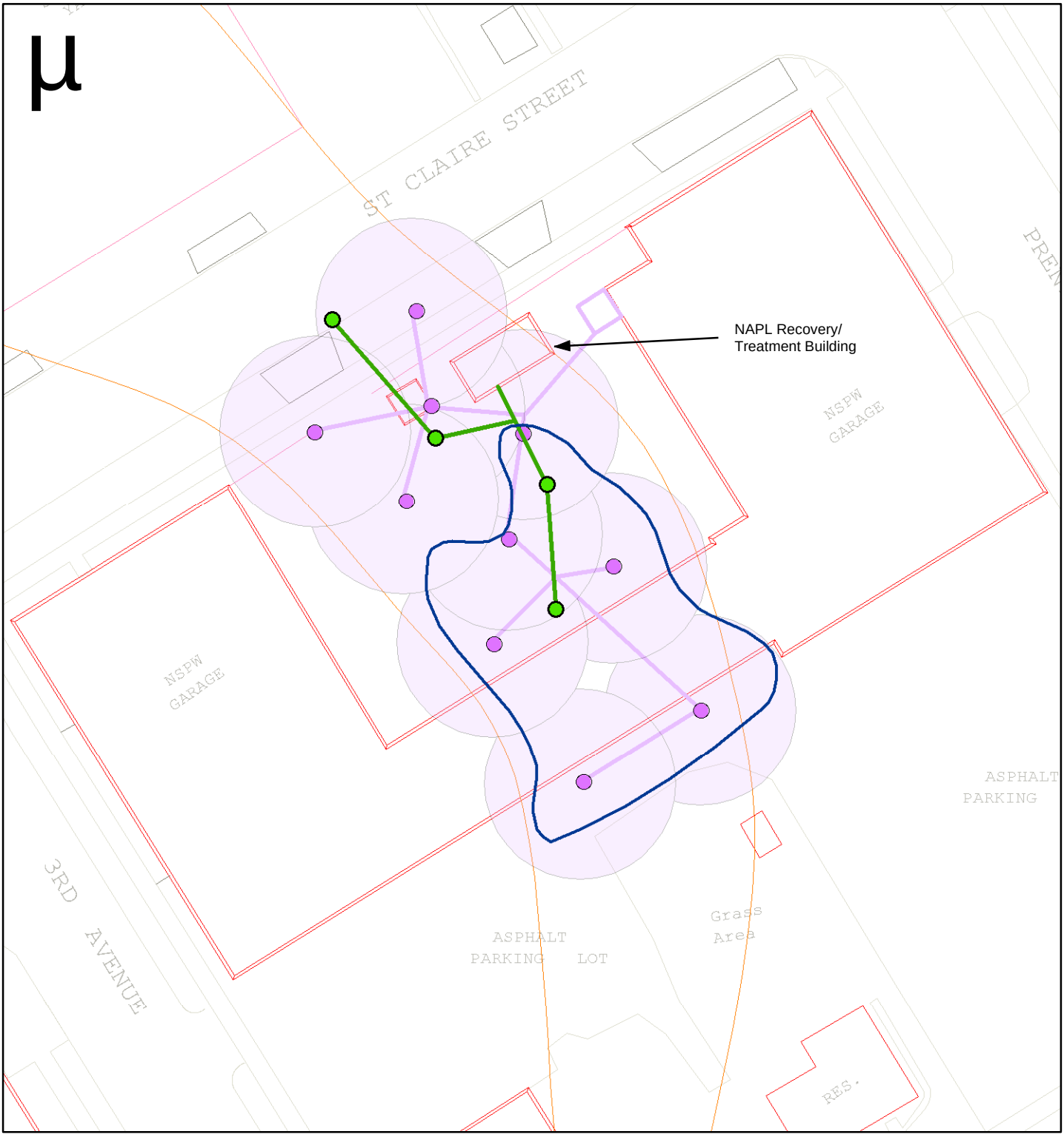
- ! Existing Extraction Wells
- NAPL Extent - Copper Falls aquifer
-) Copper Falls ERH Electrodes
- Copper Falls ERH Recovery Wells
- ERH Lateral Piping

0 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 7-6C In-Situ Electrical Resistance Heating - Copper Falls Aquifer			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 15.MAY.2008	SHEET: 7-6C	
APPROVED BY: DPT			

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- Recovery Well
- Recovery Well Lateral Piping
- Steam Injection Well
- Steam Injection Well (Area of Influence)
- Steam Injection Well Lateral Piping
- DNAPL Extent

0 25 50 75 100 Feet

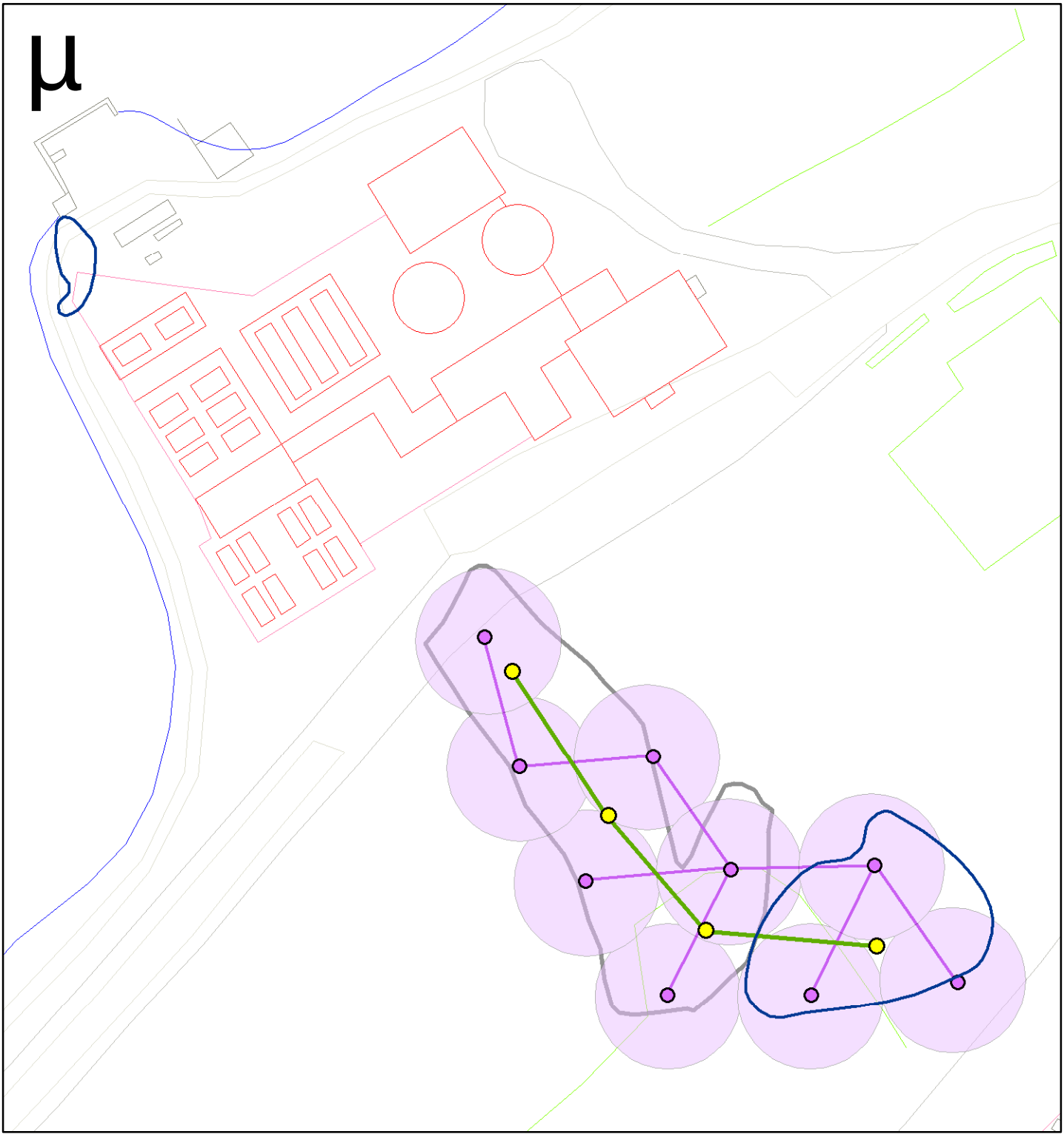
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-7A
In-Situ Steam Injection -
Shallow Soil and Groundwater in Upper Bluff Area

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-7A
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

- DNAPL extent - Kreher Park
- Former Coal Tar Dump Area
- Recovery Well
- Recovery Well Lateral Piping
- Steam Injection Well (Area of Influence)
- Steam Injection Well Lateral Piping
- Steam Injection Well

0 25 50 75 100 Feet

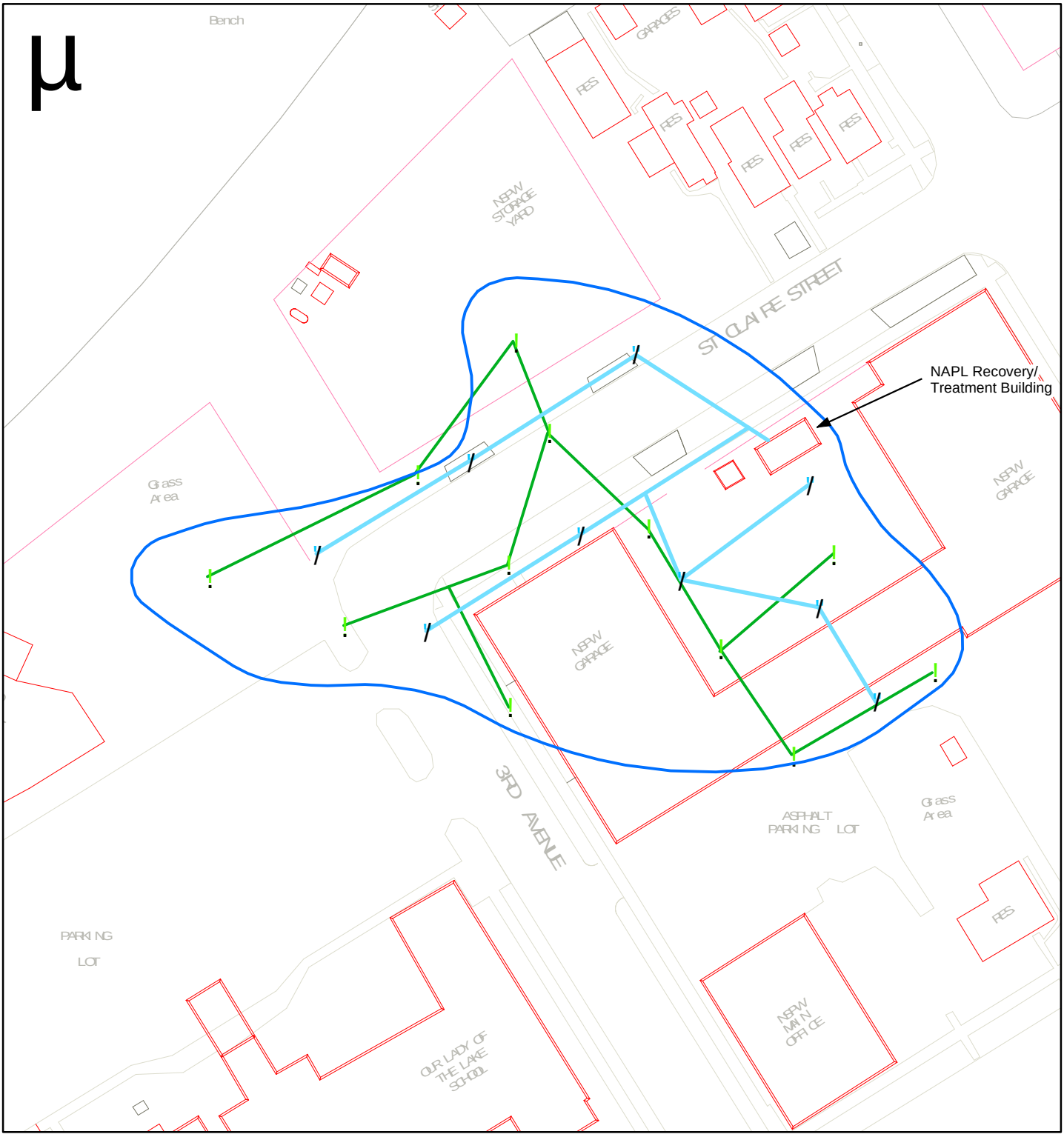
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-7B
In-Situ Steam Injection -
Shallow Soil and Groundwater - Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-7B
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

NAPL Extent - Copper Falls

Copper Falls Steam Injection wells

Description

- Injection Well
- DUS Recovery Well/Electrode
- Recovery Well Lateral Piping
- Steam Injection Well Lateral Piping

0 25 50 75 100 Feet

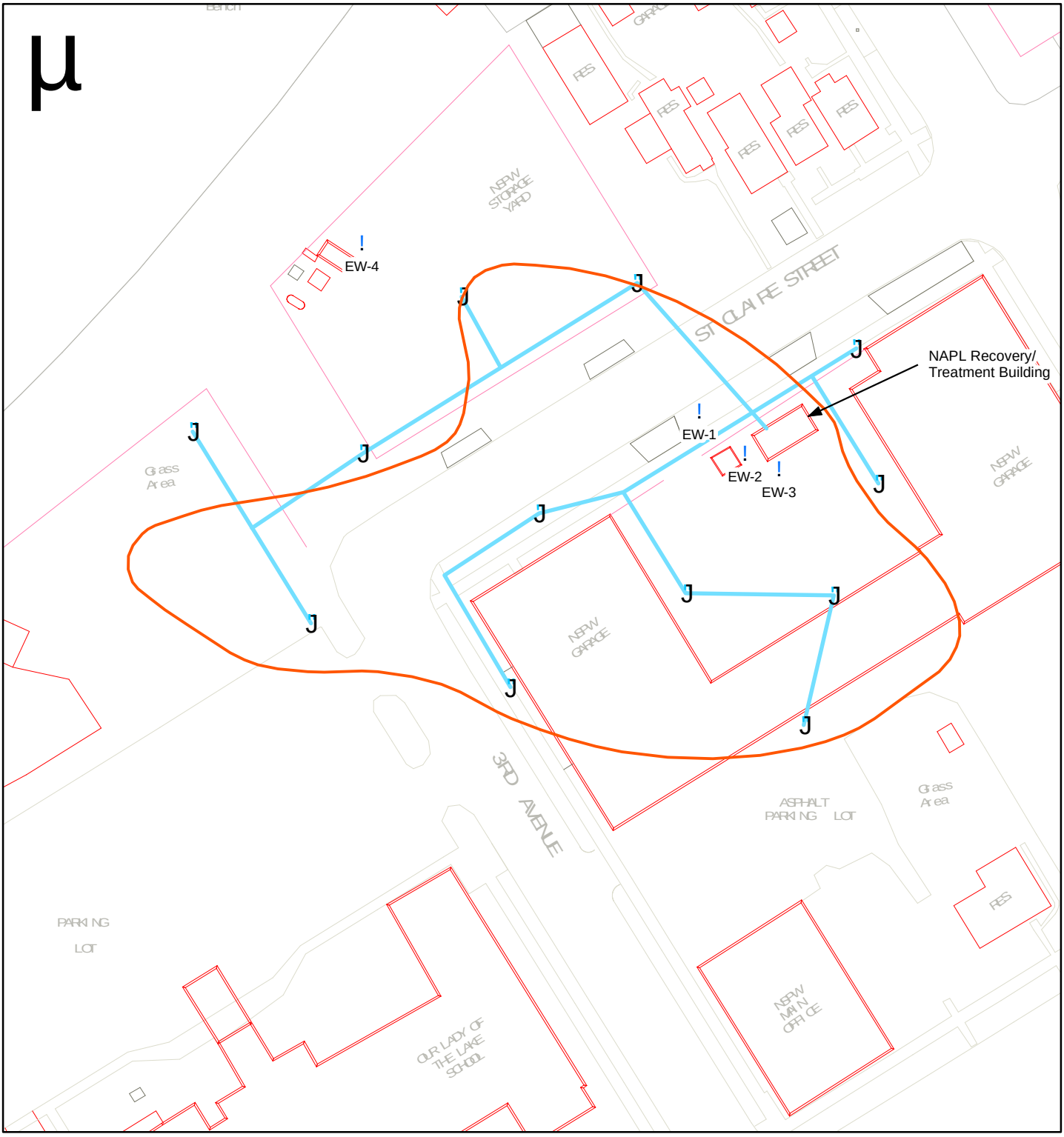
PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

TITLE: Figure 7-7C
In-Situ Steam Injection - Copper Falls aquifer

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-7C
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

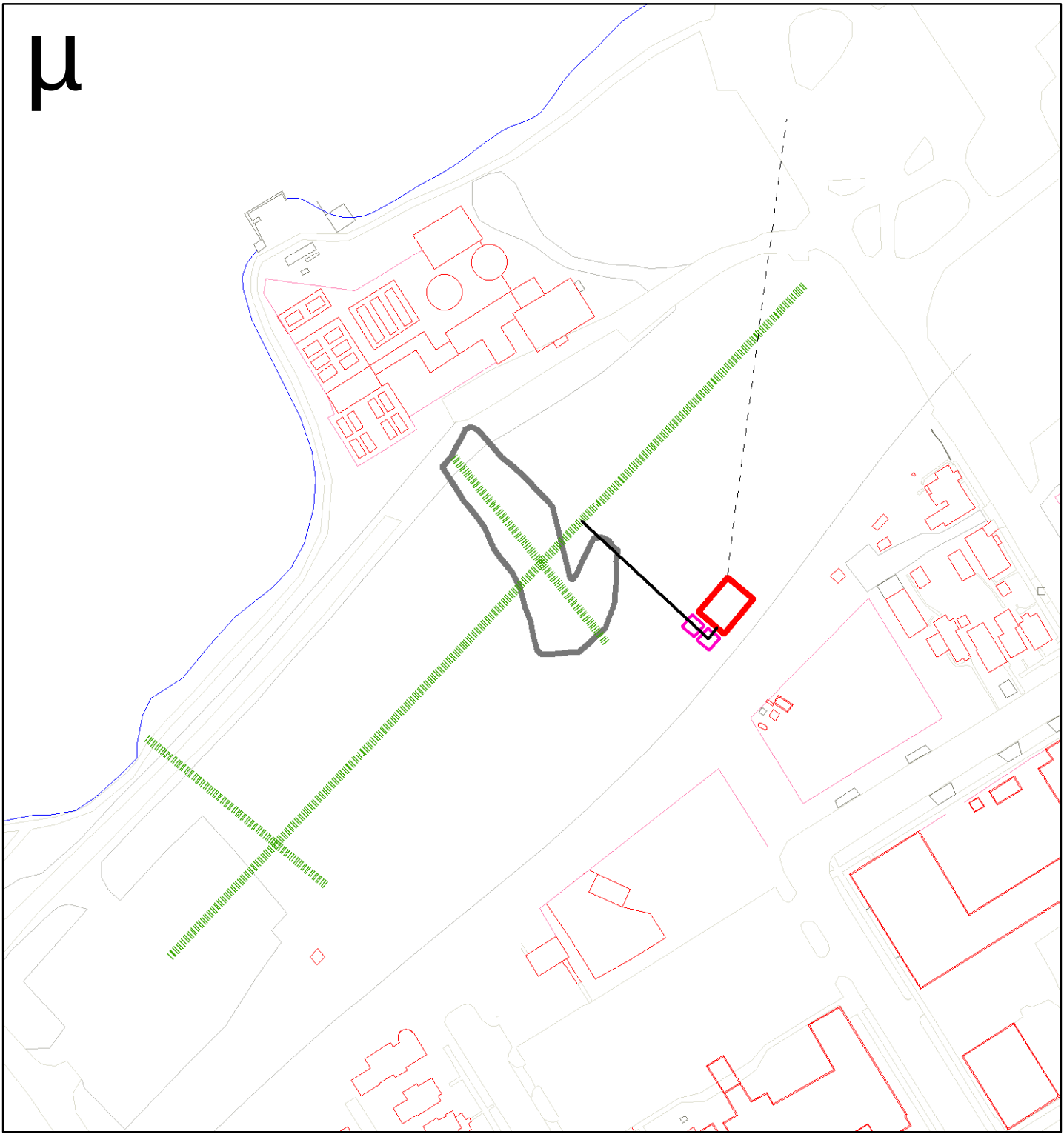
- NAPL Extent - Copper Falls aquifer
- Copper Falls GW Extraction Well
- Copper Falls GW Extraction Lateral Piping
- Existing Extraction Well

0 25 50 75 100 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE ASHLAND, WISCONSIN			
TITLE: Figure 7-8A Removal Using Groundwater Extraction - Copper Falls Aquifer & Ravine Fill			
DRAWN BY: DDZ	SCALE: AS SHOWN	PROJECT: 25688375	
CHECKED BY: MSM	DATE: 15.MAY.2008	SHEET: 7-8A	
APPROVED BY: DPT			

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100



Legend

Groundwater Extraction Trench

Description

- Effluent Discharge Line
- GW Extraction Trench
- Influent Line
- Oil/Water Separator Tanks
- Treatment Bldg
- Former Coal Tar Dump Area

0 75 150 225 300 Feet

PROJECT: ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

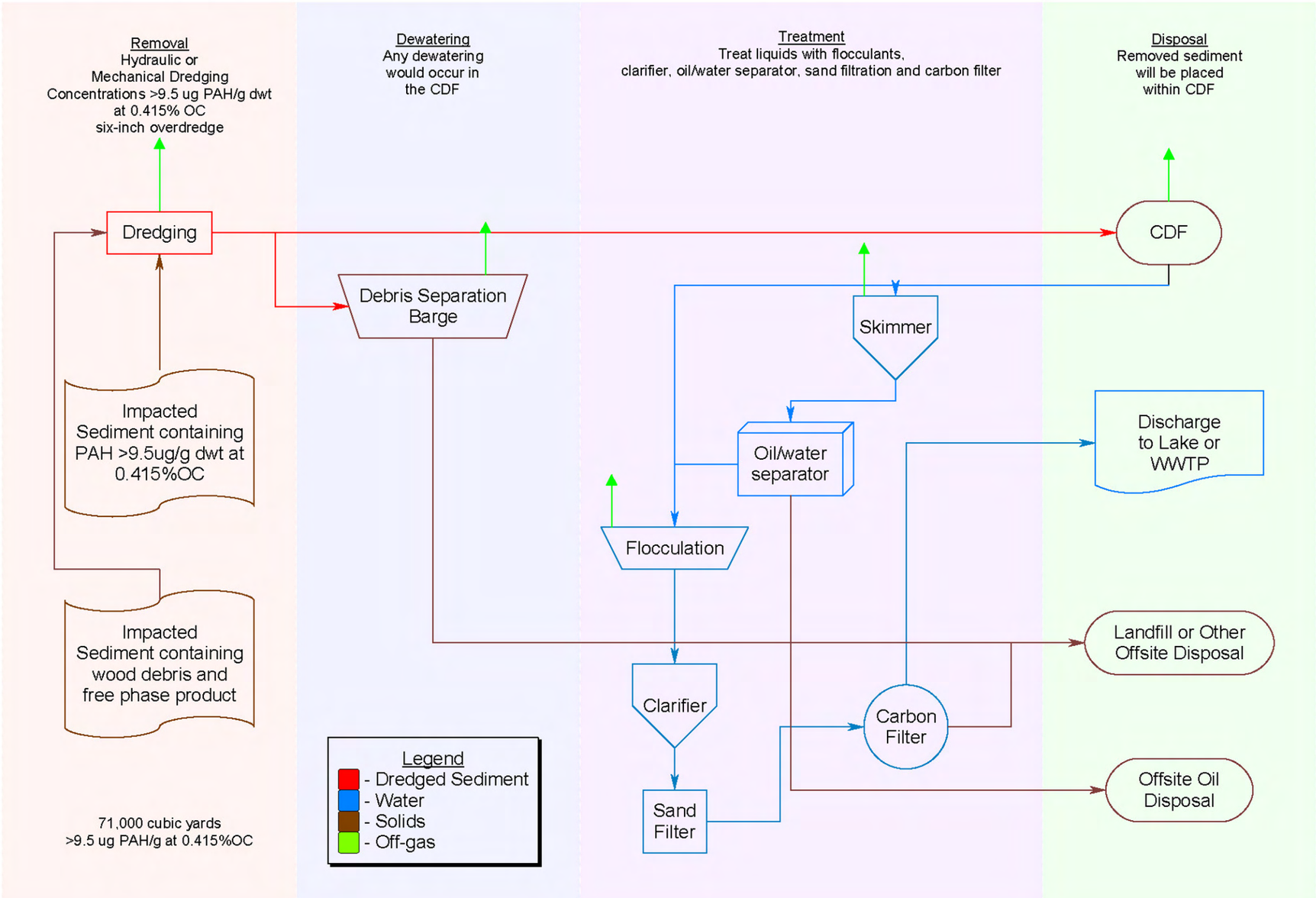
TITLE: Figure 7-8B
Removal Using Groundwater Extraction - Shallow Groundwater in Kreher Park

DRAWN BY:	DDZ	SCALE:	AS SHOWN	PROJECT:	25688375
CHECKED BY:	MSM	DATE:	15.MAY.2008	SHEET:	7-8B
APPROVED BY:	DPT				

URS

6737 W. WASHINGTON ST, SUITE 2265
MILWAUKEE, WISCONSIN 53214
414-831-4100

Alternative 2: Construct CDF over sediment containing significant wood debris and sediment with free phase, remove sediment >9.5 ug PAH/g dwt at 0.415%OC outside the CDF footprint and place in CDF; monitor sediment areas>5.6 ug PAH/g dwt at 0.415%OC; No treatment



File: projects/ashland/process diagrams/Figure 8-1 Alt 2 rff rev 2.flo

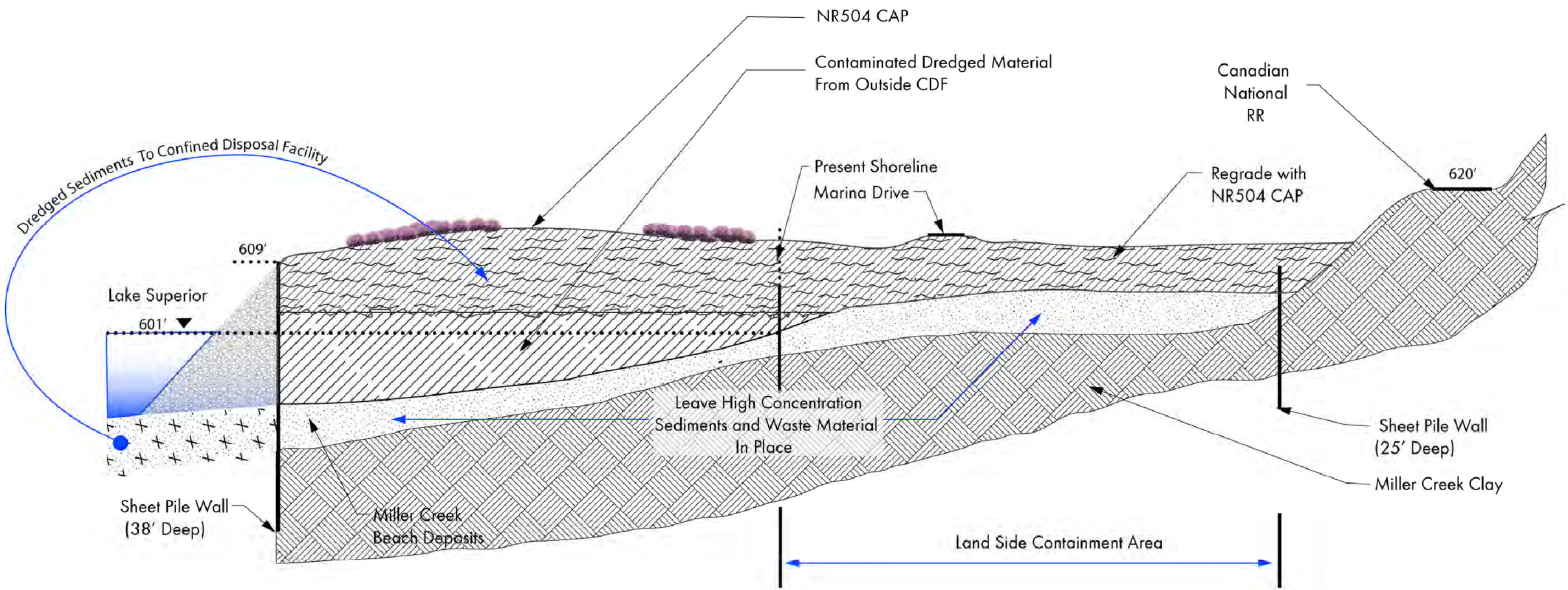
URS

6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

PROCESS FLOW DIAGRAM
ALTERNATIVE SED-2-CDF
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY: TS	DATE: 4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY: HHH	DATE: 4/30/08	25688375.73000	8-1

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16:1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_1.dwg



URS

100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

ASHLAND/NSP LAKEFRONT SITE–
SECTION CONCEPT (FOR CDF)

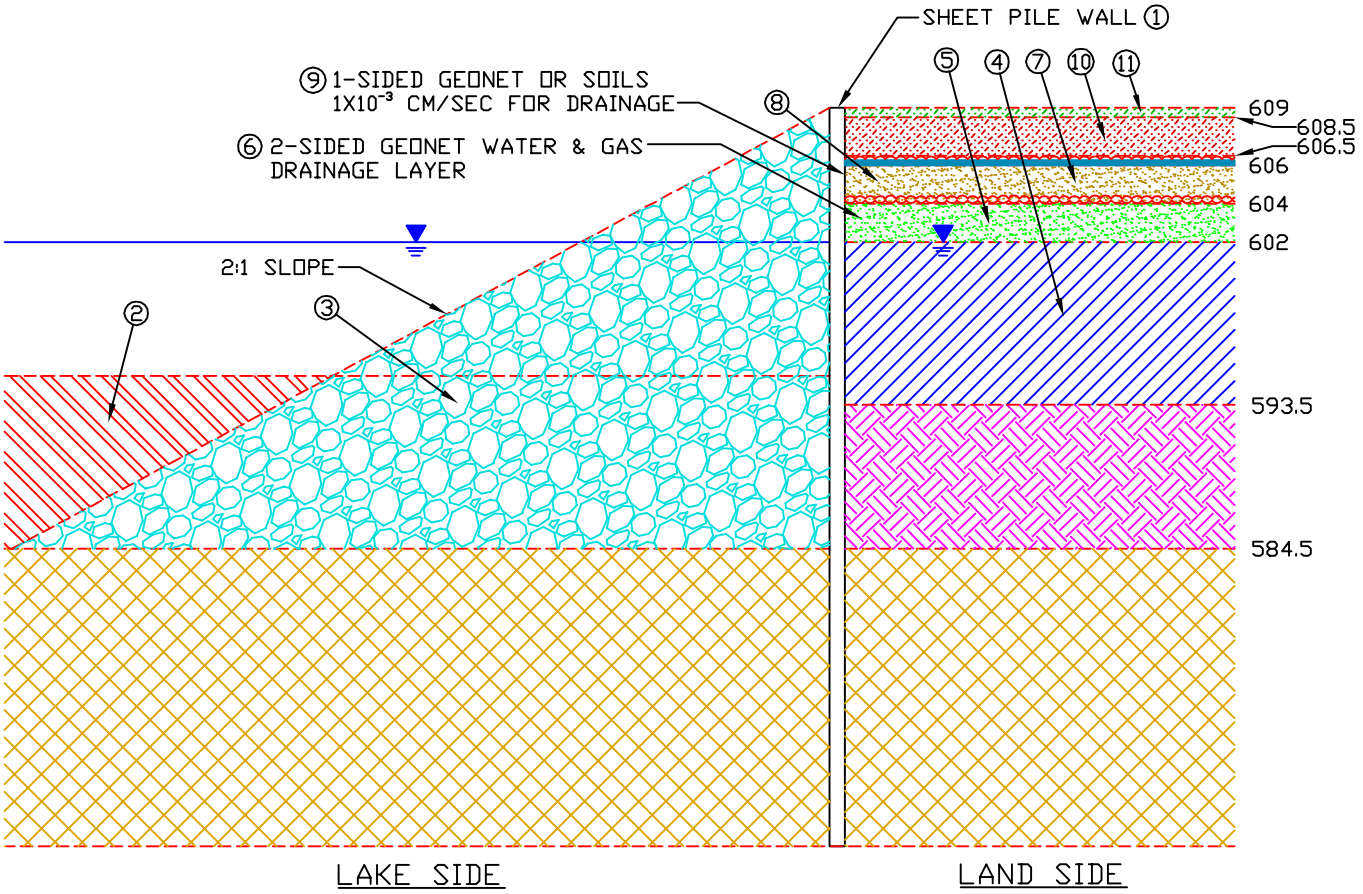
DRN BY:	KP	DATE:	4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY:	JVH	DATE:	4/30/08	25688375.76000	8–2

URS

100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

ASHLAND/NSP LAKEFRONT SITE–
REDEVELOPMENT CONCEPT PLAN (FOR CDF)

DRN BY: KP	DATE: 4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY: JVH	DATE: 4/30/08	25688375.76000	8–3



- CLAY
- SAND
- DREDGED CONTAMINATED SEDIMENT
- UNDISTURBED SEDIMENT
- UNDISTURBED SILTY CLAY
- RIP RAP
- LOCAL SOILS
- TOP SOIL
- CONTAMINATED SEDIMENT
- GEOTEXTILE DRAINAGE LAYERS
- GEOMEMBRANE

① DRIVE SHEET PILE WALL FROM ELEVATION 593.5 DOWN TO 569.0 THROUGH WOOD AND CONTAMINATED SEDIMENT LAYER, INTO UNDISTURBED SILTY CLAYS.

② EXCAVATE SEDIMENT FROM LAKE SIDE, PLACE INSIDE CONTAINMENT STRUCTURE BUT AWAY FROM SHEET PILE WALL INITIALLY.

③ CONSTRUCT REVETMENT ON BAY SIDE OF SHEET PILE WALL, CONSTRUCTED OF 24"Ø MAX RIP RAP.

④ BACKFILL LAND SIDE OF SHEET PILE WALL WITH CONTAMINATED SEDIMENT TO ELEVATION 602.0 (NOMINAL).

⑤ PLACE ONE TO TWO FEET OF SAND SUPPORT LAYER.

⑥ PLACE 2-SIDED GEONET DRAINAGE LAYER.

⑦ CAP WITH TWO FEET OF COMPACTED CLAY.

⑧ INSTALL 40 MIL GEOMEMBRANE BARRIER LAYER ABOVE CLAY LAYER.

⑨ ONE-SIDED GEONET DRAINAGE LAYER OR 1X10-3 DRAINAGE SOIL.

⑩ TWO FEET OF LOCAL SOILS.

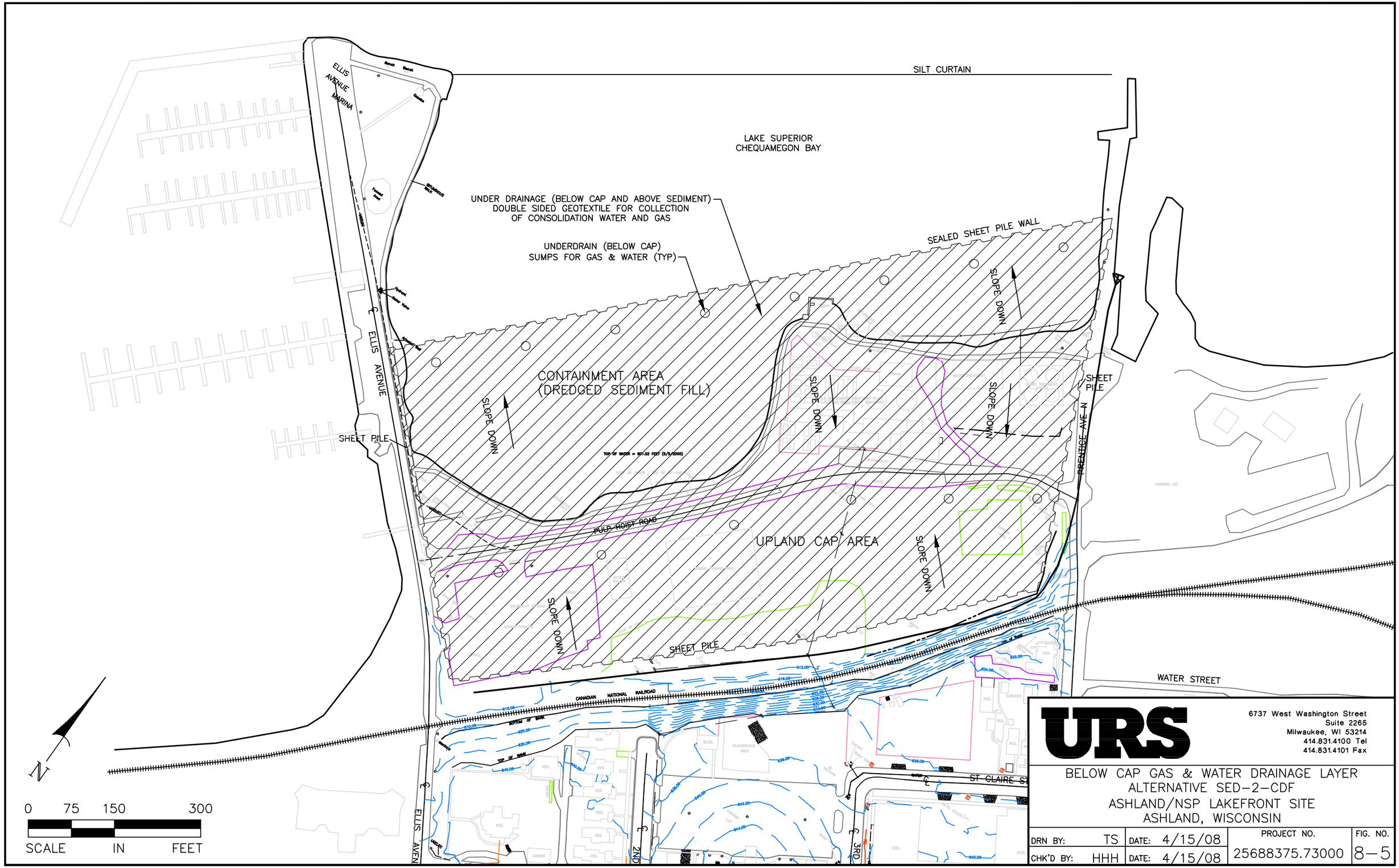
⑪ ONE-HALF FOOT OF TOPSOIL.

URS
6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

FINAL CONSTRUCTION – SHEET PILE WALL CROSS SECTION
ALTERNATIVE SED-2-CDF
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY:	TS	DATE:	4/15/08	PROJECT NO.	FIG. NO.
CHK'D BY:	HH	DATE:	4/15/08	25688375.75000	8-4

PLOT DATE: January 04, 2007 10:15am DISK FILE NAME: V:\Envir Mngt\Projects\Xcel Energy\Ashland\NSP\EPA Comments\CADD\Figure8_4.dwg



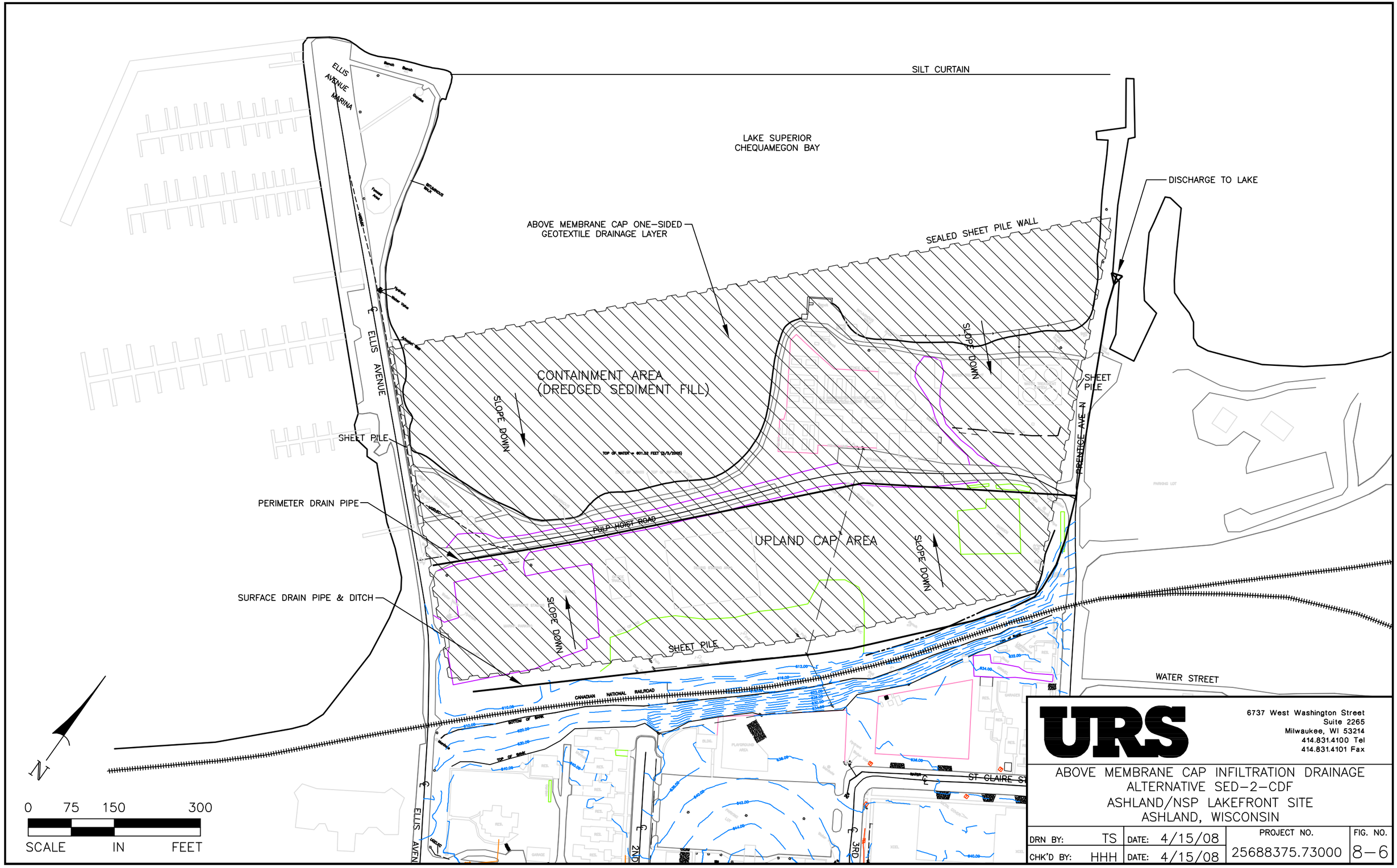
URS

6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

BELOW CAP GAS & WATER DRAINAGE LAYER
ALTERNATIVE SED-2-CDF
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY:	TS	DATE:	4/15/08	PROJECT NO.	FIG. NO.
CHK'D BY:	HHH	DATE:	4/15/08	25688375.73000	8-5

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16.1) V:\Envir Mng(\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_5&6.dwg



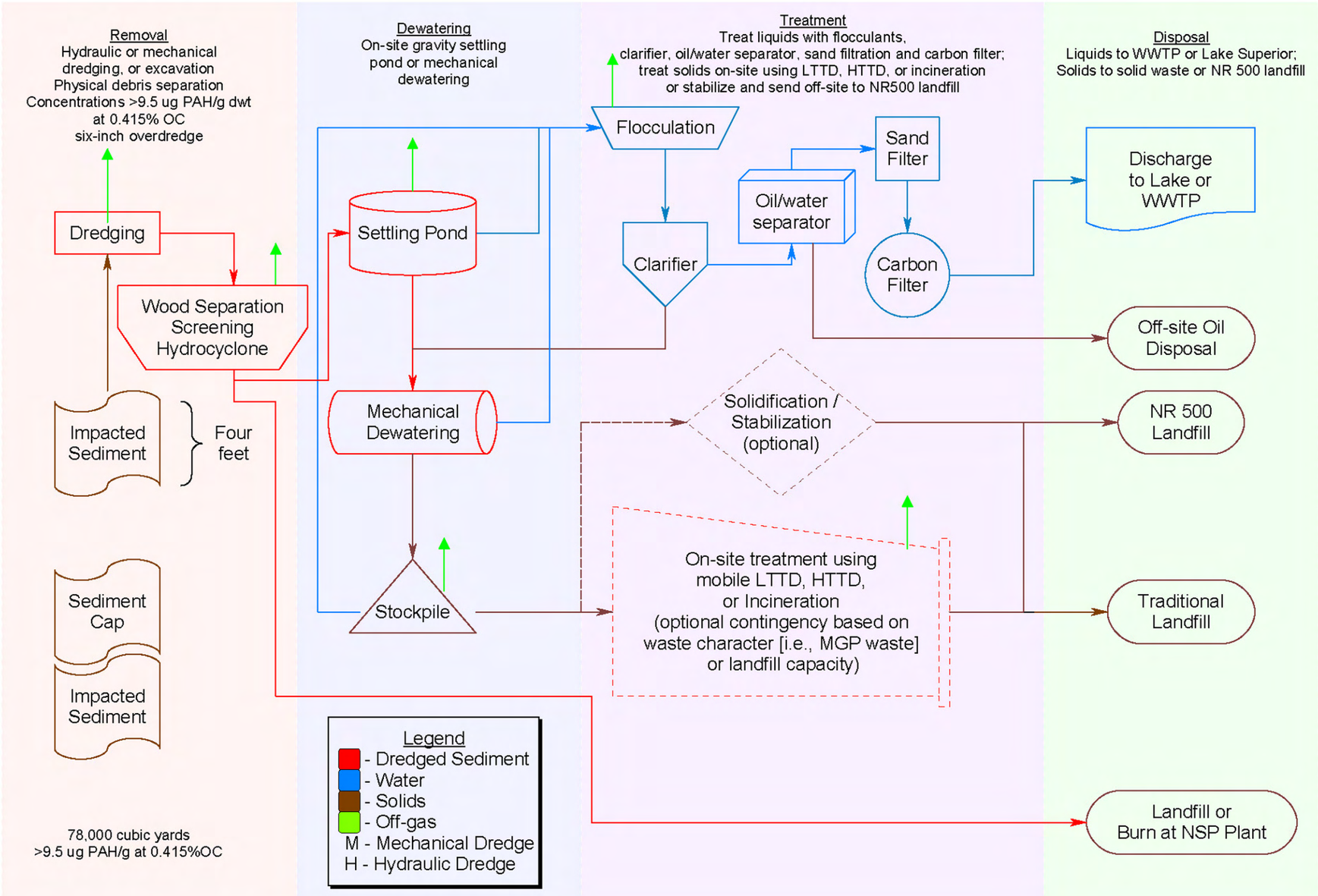
PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16.1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_5&6.dwg

URS
6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

ABOVE MEMBRANE CAP INFILTRATION DRAINAGE
ALTERNATIVE SED-2-CDF
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY:	TS	DATE:	4/15/08	PROJECT NO.	FIG. NO.
CHK'D BY:	HHH	DATE:	4/15/08	25688375.73000	8-6

Alternative 3: Remove sediment >9.5 ug PAH/g dwt at 0.415%OC to a depth of 4 feet; cap; treat sediment on-site, dispose of sediment off-site; monitor sediment areas >5.6 ug PAH/g dwt at 0.415%OC



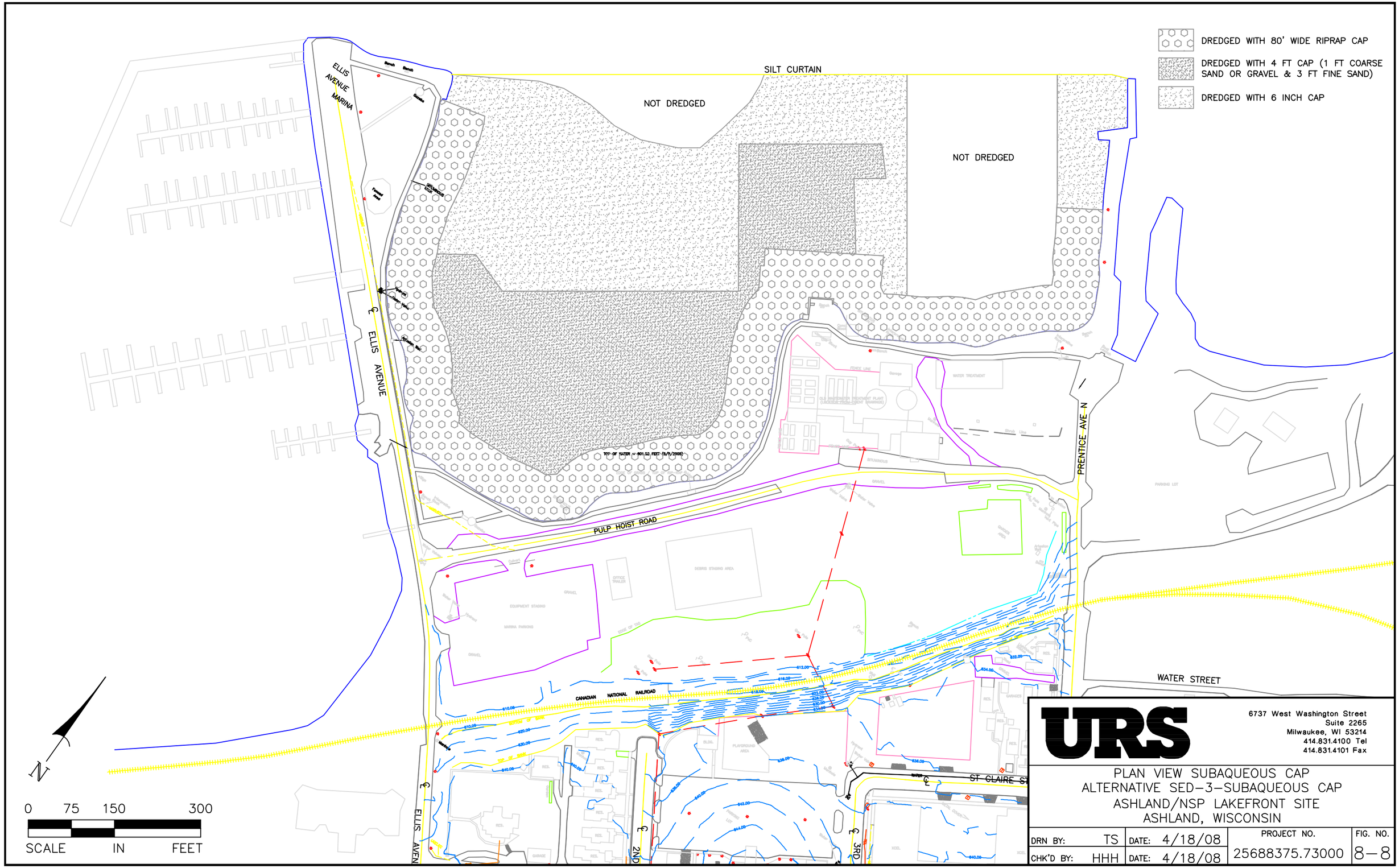
File: projects/ashland/process diagrams/Figure 8-7 Alt 3 rrf rev2.flo

URS
6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

PROCESS FLOW DIAGRAM
ALTERNATIVE SED-3-SUBAQUEOUS CAP
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY: TS	DATE: 4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY: HHH	DATE: 4/30/08	25688375.73000	8-7

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16.1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_7.dwg



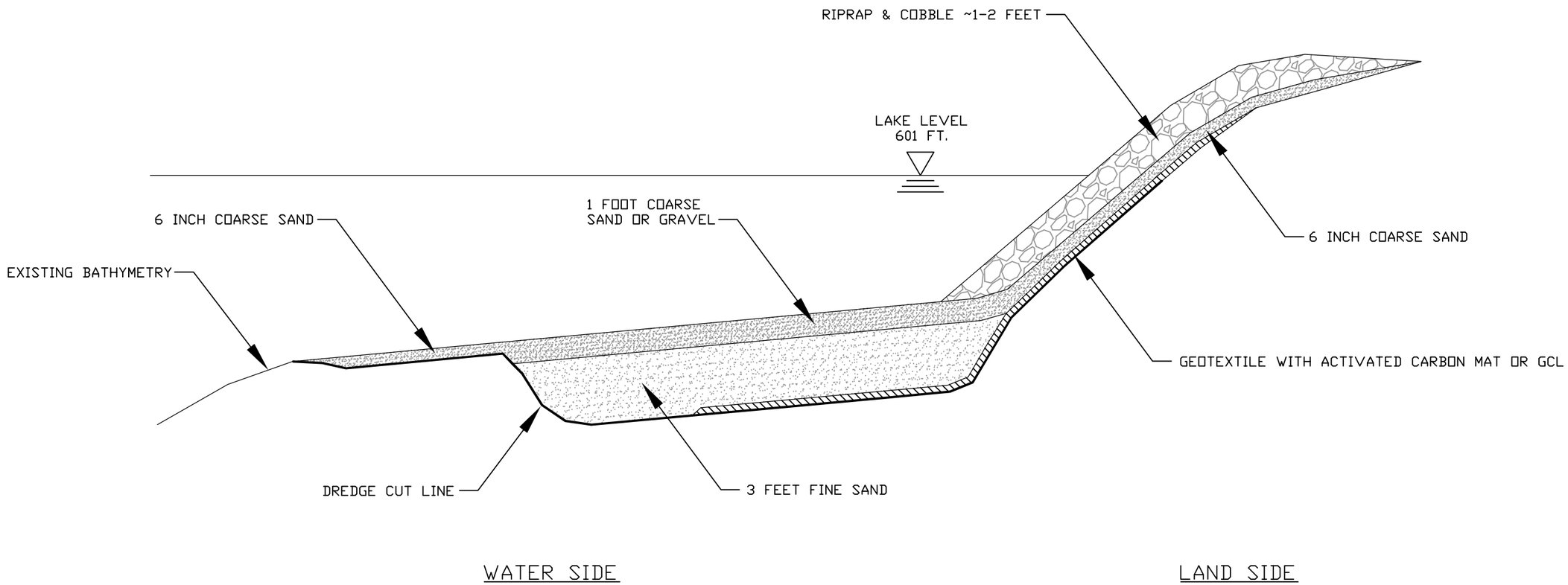
URS

6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

PLAN VIEW SUBAQUEOUS CAP
ALTERNATIVE SED-3-SUBAQUEOUS CAP
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY:	TS	DATE:	4/18/08	PROJECT NO.	FIG. NO.
CHK'D BY:	HHH	DATE:	4/18/08	25688375.73000	8-8

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16.1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_8.dwg



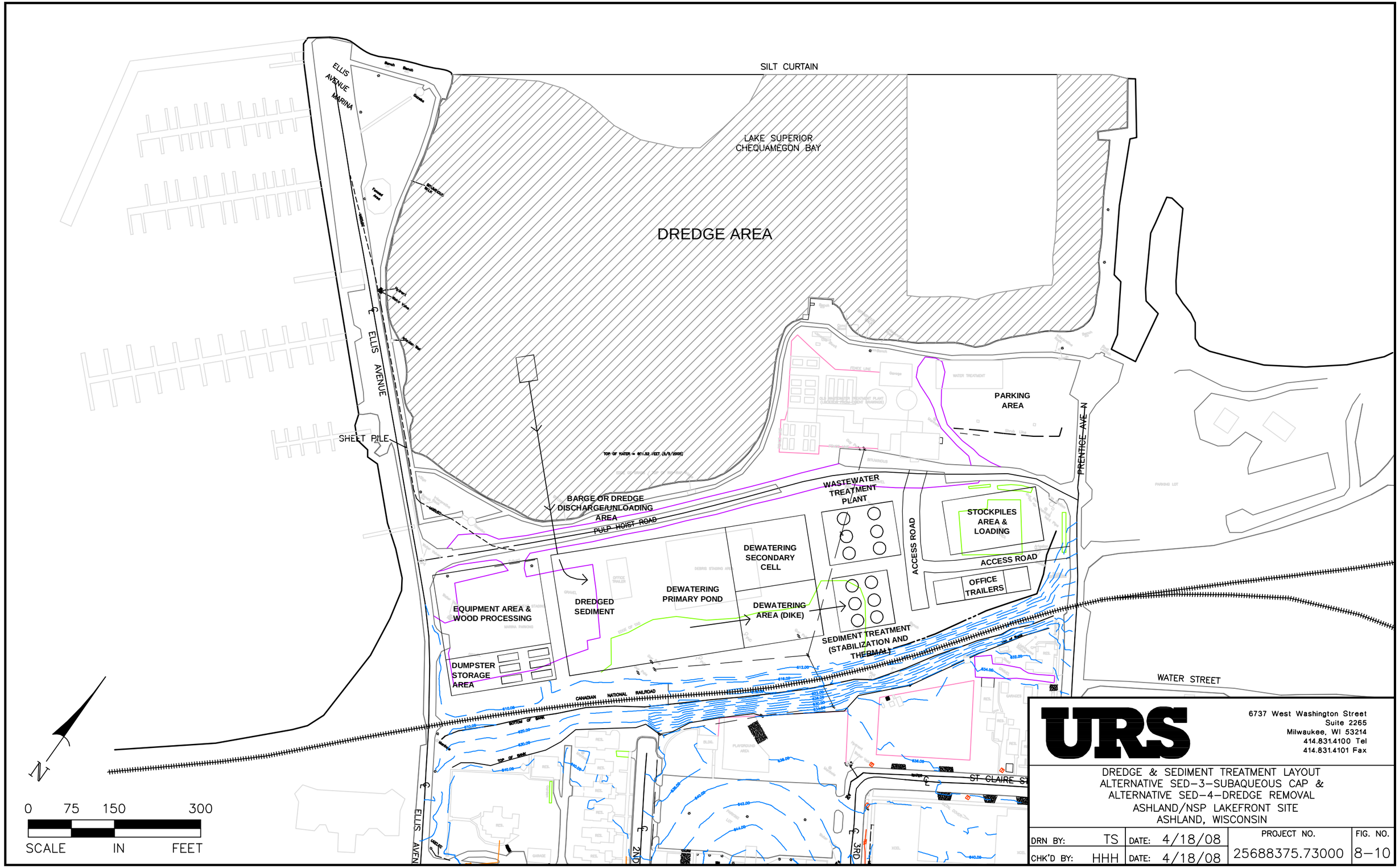
NOT TO SCALE

URS
6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

CAPPING CROSS SECTION – SUBAQUEOUS CAP
ALTERNATIVE SED-3-SUBAQUEOUS CAP
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY: TS	DATE: 4/18/08	PROJECT NO.	FIG. NO.
CHK'D BY: HHH	DATE: 4/18/08	25688375.73000	8-9

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16.1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_9.dwg



URS

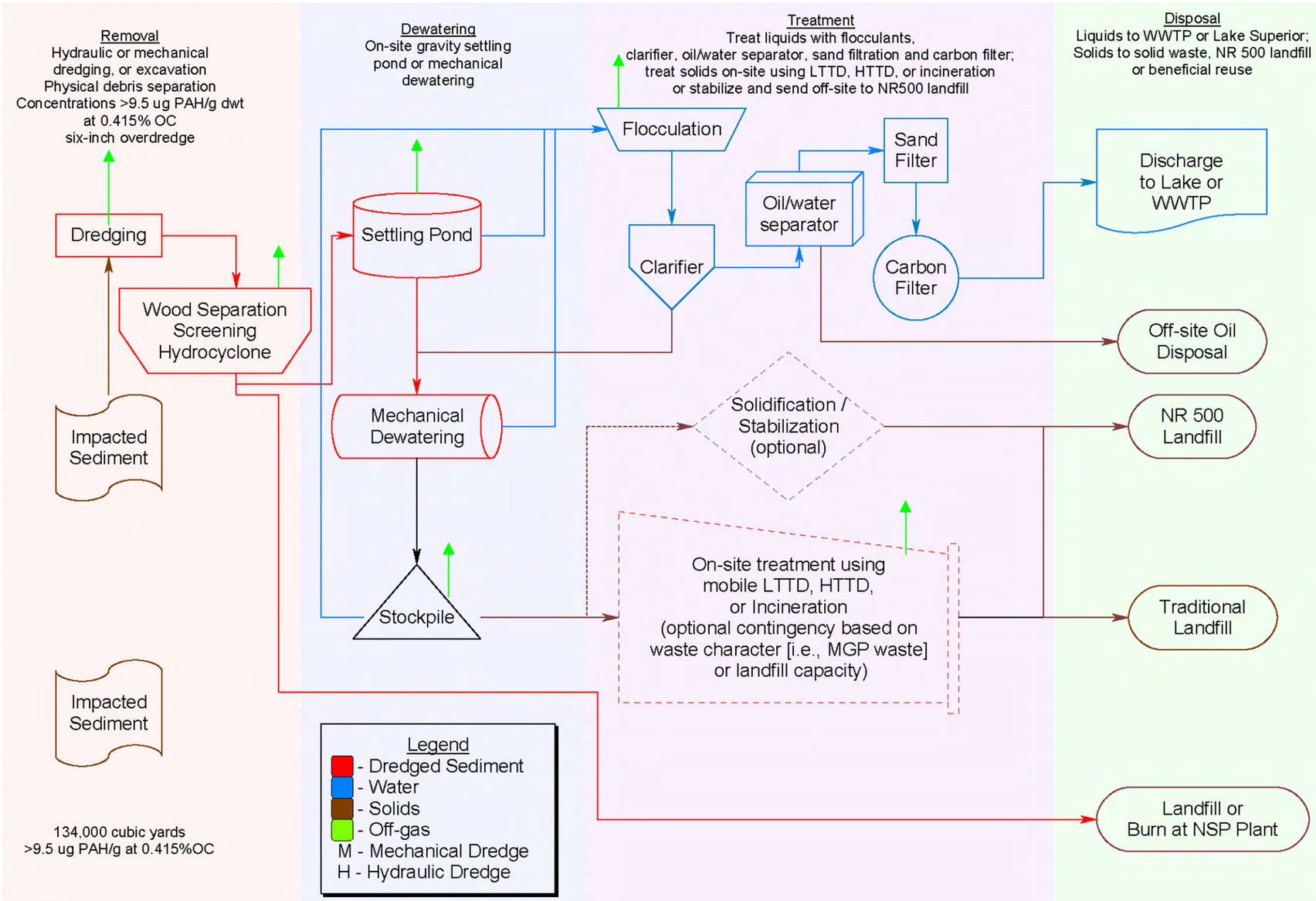
6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

DREDGE & SEDIMENT TREATMENT LAYOUT
ALTERNATIVE SED-3-SUBAQUEOUS CAP &
ALTERNATIVE SED-4-DREDGE REMOVAL
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY:	TS	DATE:	4/18/08	PROJECT NO.	FIG. NO.
CHK'D BY:	HHH	DATE:	4/18/08	25688375.73000	8-10

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16.1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_10.dwg

Alternative 4: Remove sediment >9.5 ug PAH/g dwt at 0.415%OC; treat sediment on-site, dispose of sediment off-site; monitor sediment areas >5.6 ug PAH/g dwt at 0.415%OC



File: projects/ashland/process diagrams/Figure 8-11 Alt 4 rrf rev 2.flo

URS

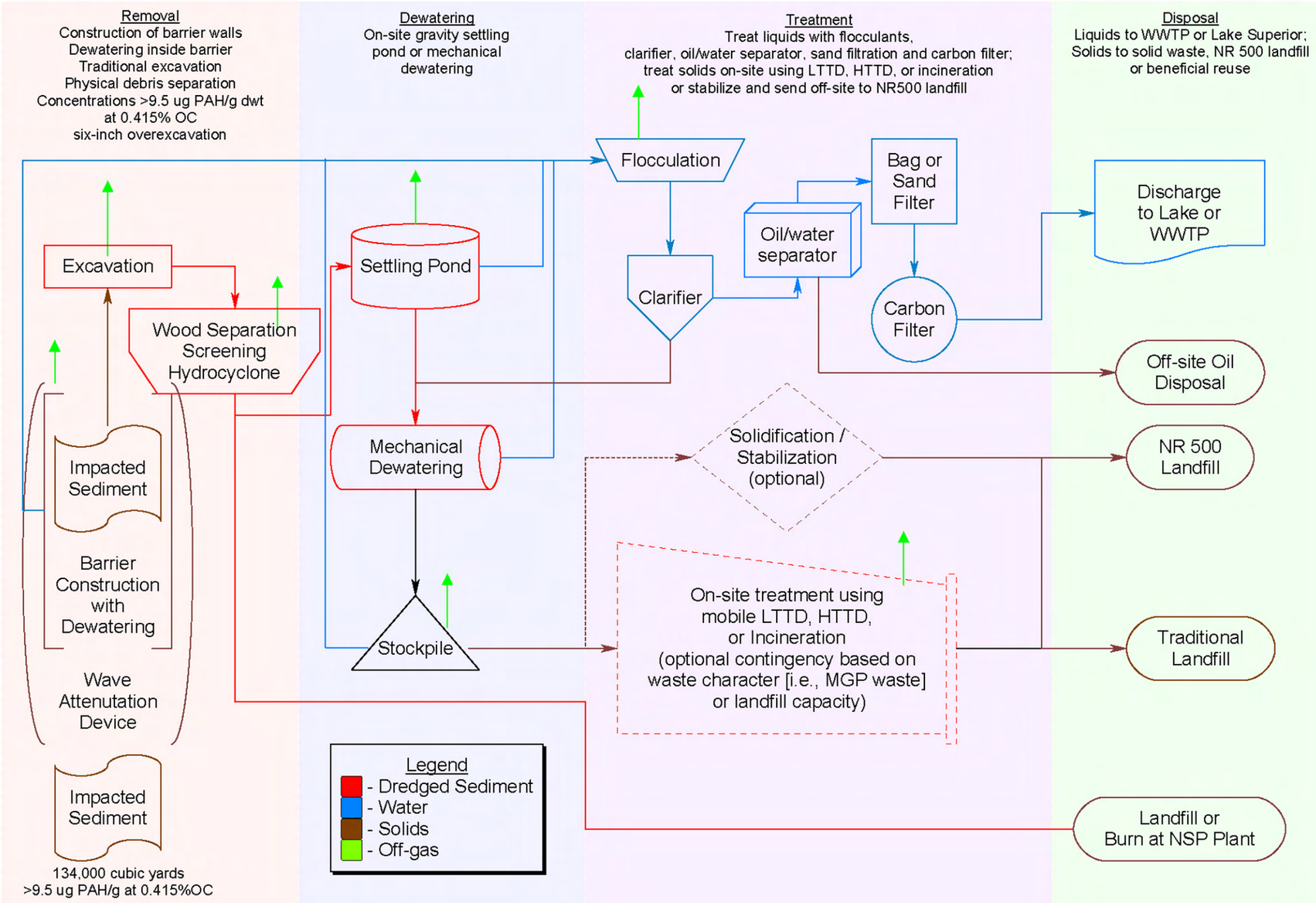
6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

PROCESS FLOW DIAGRAM
ALTERNATIVE SED-4-DREDGE REMOVAL
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY: TS	DATE: 4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY: HHH	DATE: 4/30/08	25688375.73000	8-11

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16.1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_11.dwg

Alternative 5: Remove sediment >9.5 ug PAH/g dwt at 0.415%OC; treat sediment on-site, dispose of sediment off-site; monitor sediment areas >5.6 ug PAH/g dwt at 0.415%OC



File: projects/ashland/process diagrams/Alt 5 rrf rev 2..flo

URS
6737 West Washington Street
Suite 2265
Milwaukee, WI 53214
414.831.4100 Tel
414.831.4101 Fax

PROCESS FLOW DIAGRAM
ALTERNATIVE SED-5-DRY EXCAVATION
ASHLAND/NSP LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY: TS	DATE: 4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY: HHH	DATE: 4/30/08	25688375.73000	8-12

PLOT DATE: Jan 30, 2006 1:12pm DISK FILE NAME: (16:1) V:\Envir Mngt\Projects\Xcel Energy\Ashland\FS\EPA comments\CADD\Figure8_12.dwg

NORTH

SCALE IN FEET

0 50 100 150 200

LEGEND:

= NPL SITE BOUNDARY

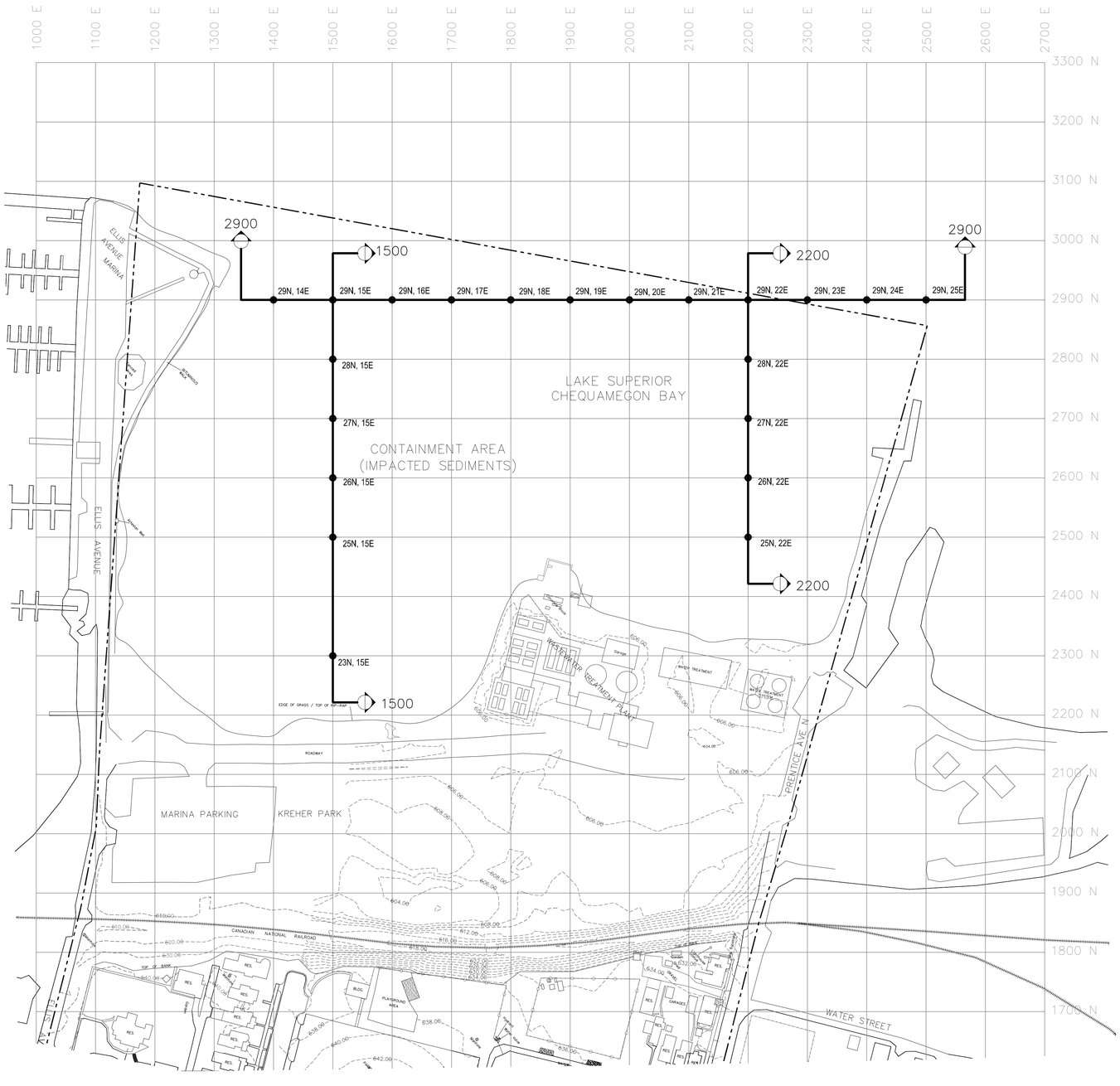
= SURFACE CONTOUR MAJOR

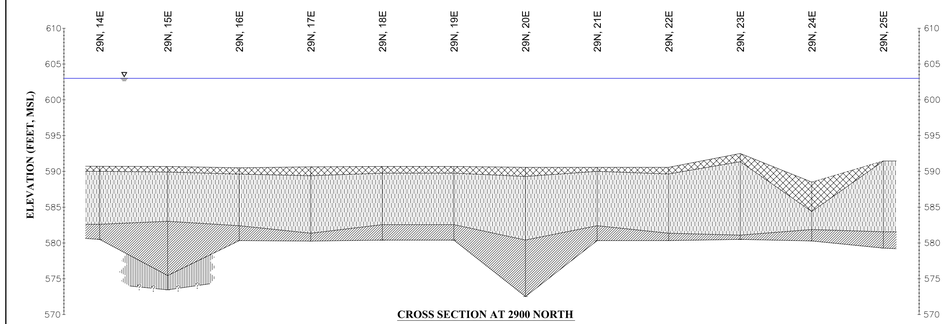
= SURFACE CONTOUR MINOR

URS
100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

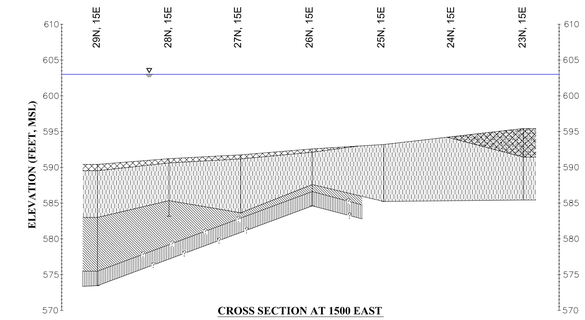
SITE PLAN WITH EXISTING CONDITIONS
DRY EXCIVATION ALTERNATIVE ASHLAND/NSP
LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN. BY:	BKR	DATE:	4/30/08	PROJECT NO.	FIG. NO.
CHK'D. BY:	JVH	DATE:	4/30/08	25688375.76000	8-13

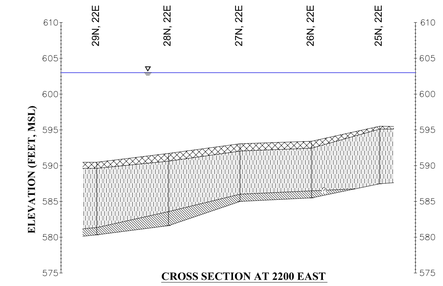




CROSS SECTION AT 2900 NORTH



CROSS SECTION AT 1500 EAST



CROSS SECTION AT 2200 EAST

LEGEND:

- = WOOD
- = SAND AND WOOD
- = SAND/SILT
- = CLAY
- = SILT
- = LAKE ELEVATION
- = INFERRED CONTACT

VERTICAL SCALE IN FEET

0 5 10 15 20

HORIZONTAL SCALE IN FEET

0 50 100 150 200

NORTH

SCALE IN FEET

0 50 100 150 200

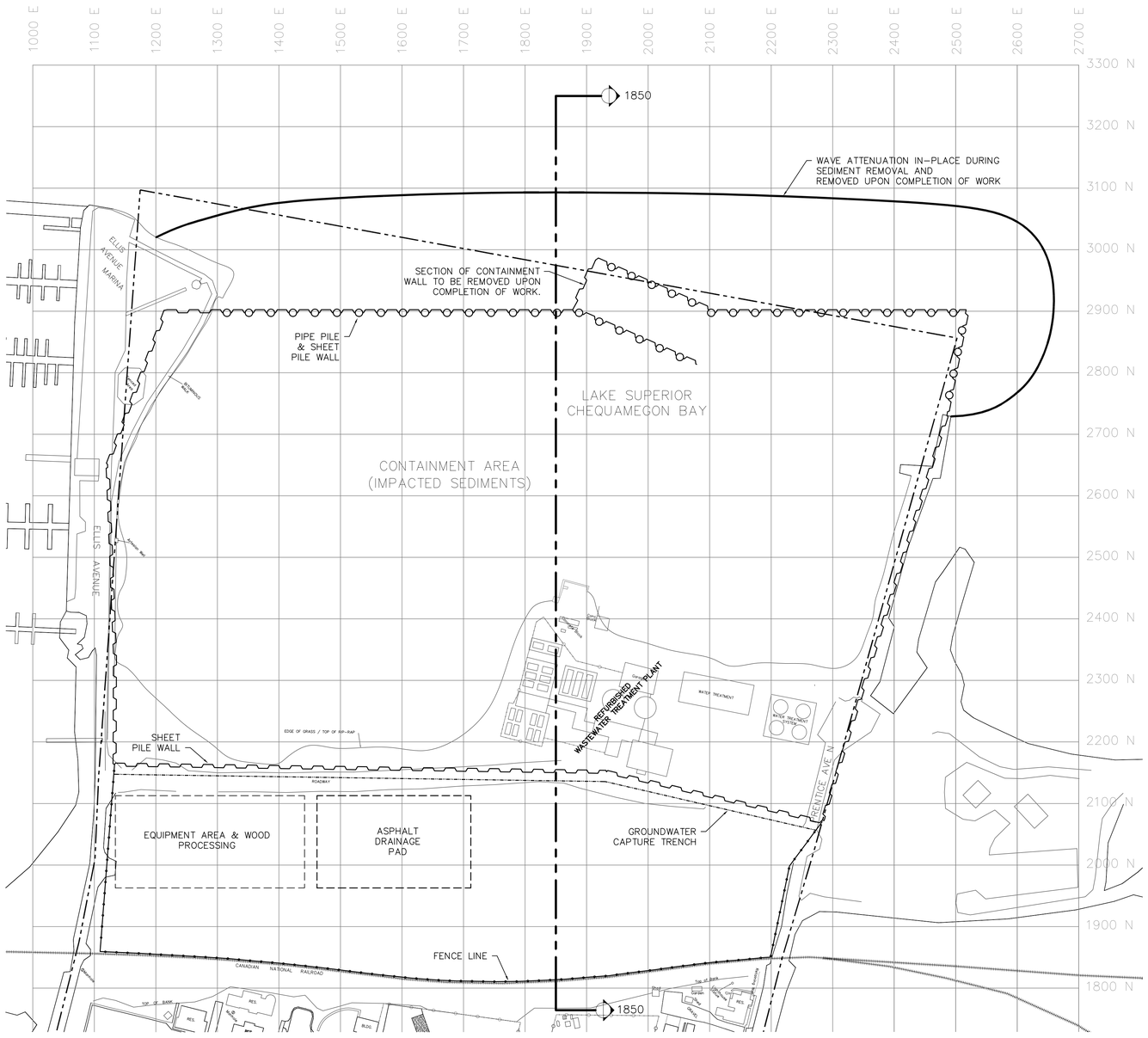
LEGEND:

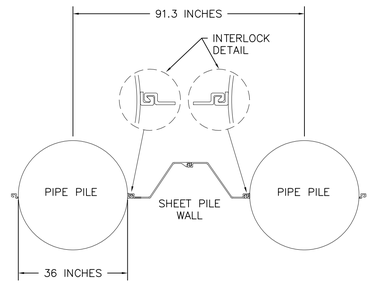
- = NPL SITE BOUNDARY
- = SURFACE CONTOUR MAJOR
- = SURFACE CONTOUR MINOR

URS
100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

EXISTING CONDITIONS & CROSS-SECTIONS
DRY EXCAVATION ALTERNATIVE ASHLAND/NSP
LAKEFRONT SITE
ASHLAND, WISCONSIN

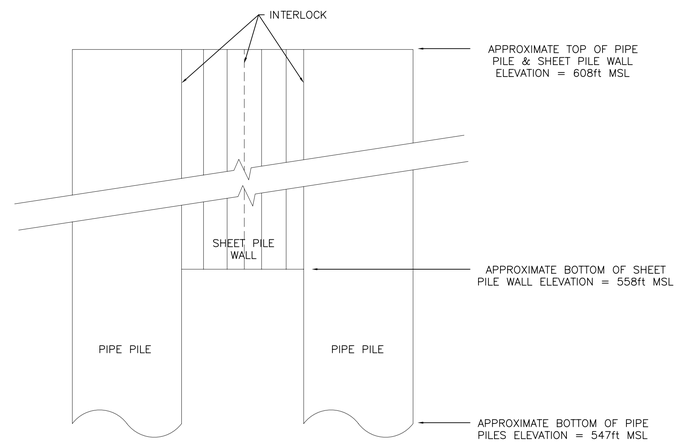
DRN BY:	BKR	DATE:	4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY:	JVH	DATE:	4/30/08	25688375.76000	8-14





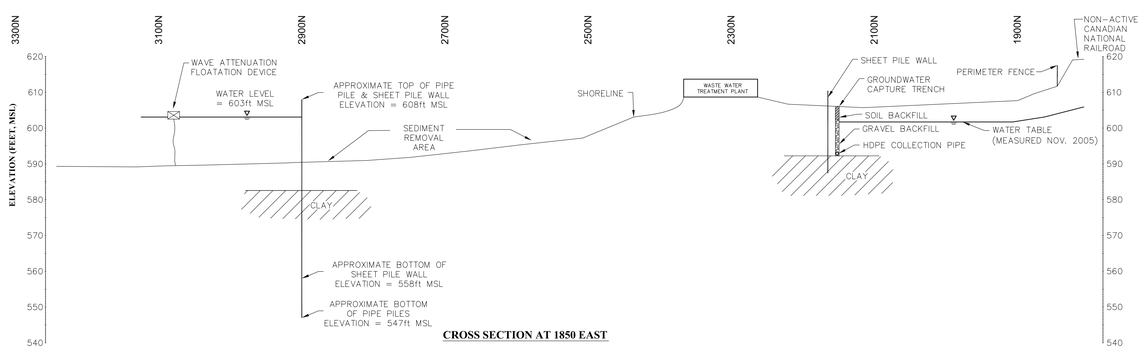
PIPE PILE / AZ SHEET PILE COMBINED WALL SYSTEM
PLAN VIEW

NOT TO SCALE



PROFILE VIEW

NOT TO SCALE



CROSS SECTION AT 1850 EAST

NORTH

SCALE IN FEET

0 50 100 150 200

LEGEND:

- = NPL SITE BOUNDARY
- = SHEET PILE WALL
- = GROUNDWATER CAPTURE TRENCH
- = FENCE LINE

NOTES:

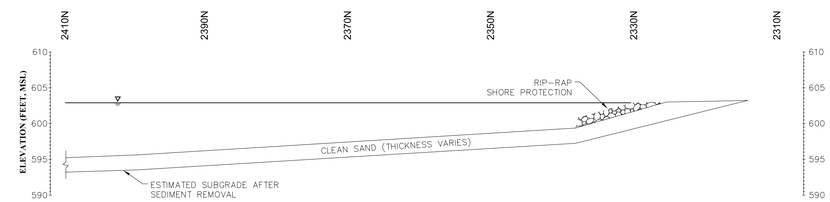
1) SECTIONS OF THE WAVE ATTENUATION DEVICE WOULD BE DESIGNED TO ALLOW BARGE ACCESS FOR INSTALLATION OF THE CONTAINMENT WALL LOCATED WITHIN THE BAY.

URS
100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

PROPOSED CONSTRUCTION ELEMENTS
& CROSS SECTION
DRY EXCAVATION ALTERNATIVE ASHLAND/NSP
LAKEFRONT SITE ASHLAND, WISCONSIN

DRN BY: BKR	DATE: 4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY: JVH	DATE: 4/30/08	25688375.76000	8-15

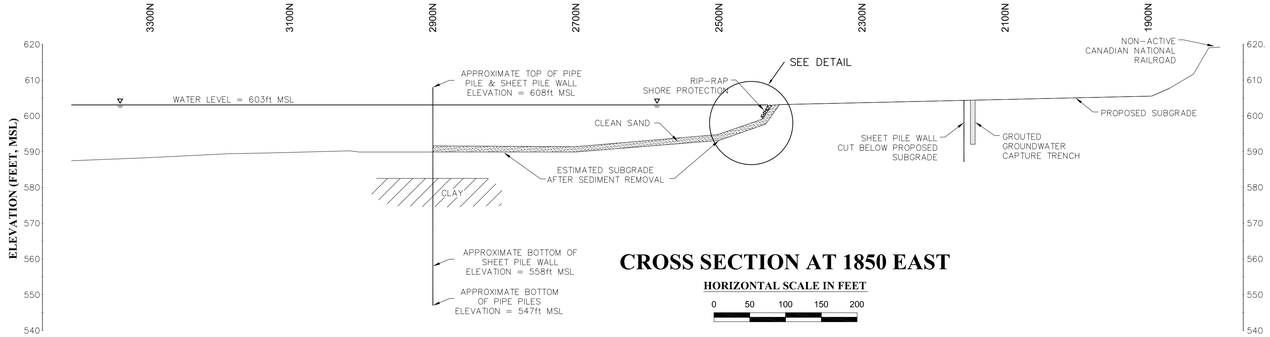
PLOTTED: May 1, 2008 BY: Barnes, Brian CTB USED: JOC-14.ctb PAPER SPACE TAB: Fig 8-15
DWG File: T:\Jobs_A\Ashland\Ashland WI Jobfiles\ 2008 - Dry Dredge\DRY\Jobfiles @ - Dry Proc (For Review Comments).dwg



DETAIL

SCALE IN FEET

0 5 10 15 20



CROSS SECTION AT 1850 EAST

HORIZONTAL SCALE IN FEET

0 50 100 150 200

NORTH

SCALE IN FEET

0 50 100 150 200

LEGEND:

- = NPL SITE BOUNDARY
- = RIP-RAP
- = SAND COVER
- = CUT-DOWN SHEET PILE WALL
- = PIPE PILE & SHEET PILE WALL

URS
100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

PROPOSED FINAL SITE FEATURES
PLAN VIEW AND CROSS SECTION
DRY EXCAVATION ALTERNATIVE ASHLAND/NSP
LAKEFRONT SITE ASHLAND, WISCONSIN

DRN BY:	BKR	DATE: 4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY:	JVH	DATE: 4/30/08	25688375.76000	8-16

PLOTTED: May 1, 2008 BY: Barnes, Brian CTB USED: JACK-FULL.CTB PAGE SPACE TYPE: Fig 8-16
DWG Name: \\chi0vs_2\Clients\Ashland\25688375 - Dry Excavation\Figures\Figure 8 - Site Plan Alternative.dwg

URS

100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

WAVE ATTENUATOR SECTIONS READY FOR SHIPMENT
DRY EXCAVATION ALTERNATIVE ASHLAND/NSP
LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY:	BKR	DATE:	4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY:	JVH	DATE:	4/30/08	25688375.76000	8-17

URS

100 S. WACKER DRIVE
SUITE 500
CHICAGO, ILLINOIS 60606
(312) 939-1000 Tel
(312) 939-4198 Fax

WAVE ATTENUATORS DEPLOYED AS BREAKWATER
DRY EXCAVATION ALTERNATIVE ASHLAND/NSP
LAKEFRONT SITE
ASHLAND, WISCONSIN

DRN BY:	BKR	DATE:	4/30/08	PROJECT NO.	FIG. NO.
CHK'D BY:	JVH	DATE:	4/30/08	25688375.76000	8-18