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2/25/03

Quality Assurance Project Plan

Ashland/NSP Lakefront Site

Task Specific - OU #4 Winter 2003 Sediment Sampling
Remedial Investigation/Feasibility Study

Ashland, Wisconsin

SEH No. WIDNR9401.15

Original Effective Date: February 25, 2003

EPA Region 5 Records Ctr.
278366

Group A

A Quality Assurance Project Plan

Ashland/NSP Lakefront Site

Task Specific - OU #4 Winter 2003 Sediment Sampling
Remedial Investigation/Feasibility Study
Ashland, Wisconsin

SEH No. WIDNR9401.15

Prepared for:
Wisconsin Department of Natural Resources

Original Effective Date: February 25, 2003

Prepared by:
Short Elliott Hendrickson Inc.
421 Frenette Drive
Chippewa Falls, WI 54729-3374
715.720.6200

A1. Signature Page

I, Cyrus. W. Ingraham, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Admin. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Admin. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Admin. Code.

Cyrus W. Ingraham, PE Project Manager	E-24690 PE Number	December 16, 2002 4-15-03 Date

I, Gloria G. Chojnacki, hereby certify that I am a scientist as that term is defined in s. NR 712.03(3), Wis. Admin. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Admin. Code.

Gloria G. Chojnacki, CHMM Environmental Scientist	CHMM Number	4-21-03 Date

I, John E. Guhl, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03(1) Wis. Admin. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Admin. Code.

John E. Guhl, PG Hydrogeologist	#120 PG Number	4-15-03 Date

US EPA Region 5 Remedial Project Manager	5/14/03 Date
US EPA Region 5 Quality Assurance Reviewer	5/14/03 Date
Severn Trent Laboratories, Inc.	Date
Battelle	Date

A1. Signature Page

I, Cyrus. W. Ingraham, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Admin. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Admin. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Admin. Code.

	E-24690	December 16, 2002
Cyrus W. Ingraham, PE Project Manager	PE Number	Date

I, Gloria G. Chojnacki, hereby certify that I am a scientist as that term is defined in s. NR 712.03(3), Wis. Admin. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Admin. Code.

Gloria G. Chojnacki, CHMM Environmental Scientist	CHMM Number	Date

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John E. Guhl, PG Hydrogeologist	PG Number	Date

US EPA Region 5 Remedial Project Manager	Date
US EPA Region 5 Quality Assurance Reviewer	Date
Severn Trent Laboratories, Inc. Richard Wright	4/15/03 Date
Battelle	Date

A1. Signature Page

I, Cyrus. W. Ingraham, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Admin. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Admin. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Admin. Code.

	E-24690	December 16, 2002
Cyrus W. Ingraham, PE Project Manager	PE Number	Date

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Gloria G. Chojnacki, CHMM Environmental Scientist	CHMM Number	Date

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John E. Guhl, PG Hydrogeologist	PG Number	Date

US EPA Region 5 Remedial Project Manager	Date
US EPA Region 5 Quality Assurance Reviewer	Date
Severn Trent Laboratories, Inc.	Date
Battelle	4/9/03 Date

A1.A Revision Page

Revision No.	Effective Date	Comment/Major Revision	Document Section	Signed
000	2/25/03	Original Document		
001	4/02/03	Revision	Group A – revise all Group D – revise pg 3 of 4 Tables – revise all Revise Figure 1 of 8 Revise Figure 8 of 8 Appendix D – replace USP-5035 – add UWC-002	

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A2.A List of Abbreviations/Terms

Battelle	Battelle Memorial Institute
BETX	Benzene, Ethylbenzene, Toluene, Xylenes
CAR	Corrective Action Report
CERCLA	Comprehensive Environmental Response and Liability Act
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CLP	Contract Laboratory Program
cm/sec	centimeters per second
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CWG	Carbureted Gas Water
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
FID	Flame Ionization Detector
FS	Feasibility Study
GC	Gas Chromatograph
gpm	gallons per minute
GPS	Global Positioning System
HAH	Heterocyclic Aromatic Hydrocarbon compounds
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICAL	Instrument Calibration
ICP	Ion Column Pressure
IDC	Initial Demonstration of Capabilities
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
LP	Light and Power
LQM	Laboratory Quality Manual
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
Mod	Modification
MS	Mass Spectrometer or Matrix Spike
MSL	Mean Sea Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon compounds
PARCC	Precision, Accuracy, Representativeness, Completeness, Comparability
PID	Photoionization Detector

A2. List of Abbreviations/Terms (Continued)

ppm	parts per million
PE	Professional Engineer or Performance Evaluation
PG	Professional Geologist
PRG	Preliminary Remediation Goal
PT	Proficiency Testing
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
RAO	Remedial Action Option
RCRA	Resource Conservation and Recovery Act
RDR	Resubmitted Data Report
RL	Reportable Limit
RI	Remedial Investigation
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SDR	Sample Discrepancy Report
SEH	Short Elliott Hendrickson Inc.
SIM	Select Ion Monitoring
SOP	Standard Operating Procedure
SRR	Street Railroad
SRRC	Street Railroad Company
STL	Severn Trent Laboratories, Inc.
SVOC	Semi-Volatile Organic Compound
TOC	Total Organic Carbon
TSA	Technical System Audit
TVA	Toxic Vapor Analyzer
USCS	Unified Soil Classification System
U.S. EPA	United States Environmental Protection Agency
UV-Vis	Ultraviolet – visual range
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources
Wis. Admin. Code	Wisconsin Administrative Code
WWTP	Wastewater Treatment Plant

A3. Distribution List

No. of Copies	Sent to
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2	Alida Roberman, Quality Assurance Reviewer Environmental Protection Agency – Region 5 77 West Jackson Boulevard Chicago, IL 60604-3590
1	James R. Dunn, Project Manager Wisconsin Department of Natural Resources 810 W. Maple Street Spooner, WI 54901
1	Cyrus Ingraham, Project Manager Short Elliott Hendrickson Inc. 421 Frenette Drive Chippewa Falls, WI 54729-3374
1	Richard C. Wright Severn Trent Laboratory - Chicago 2417 Bond Street University Park, IL 60466-3182
1	Stephen Emsbo-Mattingly Battelle Memorial Institute 397 Washington Street Duxbury, MA 02332

Quality Assurance Project Plan

Ashland/NSP Lakefront Site
Task Specific – OU #4 Winter 2003 Sediment Sampling
Remedial Investigation/Feasibility Study

Prepared for the Wisconsin Department of Natural Resources

The Quality Assurance Project Plan (QAPP) has been prepared to ensure that the precision, accuracy, completeness, representativeness and comparability of data collected during the Ashland/NSP Lakefront OU #4 Winter 2003 Sediment Sampling at Operable Unit #4 are known and documented. This QAPP is prepared as part of the on-going Remedial Investigation/Feasibility Study (RI/FS) at the Ashland, Wisconsin site. The QAPP is task specific and limited to the winter 2003 sediment sampling event.

The QAPP integrates technical and quality aspects of the project by documenting quality assurance (QA), quality control (QC) and technical activities and procedures associated with planning, implementing and assessing environmental data collection operations. The QAPP describes specific protocols for sampling, sample handling and storage, chain of custody (COC), and laboratory analysis.

Short Elliott Hendrickson Inc.® (SEH) has prepared this QAPP on behalf of the Wisconsin Department of Natural Resources (WDNR) in accordance with current United States Environmental Protection Agency (U.S. EPA) guidance and the U.S. EPA Region 5 *Instructions on the Preparation of A Superfund Division Quality Assurance Project Plan, Based on EPA QA/R-5, Revision 0.*

In accordance with U.S. EPA QA/R-5, there are four basic groups of elements that are addressed in the QAPP. The four groups of elements and their intent are summarized as follows:

A. Project Management – The elements in this group cover all aspects of project management, objectives and history. They identify the roles and responsibilities of project personnel and describe the communication procedures. These elements document that the project has a defined goal and that participants understand the goal and approach to be used.

B. Data Generation and Acquisition – The elements in this group describe the design and implementation of measurement systems that will be used during the project. Sampling procedures, analytical methods/procedures, and data handling and documentation procedures are described. Quality control procedures, frequency requirements, acceptance criteria, and corrective action procedures associated with methods/procedures are documented.

C. Assessment/Oversight – The elements in this group cover the procedures used to ensure proper implementation of the QAPP.

D. Data Validation and Usability – The elements in this group cover the QA activities that occur after the data collection phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the project objectives.

A4. Task Personnel Organization and Responsibility

SEH will direct and supervise the OU #4 Winter 2003 Sediment Sampling activities and provide project management and will perform the subsequent FS. The WDNR will oversee the winter 2003 sediment sampling activities. The EPA will oversee the WDNR. The QA and management responsibilities of key project personnel are defined below.

The lines of authority specific to this investigation are presented in Figure 1, "Project Responsibilities Chart." This chart includes all individuals discussed below.

A4.A Management Responsibilities

A4.A.(1) EPA

John Peterson, US EPA Region 5 Remedial Project Manager, will direct as well as support the WDNR Project Manager in coordinating all task activities. Mr. Peterson is responsible for EPA approval of proposed task activities and task documents.

A4.A.(2) WDNR

The WDNR is the lead agency and is responsible for providing oversight of task activities.

A.4.A.(2)(a) *Project Manager*

James R. Dunn, WDNR Project Manager, is responsible for review and approval of technical information and task deliverables, coordination of regulatory agency oversight, communication between stakeholders, and regulatory involvement in the community relations program.

A4.A.(3) Short Elliott Hendrickson

SEH is the contractor for the WDNR. At the direction of the WDNR, SEH has the responsibility for all phases of the investigation. SEH will perform the field investigation, prepare the report, and perform any subsequent studies. Project management will also be provided by SEH. The various QA, field, laboratory and management responsibilities of key project personnel are defined below.

A.4.A.(3)(a) *Project Manager*

SEH's Project Manager, Mr. Cyrus Ingraham, PE, will provide technical and managerial direction for the task including oversight of the task, committing necessary resources to meet project objectives, organizing and delegating task responsibilities, monitoring field activities, supervising the preparation of deliverables, complying with project milestones, project strategy, and tracking the task budget. Mr. Ingraham will be responsible for the activities of any subcontractors to SEH. He will also be responsible for the identification and ultimate resolution of technical problems Mr. Ingraham will report directly to the WDNR Project Manager and be the primary contact with WDNR.

A.4.A.(3)(b) *Task Coordinator*

Gloria Chojnacki, CHMM, SEH Project Scientist will serve as the SEH investigation coordinator, and will provide logistical support for coordination of project field activities with SEH staff and subcontractors in order to maintain project schedules and project quality. Ms. Chojnacki will be responsible for preparation of the task QAPP and provide input to the investigation for use in future human health risk assessment related to potential human exposure to offshore sediments. Ms. Chojnacki, will provide logistical support and report directly to the SEH Project Manager.

A.4.A.(3)(c) *Project Engineer*

Mark J. Broses, PE, will provide technical and quality assurance to the project, especially related to future ecological risk assessment concerns related to offshore sediments. Mr. Broses will report directly to the SEH Project Manager.

A4.B QA Responsibilities

A4.B.(1) EPA Quality Assurance Reviewer

Alida Roberman, Region 5 Quality Assurance Reviewer will be responsible for review and approval of the task specific QAPP.

A4.B.(2) SEH QAPP Preparer

Gloria Chojnacki, CHMM, SEH Project Scientist will be responsible for the preparation of the task specific QAPP for the winter 2003 sediment sampling at OU #4. Ms. Chojnacki will report directly to the SEH Project Manager.

A4.B.(3) SEH Quality Assurance Director

Bruce Olson, PE will be responsible for technical review, and quality assurance. Mr. Olson will be responsible for assuring that the quality of data collected during the RI/FS meets the requirements of the EPA and WDNR. As such, he will be responsible for QAPP review and approval, and data validation and assessment. Mr. Olson is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, SEH's policies, and WDNR requirements. Mr. Olson will report directly to the SEH Project Manager.

A4.C Field Responsibilities

Field personnel will be provided by SEH and Matrix Environmental, a subcontractor to SEH.

A4.C.(1) SEH Inc.

A.4.C.(1)(a) *Field Coordinator/Task Hydrogeologist*

SEH's Field Coordinator, Mr. John Guhl, PG, is a Senior Hydrogeologist and will be responsible for leading, coordinating, or performing fieldwork during the winter 2003 sediment sampling at OU #4. The Field Coordinator will report directly to the SEH Project Manager. Mr. Guhl will be responsible for coordinating day-to-day field activities; assuring that all field QA/QC elements are performed, including sampling and decontamination procedures, sample preservation and packing, and chain of COC procedures; evaluation of existing sediment data; reviewing and interpreting collected data; and preparing reports associated with field activities. Any variations from established plans and procedures will be discussed with the Project Manager and documented in the RI Report. Mr. Guhl will also be responsible for hydrogeological evaluation and contamination assessment.

A.4.C.(1)(b) *Field Personnel*

Brian Kent, CHMM, SEH Project Scientist: will provide field support for the project, providing logistical assistance to the SEH Field Coordinator during performance of field activities and assisting in the performance of field activities.

A4.C.(2) Matrix Environmental

Matrix is the field sampling contractor for SEH. The responsibilities of Matrix management team members are summarized below.

A.4.C.(2)(a) *Project Manager*

Jim Dzubay, is responsible for work scheduling, site oversight, and project management.

A.4.C.(2)(b) *Site Supervisor*

Dan Pipp is responsible for site supervision, equipment oversight, field sampling activities, documentation, and client management.

A.4.C.(2)(c) *Site Safety Officer*

Dan Pipp is responsible for site health and safety monitoring and compliance with the site health and safety plan.

A4.D Laboratory Responsibilities

A4.D.(1) Severn Trent Laboratories, Inc.

The laboratory tasked with responsibility for the routine analytical testing of sediments collected during the Ashland/NSP Lakefront Site winter sampling is Severn Trent Laboratories, Inc. Chicago (STL, formerly Weston-Gulf Coast). The laboratory is located in University Park, IL, which is approximately 30 miles south of Chicago, and is staffed by 82 professionals. The laboratory is comprised of 51,000 square feet of state-of-the-art commercial laboratory and office space and houses both inorganic and organic operations. The facility is divided into separate work areas to facilitate sample throughput.

The list of target parameters for this project is indicated in Table 1, "STL Laboratory Parameters." The select list of analytes and compounds will be analyzed via *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846), Third Edition, Update III.

A listing of the compounds and elements is presented in Table 2, "Analyte List and Analytical Sensitivity Requirements," which defines the laboratory's Method Detection Limits, Reporting Limits, and QC Acceptance Criteria.

A.4.D.(1)(a) *STL Chicago Laboratory Manager - Michael J. Healy*

Michael J. Healy is the laboratory manager for STL Chicago who will have the ultimate responsibility for the generation of reliable laboratory data. The Laboratory Manager's responsibilities include allocation of personnel and resources, setting goals and objectives for both the business and employees, to see that all tasks performed in the laboratory are conducted according to the requirements of this QAPP; and to assure

that the quality of service provided complies with the project's requirements.

The Laboratory Manager has the authority to effect those policies and procedures to ensure that only data of the highest level of excellence are produced. As such, the Laboratory Manager supports a QA Section which has responsibilities independent from sampling and analysis.

A.4.D.(1)(b) *STL Chicago Project Manager – Richard C. Wright*

Richard C. Wright is responsible for preparing the Project Technical Profile summarizing QA/QC requirements for the project, maintaining the laboratory schedule, ensuring that technical requirements are understood by the laboratory, and advising the Laboratory Manager and QA Manager of all variances. The laboratory PM will provide technical guidance to SEH and provide a review of this final QAPP to ensure accuracy of the laboratory information.

A.4.D.(1)(c) *STL Chicago Quality Manager – Terese A. Preston*

The Quality Assurance Manager has the full-time responsibility to evaluate the adherence to policies and to assure that systems are in place to produce the level of quality defined in this QAPP. In addition, the QA Manager may assist in the preparation, compilation, and submittal of quality assurance plans. The QA Manager reviews program plans for consistency with organizational and contractual requirements and will advise appropriate personnel of deficiencies.

The QA Manager maintains a sufficient staff to initiate and oversee audits of corrective action procedures, perform data review, and maintain documentation of training. In addition, the QA Manager has the authority to stop work on projects if QC problems arise which affect the quality of the data produced.

The QA Manager will communicate data issues to the Project Manager and Laboratory Manager.

A.4.D.(1)(d) *STL Technical Managers*

The Technical Managers are the Laboratory Section Managers:

- Diane L. Harper, Inorganics Section Manager, MA Biology, 27 years laboratory experience.
- Mani S. Iyer, Metals Section Manager, BA Chemistry, 30 years laboratory experience.
- Gary L. Rynkar, GC/MS Section Manager, BS Environmental Biology, 14 years laboratory experience.

All of these managers report to the Laboratory Manager and serve as the technical experts on assigned projects, provide technical liaison, assist in resolving any technical issues within the area of their expertise; and implement established policies and procedures to assist the Laboratory Manager in achieving section goals. The Technical Managers are responsible for ensuring that their personnel are adequately trained to perform analyses; that equipment and instrumentation under their control is calibrated and functioning properly; that system and performance audits are performed on an as-needed basis; provide input and review in the development and implementation of project-specific QA/QC requirements; and for providing the critical review of proposal and project work for programs as directed by the Laboratory Manager. The Technical Managers coordinate these activities with the project management and quality assurance sections.

A.4.D.(1)(e) *STL Data Management Manager*

The Data Management Manager is responsible for coordinating receipt of all data from the various service groups within the laboratory and ensuring that data are reported in a timely manner and in the proper format.

A.4.D.(1)(f) *STL Sample Custodians*

The responsibilities of the sample custodians are:

- Receiving and inspecting the incoming sample shipments/ containers;
- Recording the condition of the incoming sample shipments/ containers;
- Signing appropriate documents;
- Verifying COC and its correctness;
- Notifying the laboratory project manager of sample receipt and inspections;
- Assigning a unique identification number and customer number, and entering each into the LabNet (LIMS);
- Initiate transfer/storage of the samples to the appropriate laboratory sections/storage coolers;
- Controlling/monitoring access/storage of samples.

A.4.D.(1)(g) *STL Technical Staff*

The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may indicate that the analytical system is not in control. Analysts must use quality control indicators to assure that the method is in-control before reporting results. Any problems are brought to the attention of the project manager, QA manager, and/or laboratory manager.

A4.D.(2) **Battelle Memorial Institute**

Battelle Memorial Institute (Battelle) will conduct a forensic investigation to determine the origin of PAH at the Ashland/NSP Lakefront Site. The Battelle laboratory is located in Duxbury, MA. It is approximately 30 miles south of Boston, MA. The laboratory is comprised of 11,000 square feet of state-of-the-art organic laboratories accompanied by 14 buildings that house data management, document production, library, archives, solvent and waste storage, carpentry and fabrication shops, field equipment, and offices.

The environmental forensic investigation conducted by Battelle will include the parameters in Table 3, "Forensic Laboratory Parameters." These parameters will be analyzed in sediment and SVOC/NAPL samples. The WDNR has approved the quantitative SVOC method for regulatory compliance (WDNR No. 399022030). Battelle will perform additional forensic methods for hydrocarbon source identification purposes. These include high-resolution hydrocarbon fingerprinting and biomarkers. All methods resemble the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846), Third Edition, Update III.

Battelle has provided a Work/Quality Assurance Project Plan which is located in Appendix A, "Battelle QAPP." Battelle's analytical procedures and QA/QC methods and practices are based on this QAPP. Please refer to Section 3.0 of this plan for details on Battelle's organization and communication policy.

The quantified analytes, reporting limits, and method detection limits are presented in Table 4, "Minimum Forensic Quantitative Analytes."

The following personnel will assume primary responsibility for the execution of this project:

A.4.D.(2)(a) *Laboratory Manager – William Steinhauer*

The laboratory manager will have the ultimate responsibility for the generation of reliable laboratory data. The Laboratory Manager's responsibilities include allocation of personnel and resources, setting

goals and objectives for both the business and employees, to see that all tasks performed in the laboratory are conducted according to the requirements of the laboratory QAPP; and to assure that the quality of service provided complies with the project's requirements.

A.4.D.(2)(b) *Project Manager – Stephen Emsbo-Mattingly*

The Project Manager prepares the Project Specific Laboratory Workplan/QAPP that summarizes the applicable QA/QC requirements and laboratory schedule. The Project Manager communicates and clarifies the project objectives with the in-house laboratory team and manages unforeseen problems that may arise.

A.4.D.(2)(c) *Quality Manager – Rosanna Buhl*

The Quality Assurance (QA) Manager has the full-time responsibility to evaluate the adherence to policies and to assure that systems are in place to achieve the level of quality defined in this QAPP. The QA Manager reviews program plans for consistency with organizational and contractual requirements and will advise appropriate personnel of deficiencies.

The QA Manager is responsible for the oversight of data review, corrective actions, and QC training. In addition, the QA Manager has the authority to stop work on projects if QC problems arise which affect the quality of the data produced.

The QA Manager will communicate data issues to the Project Manager and Laboratory Manager.

A.4.D.(2)(d) *Laboratory Chemists - Various*

Laboratory Chemists are responsible for executing the Battelle (Standard Operatinr Procedures (SOP) in compliance with the specifications of the Project Specific Workplan/QAPP.

A.4.D.(2)(e) *Sample Custodians - Various*

The responsibilities of the sample custodians are:

- Receiving and inspecting the incoming sample shipments/containers;
- Recording the condition of the incoming sample shipments/containers;
- Signing appropriate documents;
- Verifying COC and its correctness;
- Notifying the laboratory project manager of sample receipt and inspections;
- Assigning a unique identification number and customer number, and entering each into the LabNet (LIMS);

- Initiate transfer / storage of the samples to the appropriate laboratory sections/storage coolers;
- Controlling/monitoring access/storage of samples.

A4.E Special Training Requirements/Certifications

All personnel responsible for performance of field activities or anyone who will be on site within the exclusion zone are required to have completed the 40-hour OSHA HAZWOPER safety training course and current 8-hour refresher courses.

SEH employees have HAZWOPER initial 40-hour training and refresher course documentation in the SEH safety files. All subcontractors to SEH are required to provide documentation of initial and current training prior to commencement of field activities. All non-SEH personnel wishing to enter the exclusion zone must provide the same training documentation. All HAZWOPER training documentation will be retained in the project files.

A4.F Project Organization Chart

The lines of authority specific to this investigation are presented in Figure 1. This chart includes all individuals discussed in Section A4.

A5. Problem Definition and Background Information

A5.A Problem to be Addressed

The offshore sediments located immediately adjacent to the site have been impacted by a wide range of SVOC contaminants and by VOCs (primarily BETX compounds). Generally, the extent of offshore contamination identified at the site to-date is contiguous with the north shoreline and extends offshore forming three undulating lobes

The historic contaminant delineation has been limited by several factors, including: elevated detection limits; low level (CLP Level II) laboratory data validation; and, limited number of Level IV samples in areas of lower contaminant concentration. Elevated detection limits from historic site data prevent contaminant delineation to the current Preliminary Remediation Goal (PRG) values. The early samples collected at CLP Level II validation are not acceptable for identifying degree and extent of contamination and risk assessment. Much of the historic data is limited to screening purpose usage. The limited number of existing CLP Level IV samples in areas of lower contaminant concentration prevent accurate contaminant delineation in these areas. Additional sediment sample collection and analysis will be required in order to complete sediment contaminant delineation at the site as well as identify

contaminant iso-concentrations that will be required for future *ecological risk assessment testing*

In addition to horizontal sediment contamination delineation, samples will be collected at depth to provide vertical definition of sediment contamination related to the PRGs.

Insufficient data has been gathered to date on sediment background concentrations of contaminants and inorganic analytes at OU #4. This data is required to rule out contaminants of potential concern (COPC), further assess remediation requirements, and conduct ecological and human health risk assessment at the site. SVOC/NAPL characterization is further needed to determine if the SVOC contamination at the site is from one or more sources.

A5.B Environmental Questions Being Asked

- What is the defined horizontal and vertical limit of contamination at OU #4 sediments with respect to the PRG values as determined by the preliminary ecological risk assessment and established regulatory limits?
- What are background concentrations of the contaminants of potential concern (COPC) in the vicinity of the site?
- Are inorganic parameters also of potential concern?
- Are there iso-concentrations of contaminants from which a dose response curve can be developed for future ecological risk assessment? What are the most critical areas within OU #4 to conduct ecological testing and evaluation that is representative of the operable unit?
- What is the fingerprinting pattern displayed by SVOC/NAPL found in OU #4 and how does this pattern relate to SVOC/NAPL found in source areas and other operable units at the site?

A5.C Existing Site Conditions

A5.C.(1) Site Description

The Ashland/NSP Lakefront Site is located in Section 33, Township 48 North, Range 4 West in Ashland County, Wisconsin as shown in Figure 2, "Site Location." The latitude and longitude of the property is 46 35' 41" North and 90 53' 01" West. As depicted on Figure 3, "Site

Features," the site is located in an active community surrounded by residences, schools, hotels, and public recreation areas.

The site is located in the City of Ashland between Prentice Avenue and Ellis Avenue along the shoreline of Chequamegon Bay. The southern portion of the site consists of a filled ravine area, which extended to just south of St. Claire Street, where a former manufactured gas plant (MGP) was located. Approximately ten acres of a City park (Kreher Park), ten acres of offshore sediments, and a deep aquifer (Copper Falls Formation) comprise the remainder of the site. The areal boundaries of the site are presented on Figure 3.

A5.C.(2) Site History

The land currently comprised by Kreher Park was created in the late 1800's and early 1900's by placement of various fill materials into Chequamegon Bay, resulting in extension of the former shoreline approximately 400 feet to the north. From the late 1800's until 1936, this portion of the Ashland shoreline was owned by various lumber companies, including Barber Mill, W. R. Sutherland Mill, Pope Lumber, and John Schroeder Lumber. Lumber processing operations ceased for the most part by 1930. Ashland County assumed ownership of this portion of the site in 1930, and the City of Ashland has since acquired the property. The City of Ashland Wastewater Treatment Plant (WWTP) was historically present on the north side of the site. The plant was relocated to an off-site location in the late 1980's. The WWTP buildings still occupy this portion of the site, however, much of the water treatment equipment has been removed from the site.

As previously described, a MGP was formerly located on top of the lakeshore bluff on the south side of the site. The MGP plant operations began some time prior to 1886 and ended in approximately 1947. The facility was historically operated by the Ashland Lighting Company, Ashland Light and SRR, Ashland LP and SRRC, and the Lake Superior District Power Company. The MGP was operated as a coal-gas facility until at least 1909, when evidence of both coal gas (coal feed stock) and carbureted water gas (oil feed stock) retorts are present in historic site drawings. A transition from coal-gas to carbureted water gas appears to have occurred some time between 1895 and 1923. After 1923, it appears only the carbureted water gas process was used at the facility.

Prior to being filled some time between 1901 and 1923, a ravine historically ran from the MGP property through the lakeshore bluff, and discharged to the former shoreline. Once the shoreline was extended to the north, an open sewer connected the mouth of the ravine with Chequamegon Bay. Several pipes historically discharged near the mouth of the former ravine, including a storm sewer pipe extending down 3rd

Avenue from Highway 2, and a 12-inch diameter clay pipe extending from the former MGP property through the fill soils in the former ravine. A two-inch tar pipe also was depicted on an historic site drawing extending through the former ravine, but the location of this pipe has not been identified during site excavation activities.

The portion of Chequamegon Bay adjacent to the site was historically used to transport logs to the lumber facilities. The Marina currently located on the north end of Ellis Avenue currently occupies a jetty that was historically used as a rail siding for the loading and unloading of ships. A log boom used for extracting floating logs from the bay was present just north of the former WWTP location. Two docks used to store and transport finished lumber products were located on the east side of the site at the end of Prentice Avenue. Chequamegon Bay is considered waters of the State of Wisconsin. The State also owns the underlying lakebed.

A5.C.(3) Project History

Contamination was first identified at the site during a 1989 environmental assessment of the former WWTP. Since then, several investigations have been conducted to determine the nature, degree, and extent of contamination. Investigation results to-date indicate extensive soil and groundwater contamination is present in the former ravine area as well as below Kreher Park. Groundwater contamination has also been identified in the deep aquifer beneath the former MGP. Sediment contamination has been identified in approximately ten acres of sediment located adjacent to Kreher Park in the embayment formed by the marina jetty on the west, and the former lumber docks on the east.

The contaminants identified during the investigations are predominantly PAHs and volatile organic carbons VOCs. Some metals contamination has also been identified at some locations.

Tasks performed to-date to assess the potential effects of site contaminants include a baseline human health risk assessment and two ecological risk assessments. Remedial Action Options (RAOs) have been assessed, several feasibility studies have been conducted, and several remedial action plans have been prepared to address portions of the site contamination. To-date, remedial activities have been limited to excavation and capping of a seep area formerly located near the mouth of the filled ravine, and groundwater extraction and treatment from the deep aquifer.

On September 5, 2002, the site was listed as a CERCLA site by U.S. EPA. The ongoing investigation activities are still being directed and approved by the WDNR with U.S. EPA approval. The future site

activities will be conducted in accordance with CERCLA requirements. However, a portion of the historic site investigation data was not collected using CLP Level IV validation methodology.

A5.C.(4) Physical Characteristics

The population of Ashland is 9,115 based on 1990 census results. Residents are served by the City's municipal water supply, which is provided by Chequamegon Bay surface water. The surface water intake is located approximately 1900 feet offshore at longitude 90 deg. 50' 29" W and latitude 46 deg. 36' 25" N. The intake is located in approximately 23 feet of water and is approximately one mile northeast of the site.

A5.C.(5) Topography

The Ashland area is located in the Lake Superior Lowland physiographic province characterized by flat to undulating topography underlain by red clay. Uplands lie to the south of Ashland and are characterized by rolling hilly topography and underlain by sand and gravel soils. Elevations in the Ashland area range from approximately 601 feet mean sea level (MSL) datum (Lake Superior surface elevation) to approximately 700 feet MSL. Regional slope is generally to the north.

Kreher Park is situated on a relatively flat terrace located below a 30-foot high lakeshore bluff just south of the former shoreline location. Elevations at Kreher Park generally range from 601 to 610 feet MSL. Elevations in the vicinity of the former MGP are approximately 640 feet MSL.

A5.C.(6) Surface Water

The site is located on the shore of Chequamegon Bay. Regional surface water flows to the north through Fish Creek and several small unnamed creeks and swales into Chequamegon Bay. Surface water at the site flows either to the City of Ashland storm sewer system, or discharges directly into Chequamegon Bay.

A5.C.(7) Regional Geology

Pleistocene till and lake deposits belonging to the Miller Creek Formation occur beneath the native surface soil horizon in the Ashland area (Clayton, 1984). The Miller Creek Formation in the Ashland area consists of glacial and lake deposited silts and clays typically containing between 5 and 30 percent sand, 30 and 65 percent silt, and 10 an 60 percent clay by weight. The lake deposits are most prevalent below the present level of Lake Superior (Clayton, 1984). Thickness of the Miller Creek Formation ranges from approximately 15 to 50 feet.

Pleistocene sand and gravel deposits comprising the Copper Falls Formation directly underlie the Miller Creek Formation in the Ashland area. The Copper Falls Formation typically consists of glacial tills containing 40 to 80 percent sand, 15 to 50 percent silt, 2 to 20 percent clay, and several percent gravel, cobbles, and boulders (Clayton, 1984). Thickness of the Copper Falls formation in the Ashland area is estimated to be over 100 feet. Precambrian sandstone bedrock of the Oronto group is anticipated to underlie the Copper Falls Formation in the Ashland area.

A5.C.(8) Regional Hydrogeology

A shallow water table is commonly found within the surficial soils overlying the Miller Creek Formation in the Ashland area. This saturated zone can locally be up to ten feet thick, but is not commonly used as a water supply source. The Miller Creek Formation acts as an aquitard restricting movement of groundwater through the formation (Bradbury, 1985).

Three deep aquifers are present in the Ashland vicinity; the Pleistocene sand and gravel aquifer (Copper Falls Formation), the Precambrian sandstone aquifer (Oronto and Bayfield groups), and the Precambrian basalt aquifer (Zaporozec, 1985).

The sand and gravel aquifer occurs immediately beneath the Miller Creek Formation. This aquifer is commonly used as a water supply source for private wells in the Ashland area. Wells typically yield from five gallons per minute (gpm) (in silty areas) to 100 gpm (in sand and gravel lenses) from the sand and gravel aquifer (Young, 1974). The sand and gravel aquifer is confined by the overlying Miller Creek Formation in the Ashland area. The potentiometric surface is typically above the ground surface near the Chequamegon Bay shoreline, resulting in artesian conditions.

The Precambrian sandstone aquifer is the primary water supply source for several nearby Bayfield peninsula communities (e.g., Washburn, Bayfield). Moderate to low permeabilities exist within the sandstone aquifer. Sandstone wells in the vicinity typically yield between 5 and 50 gpm.

The Precambrian basalt aquifer produces moderate to low yields of groundwater. Yields are typically controlled by fracture densities within the basalt. This aquifer is commonly used as a water supply source north of the Ashland area, where the basalt occurs closer to the surface.

A5.C.(9) On-Shore Site Geology

Lakeshore Terrace

A flat lakeshore terrace is present at the site extending approximately from the Wisconsin Central Rail line to the Chequamegon Bay shoreline. Near surface soils at the lakefront terrace are comprised largely of fill materials placed in the late 1800's and early 1900's. Fill materials identified during past site investigation activities include wood waste, fill soils, bricks, concrete pieces, and bottles. The fill soils are typically comprised of a surficial soil layer underlain by a layer of slabwood, sawdust, and wood pieces mixed with some soils. Thickness of fill beneath the lakeshore terrace at the site ranges from 5.5 to 14.5 feet.

Fill soils are underlain in places by a relatively thin (0 to 5.5 feet) layer of sand and silty sand beach deposits similar to the sediments encountered offshore. The beach deposits are underlain by cohesive soils of the Miller Creek Formation, which extends to a depth of between 25 to 39 feet below ground surface beneath the lakefront terrace. Water bearing sand and gravel soils are present beneath the Miller Creek formation. Depth to bedrock has not been determined at this location.

Upper Bluff Geology

The geology above the thirty-foot high lakeshore bluff in the proximity of the former ravine has been documented at several locations. Soils outside the ravine generally consist of a thin fill layer overlying cohesive soils of the Miller Creek Formation. Soils within the former ravine include a thick fill layer consisting of various fill soils, ash, wood, bottles and bricks. The fill soils are underlain by cohesive Miller Creek Formation soils in the former ravine area. However, the thickness of the Miller Creek is quite thin at some locations beneath the former ravine.

A5.C.(10) Offshore Geology

Three distinct offshore stratigraphic units have been identified at the site during past investigations. The first unit consists of a wood chip layer, which is present on the surface of the lake bottom at many locations. The wood chip layer ranges in thickness from 0 to 7 feet, and contains some sand as well as some larger wood pieces.

The second stratigraphic unit encountered at the site consists of a layer of sand and silty sand sediments. These sediments are likely Holocene shallow lake deposits placed prior to the wood waste deposition. Thickness of the sand and silty sand sediments ranges from 0 to 13 feet, averaging approximately 7 feet.

The Miller Creek Formation comprises the third offshore stratigraphic unit encountered to-date during site investigation activities. Dense silt, silty clay and lean clay deposits comprise the Miller Creek soils at this location. The Miller Creek soils were not fully penetrated during the investigation. Thickness of offshore Miller Creek soils has not been determined.

A5.C.(11) On-Shore Hydrogeology

A shallow groundwater table is present in the fill soils overlying the Miller Creek Formation in both the lakeshore terrace and the filled ravine areas. Hydraulic conductivities in the slabwood fill are very high ($4x10^{-2}$ cm/sec). Hydraulic conductivities in the ravine fill average approximately $5x10^{-4}$ cm/sec. Direction of shallow groundwater flow is generally to the north.

The sand and gravel (Copper Falls) aquifer appears to be divided into two general hydraulic flow regimes at the site. The upper portion is more silty, with hydraulic conductivities of approximately $8x10^{-4}$ cm/sec. The lower portion consists of cleaner sands and gravels, and has a hydraulic conductivity of approximately $1.2x10^{-2}$ cm/sec. An upward gradient appears to be present in the upper portion of the sand and gravel aquifer. Horizontal flow direction appears to be to the north. Artesian conditions are present along the lakefront terrace in the sand and gravel aquifer.

A5.C.(12) Offshore Hydrogeology

The three regional aquifers described earlier are most likely present at depth beneath the near shore sediments at the site. These aquifers have not yet been encountered during past sediment investigation activities at the site. Artesian conditions are present in the sand and gravel aquifer however, based on the presence of an artesian well on the marina jetty.

A5.C.(13) Operable Units

Four operable units have been established for the project. The operable units are:

- OU #1 Upper Bluff,
- OU #2 Copper Falls Formation – Deep Aquifer
- OU #3 Kreher Park between Ellis Avenue and Prentice Avenue
- OU #4 Sediments – Kreher Park Embayment

The locations of the four operable units are depicted on Figure 4 "Operable Units."

A.5.C.(13)(a) *OU #1 Upper Bluff*

The filled ravine area is approximately one acre in size and extends from the former MGP north to the Wisconsin Central Rail line. Vertically, OU #1 extends from the ground surface to the top of the Miller Creek Formation (clay aquitard separating the surficial soils from the underlying Copper Falls Formation). OU #1 is bounded to the east and west by the walls of the former ravine.

A.5.C.(13)(b) *OU #2 Copper Falls Formation*

Groundwater contamination has been detected in the Copper Falls formation below OU #1, below the lakeshore bluff adjacent to OU #1, and below OU #2. Both dissolved phase and NAPL contaminants have been identified in OU #2. The horizontal and vertical extent of contamination in OU #2 has not yet been determined, nor has the stability of the contaminant plume been established to-date. A groundwater removal and treatment system is currently operating on the former MGP property removing approximately two to three gallons per minute of contaminated groundwater from OU #2. As of November 26, 2002, a total of 4,836 gallons of NAPL had been recovered from OU #2.

A.5.C.(13)(c) *OU #3 Kreher Park*

The boundaries of OU #3 are: the Chequamegon Bay shoreline to the north, Prentice Avenue to the east, the Wisconsin Central Rail line to the south, and Ellis Avenue to the west. Vertically, OU #3 extends from the ground surface, through an earthen fill layer and a subsequent wood waste fill layer, through a thin layer of san beach deposits to the top of the Miller Creek formation. Contaminants present in the Copper Falls formation beneath OU #3 are considered a part of OU #2.

A.5.C.(13)(d) *OU #4 Sediments*

Approximately ten acres of offshore sediments contiguous to OU #3 have been impacted by contaminants. The documented horizontal extent of contamination in OU #4 is within the embayment formed by the marina jetty and the former lumber docks. The vertical extent of OU #4 is from the upper sediment surface to the top of the Miller Creek formation in some locations. Additional investigation is required to further delineate the horizontal and vertical extent of contamination in OU #4.

A5.C.(14) **<u>OU #4 Existing Data</u>**

The offshore sediments adjacent to Kreher Park have been investigated during a 1996 SEH sediment investigation, a 1998 SEH Ecological Risk Assessment (ERA), a 2001 Sediment Investigation conducted by URS, and a 2002 SEH ERA Supplement. Samples were collected during each of these events on the site grid system.

A.5.C.(14)(a) *Previously Detected Contaminants of Concern*

Offshore sediments at the site have been impacted by a wide range of PAH compounds and by VOCs (predominantly benzene, ethylbenzene, toluene, and xylenes (BETX)). Several phenolics and heterocyclic aromatic hydrocarbon (HAH) compounds were also identified in the sediments.

PRGs were developed for both the wood chip and sand substrates during SEH's February 2002 ERA Supplement using a weight of evidence approach. The PRGs established for the site during SEH's 2002 ERA Supplement are as follows:

Wood Chip Substrate:

- Total PAHs (Dry Weight) PRG = 9,750 µg/kg
- Total VOCs (Dry Weight) PRG = 972 µg/kg

Sand Substrate:

- Total PAHs (Dry Weight) PRG = 1,767 µg/kg
- Total VOCs (Dry Weight) PRG = 972 µg/kg

It was concluded that other MGP-related contaminants (e.g., phenolics, HAHs) detected at the site that may contribute to sediment toxicity would likely be co-located with PAH and VOC contaminants. Consequently, PRGs were not developed for these compounds.

A.5.C.(14)(b) *Previous Sampling Locations (CLP Level IV Validation)*

Data from six sediment sampling locations collected in March 2001 by SEH and 59 sediment sampling locations collected by URS in February and March 2001 met U.S. EPA CLP Level IV data validation requirements. These sampling locations are depicted on Figure 6, "Previous Sediment Sampling Locations, CLP Level IV Validation." Analytical tables from these sampling events are provided in Appendix B, "Historic Laboratory Data."

A.5.C.(14)(c) *Previous Sampling Locations (Level 2 Validation)*

A total of 93 sediment sampling locations were utilized during SEH site investigation activities performed in 1996 and 1998. These locations are depicted on Figure 5, "Previous Sediment Sampling Locations, CLP Level II Validation." These phases of investigation preceded the CERCLA listing of the site, and CLP Level IV analytical procedures were not utilized. Data from these sampling events will be utilized as a tool to aid in selection of sampling points used during the current sediment investigation.

A5.D References to Existing Reports

More than 73 documents have been developed for this site to date. A list of documents for the site can be found in Appendix C, "Historic Site Documents." The following reports relate specifically to OU #4 characterization or risk assessment:

- #14 – Sediment Investigation Work Plan, SEH, Feb. 1996
- #16 – Sediment Investigation Report, SEH, July 1996
- #27 – Ecological Risk Assessment: Problem Formulation, SEH 1998
- #28 – Baseline Human Health Risk Assessment, SEH, June 1998D
- #32 – Ecological Risk Assessment: Ashland Lakefront Property (Final Draft), SEH March 1999
- #49 – Sediment Sample Results Vol I of III, URS June, 2001
- #50 – Sediment Sample Results Vol II of III, URS, June 2001
- #51 – Sediment Sample Results Vol III of III, URS, June 2001
- #65 – Ecological Risk Assessment Supplement, SEH, Feb 2002

The documents relating to OU #4 have been evaluated for data gaps relating to the data quality objectives established for this task. The Data Quality Objectives (DQO) steps for the winter 2003 sediment sampling at OU #4 can be found in Group A7.

A5.E Past and Current Chemical Use

A5.E.(1) Potential Contaminant Chemistry

Three potential sources of contamination were identified to-date through the historical review of the site. These include:

- The possibility that wood treatment occurred on-site using coal tar/ creosote compounds;
- The potential for on-site disposal or migration of wastes from off-site related to the operation of a historical manufactured gas plant; and,
- The disposal of various waste materials in the fill placed on-site through the long-term development and use of the site.

Previous analytical results have indicated the presence of VOCs, PAHs, and metals. Many of these compounds are typically associated with one or more of the potential sources of contamination. The following subsections describe the chemical composition association with raw

materials and wastes from each of the potential sources identified to-date.

A5.E.(2) Wood Treatment Compounds and Wastes

The subject property was used by the lumbering/wood products industry from the 1880's through the 1930's. The potential exists that some treating of wood products may have occurred during that time period. Research on the history of wood treating indicates that wood treating for preservation has changed throughout this time period and was unregulated with regard to specific material and treatment procedures.

In general, the early wood preservative methods included dipping or direct application of metallic salts and coal tar materials. The coal tar materials used were by-products generated from the manufacturing of coal gas and were not processed further prior to use. Many facilities utilized coal tar/kerosene mixtures. By 1930, true creosote was being actively distilled from coal tar to remove the volatile fraction (<210 degrees Celsius boiling point) and heavy oils (>450 degrees Celsius boiling point). The resulting true creosote is comprised primarily of 18 PAHs. These compounds are shown on Table 5, "Major Components in Creosote."

The components of creosote with boiling points below 210 degrees Celsius generally make up less than 2 percent of whole creosote. These components include VOCs and other aromatic hydrocarbons.

A5.E.(3) Manufactured Gas Plant By-Products and Wastes

The production of coal tar is a by-product of the coal carbonization and carbureted water gas (CWG) processes that were used in the manufacturing of gas in the early part of the 20th Century. Historic Sanborn Maps indicate that earlier processes at the St. Clair Street MGP used coal carbonization methods followed by a water gas process in later years.

Five waste streams and several chemicals of concern have been identified based on a survey of 33 MGP sites according to a Gas Research Institute document titled "Management of Manufactured Gas Plant Sites. A summary of the wastes and chemicals are shown on Table 6, "Wastes and Chemicals of Interest at MGP Sites." The list of chemicals includes only those compounds that are common at MGP sites and have regulatory significance (e.g. managed under EPA CLP or RCRA TCLP guidelines). It is important to recognize that the actual compounds identified in soil or groundwater at a specific site may vary from those shown on the table due to variation in feed stock, process waste characteristics (type, density, solubility, etc.), and residual management techniques.

A5.E.(4) Disposal of Waste Materials in Fill

Various waste materials have reportedly been disposed on-site by historical owners of the property and potentially unauthorized individuals. The site was constructed through the placement of fill materials at the base of the former lakeshore bluff from the 1870's (or earlier) until the 1970's. The majority of the fill materials reportedly included slabwood and sawdust. However, other reports indicate the disposal of municipal solid wastes, fly ash and earthen fill materials may have occurred in various areas.

The chemical composition of these materials or leachate from these wastes would depend upon several unknown factors. Therefore, a list of potential contaminants from the filling of the site cannot be developed based on current information.

A6. Project Task Description and Schedule

Provides a general overview of the activities that will be performed and how and when they will be performed based upon background information and data, pre-planning site visits, and pre-QAPP scoping meetings or conference calls.

A6.A Task Description

A6.A.(1) Task 1: Data Quality Objectives

Data quality objectives (DQO) are qualitative and quantitative statements that state the objective of a proposed project or task; define the most appropriate type of data to collect; determine the most appropriate conditions for data collection; and specify acceptable decision error limits that establish the quantity and quality of data needed for decision-making.

After review and evaluation of existing data presented in Group A5.C.(14) and the reports presented in Group A5.D, several data gaps have been identified associated with OU #4. These data gaps, form the basis of the task objectives.

The purpose of the winter 2003 sediment sampling at OU #4 is to address the following needs:

- Define the horizontal and vertical limits of contamination with the analytical detection limits below the PRGs developed for the site,
- Develop the iso-concentrations of COPCs at OU #4 in order to select future locations for ecological risk assessment testing,
- Conduct forensic analysis of SVOC at OU #4 to determine if there are more than one source of the contamination at the site, and

- Determine the background concentrations of COPCs to conduct risk assessment at the site and set realistic remediation goals.

The steps followed in order to develop task DQOs can be found in Group A7. Sampling design and rationale are detailed in Group B.

A6.A.(2) Task 2: Target Parameters

The STL Chicago target parameters and analytical methods are defined in Table 1. The itemized list of compounds and elements are defined in Table 2. This table contains a complete listing of the target compounds, PRGs, reporting limits, current laboratory MDLs and QC acceptance criteria. The laboratory MDLs have been determined according to 40 CFR Part 136, Appendix B.

Because sediment materials at various locations at OU #4 vary from fine clay-like particles to wood chips, the moisture content of the sediment samples will also vary. Historically, moisture content in sediment samples has ranged from about 20% to over 80%. All sediment sample results will be reported on a dry weight basis. Therefore, high moisture content could significantly affect the analytical reporting limit to the point where the preliminary remediation goals (PRG) established for the site are exceeded.

Historically, VOC analysis performed for the site have been conducted using methanol preservation techniques (WPA Method 5035). However, at 50% moisture content, the reporting limit for benzene using the methanol preservation technique will exceed the site PRG for benzene and the reporting limit for total xylenes always exceed the site PRG. Sample preservation by Method 5030B greatly reduces the probability that site PRGs will be exceeded for either of these analytes..

For the OU #4 Winter 2003 Sediment Sampling, the following procedure will be followed in order for laboratory VOC analysis to remain below site PRGs:

All sediment samples collected for VOC analysis will be collected via Method 5030B preservation. A select number of sediment samples may be collected via the methanol preservation method for method result comparison purposes. A total moisture content will be determined by STL Chicago within 24 hours of sample receipt. Samples with greater than 90% moisture content may be rejected from analysis. STL Chicago will employ a sample preparation technique developed for the START program for US EPA Region I for those samples between 10% to 30 % solids content. The high moisture content modification concentrates or increases sediment sample extraction weight such that the extract dry weight is at least half of the weight required by the analytical method.

The logic in this modification is that the sample aliquot used in a high moisture content sample is not representative of the sediment.

The environmental forensic investigation conducted by Battelle will include the parameters in Table 3. The quantified analytes, reporting limits, and method detection limits are presented in Table 4.

A6.A.(3) **Task 3. Sampling Rationale**

Data collected during the sediment investigation will be utilized for site characterization, potential ecological and human health risk assessment, and for remedial action alternative evaluation, as necessary. The objectives of the sediment investigation and the necessary actions required to accomplish the objectives are provided in Group B1 of this document.

Based on existing sediment data from the site, there appears to be a relatively distinct area of highly impacted sediments adjacent to the shoreline and extending northward to at least site reference line 2500N. However, the actual northern boundary where levels of COPC meet the concentrations of the preliminary PRGs is not adequately established due to elevated detection limits in existing site data, and low-level validation for some existing data. Additional data collected during this sediment investigation will be to better define the line where sediment contaminant concentrations exceed preliminary PRGs for the site. Iso-concentration maps can be developed based on the results of the shallow sediment north of the known area of contamination, In addition, sediment samples will be collected at depth at several locations and analyzed to provide vertical definition of sediment contamination related to the preliminary PRGs.

A6.A.(4) **Task 4: Analytical Procedures**

A.6.A.(4)(a) *STL - Chicago*

The QAPP details the sediment sampling and analysis at the Ashland/NSP Lakefront site in Ashland, WI. STL Chicago will be providing analytical services in support of this QAPP. Their Standard Operating Procedures (SOPs) are attached in Appendix D, "STL Chicago SOPs.) and a comparison of the requested analyses and these SOPs is summarized in Table 7, "Analytical Parameters and STL Chicago SOPs."

STL has a QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in the SOPs and each SOP includes a QC section (Section 8.0) which addresses the minimum QC requirements for the procedure. The internal QC checks differ slightly for each individual

procedure but in general the QC requirements are summarized in Table 8, "QC Samples."

All data obtained will be properly documented. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient volume is available and if within hold time. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary.

A.6.A.(4)(b) *Battelle*

Battelle will follow the standard SOPs as established by their laboratory. Battelle's SOPs are considered proprietary information and are available upon request.

A6.A.(5) **Task 5. Data Validation**

A.6.A.(5)(a) *SEH – External /Internal Validation*

Data validation for the OU #4 Winter 2003 Sediment Sampling will be conducted by an external validator, MAKuehl Company. Laboratory packages received will be completed at 100 percent of samples validated at a full CLP Level IV validation. Results of laboratory deficiencies will be immediately reported to STL Chicago and corrections in procedure will be made. Sample re-analysis will be conducted, if required, and revalidation will be done. Data Validation Procedures that will be followed by MAKuehl Company can be found in Group D.

In addition, internal technical system audits will be conducted on field sampling, performance evaluation, data validation, and data package procedures. Please refer to Group C1 for SEH Assessment and Response Actions.

A.6.A.(5)(b) *STL – Chicago*

Laboratory Data Reduction Procedures

All of STLs analytical data are entered/downloaded directly into LabNet (LIMS) or recorded on pre-formatted bench sheets that are paginated and bound into laboratory logbooks. These logbooks are issued and controlled by the laboratory's QA Section. A unique document control code is assigned to each book to assure that chronological record keeping is maintained. Analytical data may be electronically stored as a secure .pdf file to which the analyst applies an electronic signature.

Analytical data is referenced to a unique sample identification number for internal tracking and reporting. Both LabNet entries and logbook pages contain the following information, as applicable: analytical method, analyst, date, sequential page number, associated sample numbers, standard concentrations, instrument settings, and raw data. Entries are in chronological order and maintained so as to enable reconstruction of the analytical sequence.

The analyst is responsible for entering/recording all appropriate information, and for signing and dating all logbook entries daily. All entries and logbook pages are reviewed for completeness by a supervisor, peer reviewer or the analyst themselves. Data review checklists document the analytical review of the LabNet entries, logbook and associated QC indicators. Copies of instrument outputs (chromatograms, mass spectra, etc.) are maintained on file or electronically with the analyst's signature/initials and date.

STLs Laboratory Data Review Procedures

All data, regardless of regulatory program or level of reporting, are subject to a thorough review process. The individual analyst continually reviews the quality of the data through calibration checks, quality control sample results and performance evaluation samples. Data review is initiated by the analyst during, immediately following, and after the completed analysis.

All levels of the review are documented on Data Review Checklists that are specific to each laboratory section (identified via Work Instruction numbers).

Primary Review

The primary review is often referred to as a "bench-level" review. In most cases, the analyst who generates the data (e.g., logs in, prepares and/or analyzes the samples) is the primary reviewer. In some cases, an analyst may be reducing data for samples run by an auto-sampler set up by a different analyst. In this case, the identity of both the analyst and the primary reviewer is identified in the raw data.

One of the most important aspects of primary review is to make sure that the test instructions are clear, and that all project specific requirements have been understood and followed.

Once an analysis is complete, the primary reviewer ensures, where applicable, that:

- Sample preparation information is complete, accurate, and documented.
- Calculations have been performed correctly.
- Quantitation has been performed accurately.
- Qualitative identifications are accurate.
- Manual integrations are appropriate.
- Data flags to indicate manual integrations are recorded.
- Manual integrations are authorized by a date and electronic initials of the analyst.
- Client specific requirements have been followed.
- Method and process SOPs have been followed.
- Method QC criteria have been met.
- QC samples are within established limits.
- Dilution factors are correctly recorded and applied.
- Non-conformances and/or anomalous data have been properly documented and appropriately communicated.
- COC procedures have been followed.
- Primary review is documented by date and initials/signature of primary analyst.

Any anomalous results and/or non-conformances noted during the Primary Review are documented on the Data Review Checklist and on an SDR; and are communicated to the Section Manager and the Project Manager for resolution. Resolution can require sample reanalysis, or it may require that data be reported with a qualification.

Secondary Review

The secondary review is also a complete technical review of a data and is performed by the Section Manager, analyst or data specialist. The secondary review is documented on the same Data Review Checklist as the primary review.

The following items are reviewed:

- Qualitative Identification
- Quantitative Accuracy
- Calibration
- QC Samples
- Method QC Criteria
- Manual Integrations
- Completeness
- Special Requirements/Instructions

If problems are found during the secondary review, the reviewer must work with the appropriate personnel to resolve them. If changes are made to the data, such as alternate qualitative identifications, identifications of additional target analytes, re-quantitation, or re-integration, the secondary reviewer must contact the laboratory analyst and/or primary reviewer of the data so that the primary analyst and/or reviewer is aware of the appropriate reporting procedures.

Completeness Review

The completeness review includes the generation of a project narrative and/or cover letter which outlines anomalous data and non-compliances using project narrative notes and SDRs or CARs (non-compliance reports) generated during the primary and secondary review. The completeness review addresses the following items:

- Is the project report complete?
- Does the data meet with the client's expectations?
- Were the data quality objectives of the project met?

Are QC outages and/or non-conformances approved and appropriately explained in the narrative notes?

The laboratory Section Manager(s), Data Management personnel and the Project Manager contribute to the completeness review.

A.6.A.(5)(c) *Battelle*

Battelle maintains a quality assurance program that employs numerous quality control parameters to assure that the produced data is of known precision and accuracy. These QC parameters are detailed in the laboratory standard operating procedures and discussed in Group B5.2. In addition, Battelle's procedures for this project will be based on the QAPP provided in Appendix A. Please refer to Section 2.0 of Battelle's QAPP for QA information.

A6.A.(6) Task 6: Quality Assurance Assessments

Internal and external QA evaluations will be conducted periodically throughout the project to ensure that usable data will be generated. Internal audits will be conducted by the QA officers from SEH and contract laboratories. External data validation audits will be conducted by Marcia Kuehl from MAKuehl Company. Planned assessments include Field Sampling Technical Assessment Audits (TSA), Performance Evaluation TSA, Data Package TSA, and Data Validation TSA.

A detailed description of the Winter 2003 Sediment Sampling QA evaluation as well as corrective action responses as the results of deviations and project deficiencies found are found in Group C1.

A6.A.(7) Task 7: Data Usability Assessment

Analytical data generated as the result of the OU #4 Winter Sediment Sampling will be assessed both internally against the DQOs established for this task and externally against validation requirements The DQO process, established the DQOs for this task, followed the seven steps presented in Group A7. Internal assessment and oversight for this task is described in Group C. Procedures detailed in Groups D1 and D2 provide the processes that will be followed to fully validate the analytical data produced during this task.

Data not meeting established Level IV validation procedures will not be usable for risk assessment purposes. However, data meeting Level II validation may be used for other purposes such as site characterization, evaluation of alternatives, engineering design, and for screening purposes. Data that that is not acceptable as Level I/II will be rejected. Forensic data must meet Level IV validation standards in order to be acceptable for determining source identification or for use in ecological and human health risk assessment.

A6.A.(8) Task 8: Project Documents, Records and Reports

Original reference documents, reports, or other data will not be taken to the field. Field staff will take copies of project documents into the field and the original(s) remain at the office. Field staff will keep detailed records and notes of field investigation activities and results, photographs, and field conversations. These original documents will be stored in the project file at SEH's Chippewa Falls, Wisconsin office or elsewhere as may be determined appropriate during the sediment investigation. The WDNR will be notified if files are stored at a location other than SEH's Chippewa Falls, Wisconsin location.

A.6.A.(8)(a) *Field Logbooks*

The primary method for recording field data and site activities will be in bound field logbooks. Entries into a field logbook will be made as activities occur or samples are collected; or, if it is not possible to record the information during the activity, as near to completion of the activity or sample collection as possible so as to minimize detail loss due to memory reliance. When practicable and warranted, entries to the field logbook will be supplemented by photographs, documented as discussed below.

Field logbooks will be bound, 5-inch by 7-inch books with paper pages with water resistant surfaces. Logbooks will be assigned to field

personnel and the cover of each logbook will contain, at a minimum, the following information:

- Project name and project number;
- Field personnel name;
- Book number (logbooks per field personnel will be numbered sequentially); and
- Date of first and last entries within the logbook.

Typically, field investigation and sample collection activities observed or information discussed in the field that is pertinent to current or future project decisions or documentation will be recorded in the field logbook. Information will be recorded in the logbook in waterproof ink. Each page number in the logbook will be numbered sequentially so no pages shall be removed from the logbook. Each new daily entry will begin on a new page and the following information will be recorded at the beginning of each daily entry:

- Date;
- Start time;
- Weather conditions;
- Field personnel present;
- Field equipment present;
- Level of personal protective equipment; and
- Signature of field personnel responsible for making entries in logbook.

In addition, the last entry of each day shall be the signature of the field personnel making the observations. Any unfilled portion of the last page of the entries each day will be lined out so no additional entries can be made for that day.

All entries in the logbook will be legible and must include the following information, at a minimum and as appropriate:

- Date and time of entry (use of military time designation is preferred but, at a minimum, specification of am or pm is required);
- Field observations;
- Field Measurements;
- Field instrument calibration procedures and results
- Record of phone conversations and field decisions;

- Visitors at site (including arrival and departure times and any pertinent discussions);
- Change to weather conditions;
- Purpose of sampling;
- Sample collector name;
- Date, time and general location of sample collection;
- Sample identification for laboratory analysis;
- Field equipment used;
- Sample description, including depth, volume, and sample containers;
- Decontamination procedures;
- Measurement units and instrumentation used; and
- Material usage and quantities.

Survey information will be recorded in separate logbooks or on separate survey data sheets. The protocols for data recording remain the same.

Any corrections to entries made in the logbook will be by lining out the incorrect information or entry by using a single line (or so that the original entry is still legible), noting the date and time of the correction, and initialing the correction. If there are changes in the field personnel making the observations during a particular day, this information will be recorded and appropriate initials provided on all entries.

When not in use in the field for an extended period of time, when full, and at the completion of the project, logbooks will be stored in the project file. If logbooks will be in the field for over two weeks, copies of completed pages will be made and placed in the project file on a weekly basis to minimize data loss if the logbook is lost or damaged.

A.6.A.(8)(b) *Data Recording Forms*

In addition to utilizing logbooks for recording data, information may also be recorded by SEH or their contractor(s) on various data recording forms. Data recording forms completed each day will be noted in the field logbook. At a minimum, it is anticipated that the following WDNR and SEH forms will be used during the sediment investigation. A sample of each form is included in Appendix E, "Project Documentation." Each form, discussed in more detail below, will include the following information:

- Project name and number;
- Date and time;
- Site location;

- Consultant or contractor representative completing the form; and
- Sample identification, location and medium.

A.6.A.(8)(c) *WDNR Recording Forms*

Soil Boring Log Information (Form 4400-122, Rev. 7-98 or most current available)

The soil boring log information form provides a detailed description of vertical soil (or sediment) profile sampled in a borehole. Soil/sediment descriptions (visual characteristics along with pertinent descriptive remarks) and geologic origin for each major unit will be recorded as well as recovery, depth of sample, USCS classification, and FID readings. The top of the form will also include general information such as site name, boring number, location, date, drilling method, and drilling company. The completed form will be submitted to the WDNR and a copy will be maintained in the project file.

A.6.A.(8)(d) *SEH Forms*

Diggers Hotline Notification

A minimum of three business days before conducting any intrusive field investigation activities at the site, Diggers Hotline will be contacted to request that buried or underwater utilities in the investigation area be located, or that utility representatives meet at the site at a designated time. A Diggers Hotline Notification form will be completed for each call made to Diggers Hotline and will be maintained in the project file.

Daily Field Report

In the event that a field logbook is not available, a Daily Field Report form may be utilized to document observations made during the day. Information that may be recorded and the protocols for doing so are the same as for recording in a field logbook. Completed daily field reports are maintained in the project file.

A.6.A.(8)(e) *Other Forms*

Chain of Custody

Laboratory specific COC forms will be utilized for each sample shipment to the laboratory, and will accompany the applicable sample(s). The COC, in triplicate (original and two carbon copies), will document the sample identifications, time and date of sample collection, desired analytical methodologies, sample container size and composition, sample collector, and person who relinquished the sample shipment. A copy of the COC will be retained by the person

relinquishing the samples and will be provided to the SEH project manager for data management.

A.6.A.(8)(f) *Photographs*

Photographic documentation will be utilized during the sediment investigation to document field conditions and observations, and to augment field logbook entries. Whether film or digital photographs are taken, the following information will be recorded in the field logbook or appropriate photography logbook.

- Date and time of photograph;
- Direction of photograph;
- Location of photographer;
- Description of subject; and
- Photograph number and roll or disk.

Once developed and appropriately labeled (with date, time, direction, subject, photographer, etc. to match entry in logbook or photography logbook), hard copy photographs will be stored in the project file. Digital photograph files will be transferred from the camera media (floppy disk, compact disk, other) to the electronic project file on the office server. Electronic or digital photograph files will be renamed and dated.

A6.B Project Schedule

A task specific project schedule can be found on Figure 8, "OU #4 Winter 2003 Sediment Sampling Schedule."

A7. Quality Objectives and Criteria for Measurement Data

A7.A Data Quality Objectives (DQO) Process

The seven steps of the DQO process are indicated in the following table.

Step 1 State the Problem	Step 2 Identify the Decisions	Step 3 Identify Inputs to the Decision	Step 4 Define Study Boundaries	Step 5 Develop Decision Rules	Step 6 Specify Limits on Decision Errors	Step 7 Optimize Sampling Design
A defined horizontal and vertical limit of contamination is needed at OU #4 sediments with detection limits low enough to correspond to PRG values determined by preliminary risk assessment and regulatory limits.	What are both the horizontal and vertical limits of contamination at OU #4 sediments with respect to the PRG values?	Validated defensible VOC, SVOC, inorganic analytes, and TOC data with sufficiently low detection limits to correspond to the PRG values. COPC chemical data compiled and evaluated.	Shallow sediments from the 0-6" depth, and deeper sediments from the 1-12' depth at OU #4 will be collected and analyzed for select VOCs, SVOCs, inorganic parameters and TOC. Specific chemical analytes are summarized on Table 2. Sample collection will be limited to collection of samples from the ice on the bay. Shallow sediment samples will be collected from locations specified along three transects as shown on Figure 7, "Proposed Winter 2003 Sampling Locations." Deep sediment samples will be collected from locations shown on Figure 7.	If chemical data passes validation assessment and data detection limits are less than PRGs, then data will be accepted for OU characterization and identification of COPCs.	Data validation will use specified evaluation criteria. Comparison of validated data will be against specified PRG values that have been agreed to by the regulatory agencies. PRG values are shown on Table 2.	32 to 34 shallow sediment samples along three transects and at select biased locations between transects and 40 to 60 deep sediment samples from 10 to 12 locations will be collected. Sample locations are based on analysis of previously collected samples that revealed insufficient data information at the proposed sampling locations.
Iso-concentrations of COPCs are needed to identify critical locations to conduct future ecological risk assessment testing. Are there iso-concentrations of contaminants from which a dose response curve can be developed for future ecological risk assessment?	What are the most critical areas within OU #4 to conduct ecological testing ? Can a dose response curve be developed for ecological risk assessment?	Validated VOC, SVOC, inorganic analytes and TOC data from the shallow and deep sediments. COPC chemical data compiled and evaluated for iso-concentration patterns.	Shallow sediments from the 0-6" depth, and deeper sediments from the 1-12' depth at OU #4 will be collected and analyzed for select VOCs, SVOCs, inorganic parameters and TOC. Specific chemical analytes are summarized on Table 2. Sample collection will be limited to collection of samples from the ice on the bay. Shallow sediment samples will be collected from locations specified along three transects as shown on Figure 7. Deep sediment samples will be collected from locations shown on Figure 7.	If chemical data passes validation assessment and data detection limits are less than PRGs, then data will be accepted for iso-concentration analysis.	Data validation will use specified evaluation criteria. Comparison of validated data will be against specified PRG values that have been agreed to by the regulatory agencies. PRG values are shown on Table 2.	32 to 34 shallow sediment samples along three transects and at select biased locations between transects and 40 to 60 deep sediment samples from 10 to 12 locations will be collected. Sample locations are based on analysis of previously collected samples that revealed insufficient data information at the proposed sampling locations.

Step 1 State the Problem	Step 2 Identify the Decisions	Step 3 Identify Inputs to the Decision	Step 4 Define Study Boundaries	Step 5 Develop Decision Rules	Step 6 Specify Limits on Decision Errors	Step 7 Optimize Sampling Design
Forensic analysis of SVOC at OU #4 is needed to identify one or more source areas of contamination, to compare fingerprinting patterns with other OUs at the site.	What are the sources of SVOC at OU #4? Are there additional sources of SVOC at the site based on forensic analysis?	Validated defensible SVOC chemical forensic data. SVOC chemical forensic data compiled and compared to source areas and other OUs.	Sample location will be determined in the field by the presence of SVOC encountered during field investigation. Sample collection will be limited to collection of samples from the ice on the bay.	If SVOC forensic analysis indicates a pattern compatible with a source area, that SVOC location will be considered from the corresponding source. If SVOC forensic analysis indicates a pattern significantly different from identified source areas, then the SVOC will be considered from a new/different source area.	No limits on the data have been decided upon at this time. All data will be acceptable for further evaluation.	4 to 8 SVOC/NAPL samples will be collected. Sample location will be determined in the field by the presence of SVOC/NAPL encountered during field investigation.
A defensible data set of the background concentrations of COPCs is needed in order to perform comparisons of site and vicinity background data to: a) determine the amounts of COPC introduced as a result of site activities, and b) to set realistic cleanup standards for future remediation.	Do concentrations of COPCs at OU #4 exceed those of background? What are realistic cleanup goals for future remediation?	Validated defensible analytical data for shallow and deep sediments not affected by site activities. Analytical data for COPCs in shallow and deep sediments in background areas compiled and statistically evaluated.	Shallow sediments from the 0-6" depth, and deeper sediments from the 1-12' depth at OU #4 will be collected and analyzed for select VOCs, SVOCs, inorganic parameters and TOC. Specific chemical analytes are summarized on Table 2. Sample collection will be limited to collection of samples from the ice on the bay. Samples will be collected from areas predetermined to be located in the vicinity of OU #4, yet not affected by site activities.	If comparison of site and background data sets shows significant differences in the concentrations of COPCs, then, pending professional judgement, it may be assumed that site activities have affected the quality of OU #4 sediments. If comparison shows no significant differences between background and OU #4 sample results, then inorganic contaminants will not be considered COPCs. Comparison of organic analytical results to background concentrations is not typically considered valid.	Professional judgement was used to determine practical vs. statistical numbers of background samples to be collected.	7 to 9 background sediment samples will be collected.

A7.B Measurement Performance Criteria - PARCC

The overall QA objective for this project is to develop and implement procedures for field sampling, laboratory analysis, COC, and reporting that will provide results which are legally defensible in a court of law. This section will provide project objectives on Precision, Accuracy, Representativeness, Completeness and Comparability. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP and within the laboratory's Standard Operating Procedures (SOPs).

A7.B.(1) Precision

Definition Precision is a measure of the degree to which two or more measurements are in agreement.

A.7.B.(1)(a) *Field Precision Objectives*

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 analytical samples. Since approximately 110 analytical samples will be collected during the Winter 2003 Sediment Sampling, the total number of duplicates for this event is approximately 11.

A.7.B.(1)(b) *Laboratory Precision Objectives*

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for three or more replicate samples. Precision control limits are provided in Table 2.

For both inorganic and organic analyses, laboratory precision shall be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) and field duplicate samples. The RPD between the matrix spike/matrix spike duplicate is calculated to compare precision DQOs.

Method precision will be based upon the percent recovery(s) within the Laboratory Control Sample (LCS).

The compounds used for organics matrix spikes analyses (including surrogate compounds) are listed in Table 2. These compounds are considered representative of the range of compounds analyzed in each method.

The RPD is calculated according to the following formula:

$$RPD = \frac{|\text{Amount in Sample 1} - \text{Amount in Sample 2}| \times 100}{(\text{Amount in Sample 1} + \text{Amount in Sample 2})/2}$$

A7.B.(2) Accuracy

Definition Accuracy is the degree of agreement between an observed value and an accepted reference value.

A.7.B.(2)(a) *Field Accuracy Objectives*

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation and holding times.

A.7.B.(2)(b) *Laboratory Accuracy Objectives*

Accuracy is a measure of the difference between a measured value and the "true" or accepted reference value. The accuracy of an analytical procedure is determined from the analysis of a sample containing a known quantity (spike) of material. Matrix spikes are evaluated by analyzing a normal environmental sample along with a spike of pre-determined compounds/parameters in that sample. In addition to the matrix spike samples, surrogate spike analyses will be conducted on samples to be analyzed for organic analysis. The accuracy acceptance criteria are presented in Table 2.

The level of recovery of an analyte and the resulting degree of accuracy expected for the analysis of Quality Assurance (QA) samples and spiked samples are dependent upon the sample matrix, method of analysis, and the contaminant. The concentration of the analyte relative to the reporting limit of the method is also a major factor in determining the accuracy of the measurement.

The accuracy of data will be evaluated by determining the percent recovery of matrix and surrogate spike samples, where applicable. In addition, method blanks will be evaluated to ensure that contamination in the laboratory is not introducing a systematic error into the analytical results.

Percent recovery for matrix spikes is determined according to the following equation:

$$\%R = \frac{(\text{Amount in Spiked Sample} - \text{Amount in Sample}) \times 100}{\text{Known amount added}}$$

Percent recovery for LCS concentrations is determined according to the following equation:

$$\%R = \frac{\text{Experimental Concentration}}{\text{Known amount added}} \times 100$$

A7.B.(3) Representativeness

Definition Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition or an environmental condition.

A.7.B.(3)(a) *Measures to Ensure Representativeness of Field Data*

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the RI/FS Workplan is followed and that proper sampling techniques are used. In designing the sampling program, media of concern have been specified.

A.7.B.(3)(b) *Measures to Ensure Representativeness of Laboratory Data*

Samples must be representative of the environmental media being sampled. The sample locations and sampling procedures were designed with the consideration of obtaining samples representative of potentially-contaminated areas or of up gradient locations not impacted by the site. Sample handling and analytical procedures have been designed to ensure a representative sample has been collected. Representativeness of specific samples will be achieved by the following:

- Collect samples from locations representing the site conditions;
- Use appropriate sampling methodology and equipment;
- Use appropriate procedures, including equipment decontamination;
- Use appropriate analytical methodologies for the parameters, while achieving required reporting limits; and,
- Analyze within the appropriate holding time.

Sample representativeness also is affected by the portion of each collected sample that is chosen for analysis. The laboratory will ensure that the samples are adequately homogenized, where applicable, prior to taking aliquots for analysis. However, it should be recognized that many means of homogenization expose the sample to significant risk of contamination or loss through volatilization. Methods of homogenization will be avoided or modified to minimize these risks.

A7.B.(4) Comparability

Definition Comparability is an expression of the confidence with which one data set can be compared with another.

A.7.B.(4)(a) *Measures to Ensure Comparability of Field Data*

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Field Sampling Plan is followed and that proper sampling techniques are used.

A.7.B.(4)(b) *Measures to Ensure Comparability of Laboratory Data*

Comparability expresses the confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured by adherence to standard analytical procedures and prescribed reporting methods. For example, each type of data will be reported in consistent units each time that type of data is collected.

A7.B.(5) **Completeness**

Definition Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

A.7.B.(5)(a) *Field Completeness Objectives*

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The field completeness objective for this project is 90 percent.

A.7.B.(5)(b) *Laboratory Completeness Objectives*

Completeness is a measure of the amount of valid data obtained from the measurement system relative to the amount anticipated under ideal conditions. The laboratory completeness objective for this project is established at 95 percent.

A7.B.(6) **Sensitivity**

Definition The difference in the amount or concentration of a substance that corresponds to the smallest difference in a response in a measurement system using a certain probability level.

A.7.B.(6)(a) *Field Sensitivity*

The Foxboro TVA-1000 has been laboratory calibrated. Calibration documentation is located in the SEH equipment files. The calibration of the FID is verified in the field using 100 ppm methane, and the calibration of the PID is verified in the field using 100 ppm isobutylene prior to conducting soil vapor monitoring. The Foxboro TVA-1000 standard specifications can be found in the Soil Headspace Vapor Monitoring SOP located in Appendix F, "SEH SOPs."

The Magellen Platinum Pro GPS receiver is pre-programmed with the sample point latitudes and longitudes. The sampling points will then be located in the filed. Testing with this brand of GPS receiver achieved a 95 percent confidence accuracy of less than one meter in open spaces,

and a 95 percent confidence accuracy of less than three meters under moderate tree cover (the proposed sampling area is an open area. Vertical control will be established by surveying the lake water surface elevation, and then measuring the depth to the upper sediment surface at each location.

A.7.B.(6)(b) *Laboratory Sensitivity*

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B. STL determines MDLs on an annual basis and these are listed in Table 2 for this project.

A8. Special Training Requirements and Certifications

All personnel responsible for performance of field activities or anyone who will be on site within the exclusion zone are required to have completed the 40-hour OSHA HAZWOPER safety training course and current 8-hour refresher courses.

SEH employees have HAZWOPER initial 40-hour training and refresher course documentation in the SEH safety files. All subcontractors to SEH are required to provide documentation of initial and current training prior to commencement of field activities. All non-SEH personnel wishing to enter the exclusion zone must provide the same training documentation. All HAZWOPER training documentation will be retained in the project files.

No other specific training or certification will be required for the winter sampling at OU #4.

A9. Documentation and Records

Note the description of the data management system established for the project, including a description of types of data that will be collected is presented in element B10.

A9.A Record Generation

The following subsections describe the documents and records that will be generated during the project.

A9.A.(1) Sample Collection Records

Sample collection records will document that the proper sampling protocol was performed in the field. These records will include; field logbooks, soil boring logs, daily field reports, COC forms, COC seals, and COC tags. A detailed description of the sample collection records

documents is provided in Group B3.B.(1) of the QAPP. Copies of example forms are provided in Appendix E.

A9.A.(2) QC Sampled Records

The generation of QC samples will be documented in field logbooks, daily field reports, and on COC forms. Sample preservation will be recorded on these documents by the sample collectors. Sample integrity will be documented on the COC form by the final sample custodian (analytical laboratory).

A9.A.(3) Field Analysis Records

Field analysis will be limited to the performance of headspace vapor monitoring of sediment samples. An SOP for this field analysis is provided in Appendix F. The data generated during field analysis will be recorded on the field logbooks and soil boring logs. The field data will ultimately be presented on final boring logs in the field investigation report. Original field documents will be retained in the project file.

A9.A.(4) Fixed Laboratory records

A.9.A.(4)(a) *STL – Chicago Laboratory Records*

Data reports are filed electronically as .pdf files by sample job number. Hardcopy COC files are maintained and are filed in Job Number order.

Laboratory data, project management files, QA records (e.g., PT scores/corrective actions; MDLs/IDLs, statistical analysis, QAPPs, etc.), Human Resources information, etc., are compiled by date order. The same procedure is followed both in current and archived hardcopy storage.

Upon archiving, a *Records Management Form* is prepared for each storage box of records. This form documents the department, department manager, contents (description and dates), term of retention (e.g., no. of years) and an assigned identification number. The original of this form is maintained with the data management department with a carbon copy filed within the storage box. Upon purging of records, the individual department managers sign the original form as confirmation for the destruction of the associated data. This signature indicates that the laboratory has maintained the information for the required amount of time and is no longer required to store it.

Table 9, "STL Record Types," outlines the types of laboratory records produced by STL Chicago. Table 10, "STL Record Retention," outlines STL's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is issued. For other records, such as Controlled Documents, QC, or

Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs/project that may require lengthier retention requirements are maintained and tracked to ensure compliance.

A.9.A.(4)(b) *Battelle*

Battelle will prepare a final data report package including an electronic copy summary Excel tables for all field and QC data. The final data report will be due within 90 days of the receipt at Battelle of the last sample from the delivery group. Samples will be disposed of after one year. All paper records will be archived for three years. Electronic records will be archived for seven years.

A9.A.(5) Data Handling Records

A.9.A.(5)(a) *STL - Chicago*

See Group A6.A.(5)(b) for STLs information on data reduction and review.

A.9.A.(5)(b) *Battelle*

Battelle's procedure for this project will be based on the QAPP provided in Appendix A. Please refer to Group A6.A.(5)(c) and Appendix A for Battelle's information on laboratory documentation and deliverables.

A9.B Data Reporting Package Format and Documentation Control

A9.B.(1) Field Reporting

Please refer to Field Documentation of data collection which is detailed in Group B3.B.(1)(d).

A9.B.(2) Laboratory Reporting - STL Chicago

A.9.B.(2)(a) *Laboratory Documentation*

Hardbound, pre-formatted laboratory logbooks are issued by STLs Quality Assurance (QA) department. Electronic batch information is maintained on LabNet (LIMS) and are created by a consecutively assigned batch number.

Each book has consecutively numbered pages and the forward of book contains a form for the printed name and signature of those individuals using the logbook; and instructions on documentation requirements within the book. Black ink pen must be used for all entries. Analyst cannot erase or overwrite any incorrect entries. Errors in documentation are corrected by drawing a single line through the error, initialing and dating the incorrect entry and writing the correct entry above or beside the incorrect entry.

Data is recorded in chronological order as the event occurs. All anomalies that may occur during the analysis are documented. Once the data page is fully completed and reviewed, the analyst will sign, date and cross-out (i.e., "Z"-out) the page to indicate that no further data or modifications can be added or made to that particular page.

All logbooks are reviewed/signed/dated. This review insures that all appropriate blanks are filled-in and that all cross-outs are appropriately documented. Once approved, the reviewer will sign and date the page.

A.9.B.(2)(b) *Laboratory Data Deliverable*

Analytical reports comprise final results (uncorrected for blanks and recoveries unless specified), methods of analysis, levels of reporting, surrogate recovery data, and method blank data. In addition, special analytical problems will be noted in the case narratives. The number of significant figures reported are consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) or three (3) significant figures.

Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per kilograms, µg/kg). Reporting limits take into account all appropriate concentration, dilution, and/or extraction factors.

The final report is generated with various steps of approval prior to printing of the final version. If any analytical anomalies were encountered during the analyses, e.g., an out-of-control matrix duplicate, it is documented in a case narrative. The case narrative is prepared by the respective operating unit and submitted to the data management section to insert in the final report.

The final report forms are printed, data packages are organized, a glossary of flags and acronyms is added, and reports are paginated. The final data report that will be provided by STL Chicago will contain the following items:

- Cover Page – signed by the project manager
- Table of Contents
- Sample Information
- Results to the RL with RL for non-detects
- TIC Report – if applicable
- Laboratory Chronicle
- Quality Control (Wet Chemistry)
- Quality Assurance Methods References and Notes
- Case narrative

- Chain of Custody
- LabNet Forms (i.e., similar to CLP)
- Raw Data

A9.B.(3) Laboratory Reporting – Battelle

Battelle will prepare a report with the following minimum information:

- Tabulated results of analyses for field samples and QC samples
- PAH/heteroatomic compounds in water ng/L
- PAH/heteroatomic compounds in soil µg/kg
- PAH/heteroatomic compounds in NAPL mg/kg
- High-resolution GC/FID hydrocarbon fingerprints
- Full Scan GC/MS chromatographic fingerprints for all SVOC/NAPL samples
- GC/MS chromatograms for selected biomarker compounds
- Histograms of PAH distributions for each sample
- Results of analysis in Microsoft Excel spreadsheet

The final data report package will include an electronic copy summary Excel tables for all field and QC data. The final data report will be due within 90 days of the receipt at Battelle of the last sample from the delivery group. Samples will be disposed of after one year. All paper records will be archived for three years. Electronic records will be archived for seven years. Battelle's procedure for this project will be based on the QAPP provided in Appendix A. Please refer to Section 1.3 and Section 2.0 of the Battelle QAPP located in Appendix A for information on laboratory documentation and deliverables.

A9.C Data Reporting Package Archiving and Retrieval

A central project file has been established at SEH's Chippewa Falls, Wisconsin office. The project file will include originals or copies of project-related paperwork for technical and administrative purposes. File contents will include, but not be limited to, contracts, correspondence, transmittals, records of conversations, meeting notices and minutes, quality assurance information, community involvement information, permits, access agreements, regulatory requirements, reports and studies, progress reports, previous reports, field information logs and forms, COC records, laboratory analytical data, and survey information.

SEH personnel familiar with the project will label all project related documents for filing based on their familiarity with the project, item to be filed, and filing categories. The item will then be forwarded to SEH's central file coordinator who is responsible for maintaining the file under the direction of the SEH project manager. SEH will maintain all project files for a minimum of seven years from the point of project closure or until deemed appropriate by the project manager, whichever is longer.

Group B

B Data Generation and Acquisition

The following subsections describe the design and implementation of measuring systems to be used during the winter 2003 sediment sampling in OU #4. Standard Operating Procedures (SOPs) are included in Appendix F.

B1. Sampling Process Design

The following subsections describe the design of the sampling event.

B1.A Sampling Design

The purpose of the winter 2003 sediment sampling event is to develop iso-concentration maps defining the degree and extent of sediment contamination reflective of preliminary PRG values. Background concentrations of COPCs will be determined in sediments located in the vicinity of the site.

The following sampling system was developed to identify the methodology, location, number, and depth of sediment sample collection to be utilized during the sediment investigation. Sediment samples have been previously collected from several locations and depths. These samples have been analyzed for various parameters at CLP Level II or Level IV. The previous data was used to support decisions regarding the proposed locations, type, number, analytical parameters and methods for the proposed sampling events. All data collected during this investigation will be at CLP Level IV, unless specifically indicated. Schedule and rationale for the sampling activities is provided in Groups B1.B and B1.C.

B1.A.(1) Sample Location Survey

Each proposed sediment sampling point will be located and marked using a Magellen Platinum Pro GPS receiver pre-programmed with the sample point latitudes and longitudes. Vertical control will be established by surveying the lake water surface elevation, and then measuring the depth to the upper sediment surface at each location. The latitude, longitude, and depth to sediment surface at each sampling location then be recorded.

B1.A.(2) Shallow Sediment Sampling

Shallow sediment sampling is defined for the purpose of this QAPP as samples collected in the estimated bioactive zone (0-6"). There is currently insufficient data that meets a detection level that corresponds to the preliminary PRGs. Accordingly additional data is required that documents the extent of contamination with method detection levels that do not exceed the preliminary PRGs.

Insufficient data also exists documenting shallow sediment concentrations of COPCs that would be considered background levels. Accordingly, a representative number of shallow sediment samples are required from a location that represents the site without the introduction of COPC.

Inorganic analyte results are of insufficient quantity and quality to be eliminated as COPC in the shallow sediment. Accordingly, a representative number of samples will be collected from the shallow sediment for analysis of select inorganic analytes.

SEH proposes to collect a total of 34-36 shallow sediment samples along transects and at select biased locations between transects. The samples will be collected in the area extending north from the previously documented extent of contamination and at background locations as depicted on Figure 7, "Proposed Sediment Sampling Locations." Shallow sediment samples will be collected from the upper sediment surface to a depth of six inches using a pole-mounted Ponar® sampler modified with pneumatic jaws. The pneumatic jaws are necessary to close the sampler and retain the sample in the wood waste matrix present at some of the proposed sampling locations. The Ponar sampler will be lowered to the lake bottom through a hole cut in the ice. The sampler will then be closed, and the sediment sample extracted. Excess water will be decanted, and the sample removed for observation and processing. Details of the shallow sediment sampling process are provided in the Sediment Sampling SOP (Appendix F).

B1.A.(3) Deep Sediment Sampling

Deep sediment sampling is defined for the purpose of this QAPP as samples collected below the bioactive zone (0-6"). There is currently insufficient data from deeper sediments to define the horizontal or vertical extent of COPC at CLP Level IV. In addition, there is insufficient data that meets the detection levels that corresponds to the preliminary PRG. Lastly, there is insufficient inorganic analyte results at CLP Level IV to be eliminated as COPC in the deeper sediment. Deep sediment samples will be collected to obtain representative data of sufficient quantity and quality to address these gaps.

Deep sediment samples are proposed for collection at 10 to 12 locations as shown on Figure 7. The deep sediment samples will be collected from the sediment surface at each location to a maximum depth of approximately 12 feet. The samples will be collected at two-foot intervals using a Macrocore® core sampler. The Macrocore will be lowered to the lake bottom on drilling rods and advanced to the top of the desired sample interval. The Macrocore tip will then be opened from

the surface and the sampler advanced through the sample interval, thus collecting a discrete sample. Each sample will be retained in a dedicated acetate liner and capped. Portions of each sample may be removed for observation and processing. Details of the deep sediment sampling process are provided in the Sediment Sampling SOP (Appendix F).

B1.A.(4) Sediment Classification and Documentation

Upon collection, each sediment sample will be classified in the field by an SEH hydrogeologist in accordance with the Unified Soil Classification System (ASTM D2487). Visual and olfactory observations of contamination will also be made and recorded. If biota is observed in the sample, it will be noted, however, species and abundance data will not be collected. Data from the deep sediment sampling locations will be recorded on soil boring logs (WDNR Form 4400-122).

B1.A.(5) Field Screening

Representative portions of each sediment sample will be retained for field screening for relative concentrations of VOCs. The field screening will be performed using a Foxboro Toxic Vapor Analyzer (TVA) model TVA-1000 equipped with both a flame ionization detector (FID) and a photoionization detector (PID). The field screening procedure is detailed in Soil Headspace Vapor Monitoring SOP (Appendix F).

B1.A.(6) Decontamination

Field sampling tools and equipment will be decontaminated in accordance with the Decontamination SOP in Appendix F.

B1.A.(7) Investigative Waste Management

Investigative waste (i.e., excess sediment samples, decontamination water, disposable personal protective equipment, used acetate liners) generated during the sediment investigation will be containerized in 55-gallon drums. The drums will be covered, sealed, and labeled appropriately. The drums will be stored at an on-site location selected by the WDNR pending sample analysis. Disposal options will be determined based on the results of sediment chemistry data collected during the investigation.

B1.B Schedule of the Project

The field and laboratory activities required to complete the winter 2003 sediment investigation are scheduled to be performed in accordance with the timeline shown in Figure 8.

Since the schedule is dependant in part on safely accessible ice over the study area, the dates specified above are approximate. If unseasonably warm or rainy weather conditions prevent accessing the study area during the 2002-2003 ice cover season, the schedule will be delayed until the following winter season, or until proposed methodologies can be modified to accommodate summer sampling.

B1.C Sampling Design Rationale

Data quality objectives (DQOs) are qualitative and quantitative statements derived from outputs of the DQO process that:

- Clarify the study objective;
- Define the most appropriate type of data to collect;
- Determine the most appropriate conditions from which to collect the data; and
- Specify tolerable limits on decision errors, which will be used as the basis for establishing the quantity and quality of data to support decisions.

Data collected during the sediment investigation will be utilized for site characterization, potential ecological and human health risk assessment, and for remedial action alternative evaluation, as necessary. The objectives of the sediment investigation and the necessary actions required to accomplish the objectives are provided in Group B1 of this document.

At least initially, two levels of data methodology will be used to achieve the current DQOs for this sediment investigation. Following are the two methodology levels and the usefulness of the data generated from them.

- Level I – Field Screening: This level is characterized by the use of portable instruments (e.g., TVA) that provide qualitative, real time data to assist in determining locations of sampling points and/or health and safety support. For example, during the sample collection, a TVA will be utilized to screen sediment for the presence of VOCs and to assess working conditions during drilling and sampling activities.
- Level IV – CLP Analysis: This level is characterized by more rigorous QA/QC procedures and documentation and third party validation.

Based on existing sediment data from the site, there appears to be a relatively distinct area of highly impacted sediments adjacent to the shoreline and extending northward to at least site reference line 2500N. However, the actual northern boundary where levels of COPC meet the concentrations of the preliminary PRGs is not adequately established due to elevated detection limits in existing site data, and low-level validation for some existing data. Additional data collected during this sediment investigation will be to better define the line where sediment contaminant concentrations exceed preliminary PRGs for the site. Iso-concentration maps can be developed based on the results of the shallow sediment north of the known area of contamination, In addition, sediment samples will be collected at depth at several locations and analyzed to provide vertical definition of sediment contamination related to the preliminary PRGs.

Based on review of existing site data, SEH proposes to collect 32 to 34 shallow sediment samples using a biased sampling design from the vicinity of known contamination for the purpose of delineating horizontal contamination with respect to current PRGs. Thirty of the shallow samples will be collected along three transects using the existing site grid system. Each transect will approximately bisect one of the three known lobes of contamination based on earlier studies. The remaining four shallow sediment samples will be collected between the three transects to provide better delineation of contamination. The proposed sampling points are depicted on Figure 7. The logic for selecting these shallow sampling points is that there is some known information along these transects, and additional studies would most efficiently provide delineation of shallow contamination, thus the extent of current (or future) PRGs could be determined.

The biased sampling design was also used to select 7 to 9 shallow background sediment sampling locations to be used for determining the range of concentrations of contaminants in sediments not impacted by site contaminants, but in the general vicinity of the site. The shallow background sediment samples will be collected along a transect along the 3200E site grid line. The proposed background sediment sampling locations are depicted on Figure 7.

A biased sampling design was used to select the location of 40 to 60 additional deep sediment samples proposed for collection and analysis at the 10 to 12 sampling points depicted on Figure 7. Two of the sampling points will be located along the background transect selected for the shallow sediment sampling. The rationale for these samples is to provide data to delineate the vertical extent of contamination with respect to PRGs. Past studies tend to indicate the vertical extent of

sediment contamination is generally confined to the upper twelve feet of sediments due to geologic factors (the presence of the Miller Creek Formation). Sampling of seven sampling points within the known area of impact and just outside this area will provide details needed to determine vertical extent of contamination. The site grid system will again be implemented during deep sampling so some use can be made of historic data at given locations.

B2. Sampling Methods Requirements

The following subsections describe how samples will be collected in a consistent manner. Details regarding prevention of cross-contamination, sample media and matrices, sample locations, sample volumes, and sample preservation are provided.

B2.A Sampling SOPs

Sampling SOPs will provide consistency between samplers, will facilitate collection of accurate, precise and representative samples, and help ensure data comparability and usability. Sampling SOPs for collection of sediment samples methodologies are included in Appendix F.

B2.B Cleaning and Decontamination Procedures

All sampling equipment that will come into contact with the samples will be cleaned initially before beginning field activities, and decontaminated prior to collection of a discrete sample. For the sediment investigation, the equipment coming into contact with sediment samples will include the Macrocore® sampler and the Ponar® dredge. Disposable equipment coming into contact with samples will include liners, catchers, tubing, and gloves. The disposable equipment described above will be brought to the site new and in factory packaging, will be dedicated to the collection of one discreet sample, and will subsequently be disposed. The initial equipment cleaning and decontamination procedures are described in further detail in SOPs (Appendix F).

B2.C Field Equipment Maintenance

All field equipment and instrumentation used during the sediment investigation will be brought onto site in good working order and calibrated (if necessary). When feasible, a backup instrument in good working order will be kept on-site during performance of field activities to be used if mechanical problems occur with the original instrument. Instruments requiring calibration will be calibrated daily. Calibration results will be documented in the project field log book. Instrument readings taken during the investigation (e.g., field headspace readings)

will be documented either on boring logs, in the field log book, or both. Instruments to be utilized during the investigation along with maintenance procedures and spare parts are provided on Table 11, "Preventative Maintenance."

B2.D Inspection and Acceptance Requirements for Supplies/Sample Containers

STL Chicago (STL) will be providing the sample containers for this RI/FS. The laboratory purchases all sample containers from ESS that are precleaned according to the U.S. EPAs cleaning procedures, and each bottle lot is analyzed for purity. The lot number is labeled for traceability to a certificate of analysis.

The samples collected for the portion of the RI/FS are sediment samples. Therefore, preservation at 4 $\pm 2^{o}$C is the required preservative. Refer to Table 12, "Sample Containers, Sample Volumes, Preservation, and Holding Times for Sediment Samples" for holding time and sample size requirements. Upon receipt at STL, sample collection dates are noted by the sample custodian. The laboratory's LIMS tracks each samples hold time.

B3. Sample Handling and Custody Requirements

The following subsections describe the procedures to be used during the sediment investigation to ensure that:

- Samples are collected, transferred, stored, and analyzed by authorized personnel;
- Sample integrity is maintained during all phases of sample handling and analysis; and
- An accurate written record is maintained of sample handling and treatment from the time of sample collection through sample analysis to disposal.

B3.A Sample Handling

Proper field and laboratory documentation will be maintained to ensure sample authenticity and data integrity. For sediment samples selected for laboratory analysis, the following order of analytical parameter sample fraction collection will be utilized:

1. VOCs
2. SVOCs
3. Cyanide
4. Hexavalent Chromium
5. Total Metals
6. TOC and Total Solids

The sample numbering system for field sample collection will utilize a two-letter Project Identification Code followed by a Sample Matrix Code and a Location Code (note, the location code deviates somewhat from EPA guidance so the site grid system can be utilized). The Project Identification Code will be AS (Ashland). The matrix or type of each sample will be identified by an alpha code as follows:

SD – Sediment sample
NA – Nonaqueous phase liquid sample
TB – Trip blank sample
FB – Field blank sample
RB – Rinseate blank sample
FD – Field duplicate sample
MS – Matrix spike sample
MSD – Matrix spike duplicate sample

The location code will follow the sample type code. The location code will consist of a northing and easting value corresponding to the site grid location where the sample was collected and the depth interval from which the sample was collected (e.g., 2400N 1900E 0-0.5 ft.). Thus, examples of sample identification numbers would be: AS-SD-2400N 1900E 0-0.5 ft. (Ashland site, sediment sample, grid 2400N 1900E, 0 to 0.5 ft. below sediment surface); and, AS-FD-3100N 2400E 4.0 to 6.0 ft. (Ashland site, field duplicate sample, grid 3100N 2400E, 4.0 to 6.0 ft. below sediment surface).

Samples will be transported to the analytical laboratory via Federal Express priority overnight service to meet required sample extraction, digestion, and holding times. Samples will be immediately chilled to 4 degrees C upon collection and will be maintained at 4 degrees C ±2 degrees until the samples are delivered to the analytical laboratory. Standard COC documentation will be maintained during sample shipment and receipt. COC seals will be placed over any potential opening on a cooler during sample shipment. Copies of example COC forms and COC seals are provided in Appendix F. Sample container, volume, preservation and holding times are provided on Table 12.

B3.B Sample Custody

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the COC intact. All field personnel will follow the EPA COC procedures to ensure preservation of the integrity of all samples. COC records will be used for all sample manifesting on the project. The COC records will be initiated by the lab at the time of sample bottle preparation and will

follow each bottle through the sequence from bottle preparation through completion of chemical analysis.

Collected samples will be kept under lock and key or within sight at all times until their shipment to the laboratory. SEH field samplers will act as sample custodians and document control officers to monitor the location of collected samples and to record vital sample information in field logbooks.

At the laboratory, each sample will receive a unique STL or Battelle sample number that consists of the job number and a sequential number. This sample number will be logged into the LabNet (LIMS). A COC form will accompany all samples throughout sample movement in the laboratory. Every person handling a sample will note the location change, time, date, and reason for movement.

B3.B.(1) Field Custody Procedures

The following field custody procedures will be implemented while evidence is collected during the sediment investigation.

B.3.B.(1)(a) *Procedures for Transfer of Custody Between Individuals*

For the purpose of the sediment investigation, the samples collected for analysis will remain in the custody of the SEH sampling team responsible for collection until a given batch of samples has been fully processed and sealed within a cooler. Sample processing will include opening the sampling device, mixing the desired sample interval as necessary, placing representative portions of the sample in the required sample bottles and preserving as necessary, numbering in accordance with the sample numbering system described in detail in Group B3.A, tagging and labeling, placement in a cooler (on ice), documenting on COC forms and in field book, and sealing of completed batch of samples with COC seals. During the sample processing activities, the SEH sample custodians will either maintain the samples within their possession, maintain unsealed sample coolers within their line of sight, or place the unsealed coolers in a secure, locked location (e.g., locked vehicle).

B.3.B.(1)(b) *Sample Numbering System*

The sample numbering system described in Group B3.A will be utilized during the sediment investigation.

B.3.B.(1)(c) *Sample Packaging and Shipment Procedures*

Once sample processing activities are completed, a given batch of samples will be placed on ice in a cooler (or coolers) with appropriate COC documentation. Packaging material will be added as necessary to minimize the potential for sample breakage during shipment. The cooler(s) will then be sealed by placing COC seals over all potential openings. The cooler(s) will remain sealed through transport to the analytical laboratory, where laboratory personnel will assume custody of the samples. Sample shipment will be performed by Federal Express via priority overnight shipping. Air bills will be completed for each shipment and will be retained as part of chain-of custody documentation.

B.3.B.(1)(d) *Field Documentation*

Field staff will keep detailed records and notes of field investigation activities and results, photographs, and field conversations. These original documents will be stored in the project file at SEH's Chippewa Falls, Wisconsin office or elsewhere as may be determined appropriate during the sediment investigation. The WDNR will be notified if files are stored at a location other than SEH's Chippewa Falls, Wisconsin location.

Field Logbooks – The primary method for recording field data and site activities will be in bound field logbooks. Entries into a field logbook will be made as activities occur or samples are collected; or, if it is not possible to record the information during the activity, as near to completion of the activity or sample collection as possible so as to minimize detail loss due to memory reliance. When practicable and warranted, entries to the field logbook will be supplemented by photographs, documented as discussed below.

Field logbooks will be bound, 5-inch by 7-inch books with paper pages with water resistant surfaces. Logbooks will be assigned to field personnel and the cover of each logbook will contain, at a minimum, the following information:

- Project name and project number;
- Field personnel name;
- Book number (logbooks per field personnel will be numbered sequentially); and
- Date of first and last entries within the logbook.

Typically, field investigation and sample collection activities observed or information discussed in the field that is pertinent to current or future project decisions or documentation will be recorded in the field logbook. Information will be recorded in the logbook in waterproof ink. Each page number in the logbook will be numbered sequentially so no pages shall be removed from the logbook. Each new daily entry will begin on a new page and the following information will be recorded at the beginning of each daily entry:

- Date;
- Start time;
- Weather conditions;
- Field personnel present;
- Field equipment present;
- Level of personal protective equipment; and
- Signature of field personnel responsible for making entries in logbook.

In addition, the last entry of each day shall be the signature of the field personnel making the observations. Any unfilled portion of the last page of the entries each day will be lined out so no additional entries can be made for that day.

All entries in the logbook will be legible and must include the following information, at a minimum and as appropriate:

- Date and time of entry (use of military time designation is preferred but, at a minimum, specification of am or pm is required);
- Field observations;
- Field Measurements;
- Field instrument calibration procedures and results
- Record of phone conversations and field decisions;
- Visitors at site (including arrival and departure times and any pertinent discussions);
- Change to weather conditions;
- Purpose of sampling;
- Sample collector name;
- Date, time and general location of sample collection;
- Sample identification for laboratory analysis;
- Field equipment used;

- Sample description, including depth, volume, and sample containers;
- Decontamination procedures;
- Measurement units and instrumentation used; and
- Material usage and quantities.

Survey information will be recorded in separate logbooks or on separate survey data sheets. The protocols for data recording remain the same.

Any corrections to entries made in the logbook will be by lining out the incorrect information or entry by using a single line (or so that the original entry is still legible), noting the date and time of the correction, and initialing the correction. If there are changes in the field personnel making the observations during a particular day, this information will be recorded and appropriate initials provided on all entries.

When not in use in the field for an extended period of time, when full, and at the completion of the project, logbooks will be stored in the project file. If logbooks will be in the field for over two weeks, copies of completed pages will be made and placed in the project file on a weekly basis to minimize data loss if the logbook is lost or damaged.

Data Recording Forms – In addition to utilizing logbooks for recording data, information may also be recorded by SEH or their contractor(s) on various data recording forms. Data recording forms completed each day will be noted in the field logbook. At a minimum, it is anticipated that the following WDNR and SEH forms will be used during the sediment investigation. A sample of each form is included in Appendix E. Each form, discussed in more detail below, will include the following information:

- Project name and number;
- Date and time;
- Site location;
- Consultant or contractor representative completing the form; and
- Sample identification, location and medium.

Soil Boring Log Information Form – The soil boring log information form (WDNR Form 4400-122, Rev. 7-98, or most current available) provides a detailed description of vertical soil (or sediment) profile sampled in a borehole. Soil/sediment descriptions (visual characteristics along with pertinent descriptive remarks) and geologic origin for each major unit will be recorded as well as recovery, depth of sample, USCS

classification, and TVA readings. The top of the form will also include general information such as site name, boring number, location, date, drilling method, and drilling company. The completed form will be submitted to the WDNR and a copy will be maintained in the project file.

Diggers Hotline Notification – A minimum of three business days before conducting any intrusive field investigation activities at the site, Diggers Hotline will be contacted to request that buried or underwater utilities in the investigation area be located, or that utility representatives meet at the site at a designated time. A Diggers Hotline Notification form will be completed for each call made to Diggers Hotline and will be maintained in the project file.

Daily Field Report – In the event that a field logbook is not available, a Daily Field Report form may be utilized to document observations made during the day. Information that may be recorded and the protocols for doing so are the same as for recording in a field logbook. Completed daily field reports are maintained in the project file.

Chain of Custody – Laboratory specific COC forms will be utilized for each sample shipment to the laboratory, and will accompany the applicable sample(s). The COC, in triplicate (original and two carbon copies), will document the sample identifications, time and date of sample collection, desired analytical methodologies, sample container size and composition, sample collector, and person who relinquished the sample shipment. A copy of the COC will be retained by the person relinquishing the samples and will be provided to the SEH project manager for data management.

B.3.B.(1)(e) *Photographs*

Photographic documentation will be utilized during the sediment investigation to document field conditions and observations, and to augment field logbook entries. Whether film or digital photographs are taken, the following information will be recorded in the field logbook or appropriate photography logbook.

- Date and time of photograph;
- Direction of photograph;
- Location of photographer;
- Description of subject; and
- Photograph number and roll or disk.

Once developed and appropriately labeled (with date, time, direction, subject, photographer, etc. to match entry in logbook or photography logbook), hard copy photographs will be stored in the project file. Digital photograph files will be transferred from the camera media (floppy disk, compact disk, other) to the electronic project file on the office server. Electronic or digital photograph files will be renamed and dated.

B3.B.(2) Laboratory Custody Procedures – STL Chicago

The purpose of COC procedures is to document the history of sample containers and samples, including sample extracts. The associated records provide traceability from the time of preparation of sample containers, through collection, shipment, analysis, and disposal of the sample. Items under custody are defined as:

- It is in your actual possession, or
- It is in your view, after being in your physical possession, or
- It was in your possession and then you locked or sealed it up to prevent tampering, or
- It is in a secure area.

A majority of the data generated by a laboratory is potentially litigation evidence. A primary step in the evidentiary trail is to provide proof that the sample collected in the field is the sample that was actually analyzed. The COC forms provide the necessary documentation.

In addition to providing accountability for the physical location of the sample, sample integrity depends on proper collection and storage of the sample. Description of COC procedures associated with sample collection, receipt, storage, preparation, analysis, and general security procedures are described later in this section.

The Laboratory Section Managers are responsible for the records received or generated by their respective areas in the laboratory. Laboratory documentation used to establish COC and sample identification may include the following:

- Field COC forms or other paperwork that arrives with the sample.
- The laboratory COC.
- Sample labels are attached to each sample container and should contain the following information: sample date; time (2400 clock); sample description; sample matrix; filtration, preservation, and known hazards information; job number; and parameter group.

These labels are verified for accuracy against the paperwork received with the samples. The signed COC form will serve as documentation of this verification, rather than attempting to peel or remove labels to place in the written documentation file.

- Sample storage via LabNet.
- Sample disposition system, which documents sample disposal by a contracted waste disposal company.
- Errors in all documentation are deleted with one line through the error, the appropriate correction is made, then initialed and dated by the person making the correction. All documentation/logs are signed/initialed by appropriate personnel.

B.3.B.(2)(a) *Sample Receipt*

Sample custodians are responsible for samples received at STL or Battelle. Upon receipt, the sample custodian(s) signs, dates, and documents the time of sample receipt on the air bills received from the couriers. If the client name is not written on the air bill, it is written in by the sample custodian(s). The COC seals, if present, are cut and kept to check with the seal number on the COC.

The sample custodian(s) will inspect the sample container for integrity and update the following information on the electronic sample receipt checklist: cooler temperature (4 $\pm 2^{\circ}$C); the presence of leaking or broken containers; properly preserved; and that the sample(s) were received within its EPA established hold time. Any additional comments are also noted. The sample custodian(s) will sign (with date and time of receipt) the COC form, thus assuming custody of the samples. Any errors made on the COC are corrected by drawing a single line through the incorrect entry, initialing, and dating the cross out.

The sample custodian(s) will coordinate sample bottle information (e.g., sample tag/label, etc.) and COC records to verify sample identity and to ensure that all information is correct. Any inconsistencies will be resolved with the Project Manager and/or client with corrective action specified before sample analysis proceeds.

The sample custodian(s) will assign, via LabNet, a unique job number to each sample received. The job number will be recorded on the COC and on the bottles (with each individual sample ID#) using printed labels. The job number is the primary means of tracking a sample through the laboratory. The samples are then placed in refrigerated storage by the sample custodian(s).

B.3.B.(2)(b) *Sample Storage*

All samples are stored in refrigerated walk-in coolers that are maintained at 4 ±2°C. The temperature of the coolers is monitored four times daily by an electronic monitoring system.

STL maintains eight coolers for storing samples/extracts. Two coolers are designated for samples that require internal COC and are locked at all times. Access to these coolers is maintained through the sample custodians.

B.3.B.(2)(c) *Sample Tracking*

All samples are maintained in the appropriate coolers prior to and after analysis. The analysts remove and return their samples as needed. Samples that require internal COC are relinquished to the analysts by the sample custodians. The analyst and sample custodian must sign STLs *Internal COC* form that documents relinquishing custody of the sample(s) from the sample custodian to the analyst. When the samples are returned, the analyst will sign the *Internal COC* form returning sample custody to the sample custodian.

Any change in the sample during the time of custody will be noted in a Sample Discrepancy Report (SDR) (i.e., sample breakage or depletion).

B.3.B.(2)(d) *Sample Disposal*

STLs standard sample/extract/digestate disposal time is 30 days after the final report is submitted. The sediment samples are labpacked and disposed of by a contracted waste company.

Samples requiring internal COC are disposed of 60 days after the report has been submitted, unless other arrangements have been specified by the Project Manager. One week prior to sample disposal, a list is provided to the Project Manager for verification.

B3.B.(3) Laboratory Custody Procedures – Battelle

Battelle has provided a Work/Quality Assurance Project Plan which is located in Appendix A. Battelle's receipt, storage, and handling procedures are based on this QAPP. Please refer to Section 1.1.2 of this plan for details on Battelle's custody and handling policy.

B3.B.(4) Final Evidence Files

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities as described in this QAPP. SEH is the custodian of the evidence files and maintains the contents of the field files for the RI/FS, including all relevant records, reports, logs, field notes, pictures, subcontractor

reports, and data reviews in a secured, limited access area and under custody of the SEH Project Manager.

The final evidence file will include at a minimum:

- Field logbooks.
- Field data and data deliverables.
- Photographs.
- Drawings.
- Soil boring logs.
- Laboratory data deliverables.
- Data validation reports.
- Data assessment reports.
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation including forms, air bills, etc.

The file will be maintained during the pendency of the completion of this RI/FS. The file will be offered to the EPA prior to disposal.

B4. Analytical Methods Requirements

Sediment samples collected during field sampling activities for the project will be analyzed by Severn Trent Laboratories in Chicago, Illinois. Fingerprint samples collected during the field investigation will be analyzed by Battelle in Duxbury, Massachusetts.

B4.A Analytical Parameters and Matrices

The laboratory named above will implement the method SOPs. The laboratory SOPs for sample preparation, cleanup and analysis are based on SW-846 Update III. These SOPs provide sufficient details are specific to the quoted method.

Table 2 presents the general chemistry reporting limits and method detection limits (MDLs) for the method compound/parameters.

Table 4 presents the forensic chemistry reporting limits and MDLs.

B4.B Sample Prep and Cleanup SOPs

Severn Trent Laboratory will implement the Sample Preparation and Cleanup SOPs. The laboratory SOPs for sample preparation, cleanup, and analysis are based on SW-846 Update III. These SOPs provide sufficient details are specific to the quoted method.

B4.C Analytical Methods SOPs

The STL laboratory SOPs listed on Table 7 will be utilized during analysis of sediment samples.

Battelle laboratory SOPs are listed on Table 3.

B4.D Method Validation Study

Validation of all analytical results will be performed by MAKuehl Company of Green Bay, Wisconsin. Please refer to Group D for data review, validation, and verification methods that will be followed for this task.

B4.E Analyte Groups of Interest

A complete listing of project target compounds, reporting limits and current laboratory MDLs are listed in Table 2 and Table 4.

The MDL is the lowest concentration that can be detected for a given analytical method and sample matrix with 99 percent confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants." MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratories maintains MDL studies for analyses performed; these are verified at least annually.

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. The laboratory reporting limits are further related and verified by the lowest point on a calibration curve. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory endeavors to keep reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported.

B4.E.(1) List of Associated Quality Control Samples

The laboratory SOPs listed in Table 3 and Table 7 include a QC section which addresses the minimum QC requirements for the analysis of specific analyte groups. Table 8 contains a complete listing of the associated STL QC samples for every analyte group.

B4.F Quantities and Types of QC Samples

One duplicate sample will be collected for every ten sediment samples collected. Matrix Spike and Matrix Spike Duplicate (MS/MSD) samples will be collected for every twenty sediment samples collected. At least one MS/MSD will be collected if less than twenty samples are collected in a given sample shipment. MS/MSD samples will not be collected for SVOC fingerprinting samples.

B5. Quality Control Requirements

The following subsections describe the quality control measures to be taken on the project. The objective of the quality control measures is to define the acceptable limits of performance for field and laboratory analysis.

B5.A Field Sampling Quality Control

SEH has a program in place to ensure the reliability and validity of field analyses performed during the sediment investigation. For this project, field analyses will be limited to headspace vapor monitoring of sediment samples. An SOP describing this method and associated calibration and QC requirements is included in Appendix F.

B5.B Analytical Quality Control Checks – STL Chicago

STL has a QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in writing as SOPs and each SOP includes a QC section (Section 8.0) which addresses the minimum QC requirements for the procedure. The internal QC checks differ slightly for each individual procedure but in general the QC requirements include the following (which are also addressed in Table 8):

- Method Blank – A blank matrix processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.
- Matrix Spike – Field sample to which a known amount of target analyte(s) is added.
- Surrogates (Organics Only) – Compounds similar to the target analytes in structure, composition and chromatography but not typically found in nature. Added to each blank, sample and QC indicators to measure method performance.
- Laboratory Control Sample – A blank matrix spiked with a known amount of analyte(s), processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

All data obtained will be properly documented. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient volume is available and if within hold time. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary. (Refer to Group B7 for instrument calibration procedures).

B5.C Analytical Quality Control Checks – Forensic Methods

Battelle maintains a quality assurance program that employs numerous quality control parameters to assure that the produced data is of known precision and accuracy. These QC parameters are detailed in the laboratory standard operating procedures and summarized in Table 4.

The corrective action for QC exceedances includes a review of peak integrations, notification of the Project Manager, and disclosure in the laboratory report as necessary. If necessary, the Project Manager can request additional corrective actions, like sample reanalysis. All project deliverables are independently reviewed according to the laboratory quality assurance plan prior to release to the client.

B6. Instrument and Equipment Maintenance

B6.A Field Instrument Maintenance

The field preventive maintenance procedures and frequencies of checks are detailed in Table 11 of this QAPP. Critical spare parts include spare batteries and back-up instruments.

An inventory control system governing field equipment and instrumentation will be maintained by SEH equipment storeroom supervisor as the basis for maintenance and calibration control. The inventory control documentation includes the following:

- Description of instrument.
- Manufacturer, model number, and serial number.
- Identification number.
- Name, address, and telephone number of company that services the instrument or equipment.
- Type of service policy.
- Timing and frequency of routine maintenance, service and calibration.

Instruments will be maintained in accordance with manufacturer's specifications. More frequent maintenance may be required depending on operational performance. Instrument logs will be maintained to document the date and type of maintenance performed.

Contracts on major instruments with manufacturer's and service agencies are used to provide routine preventative maintenance and to ensure rapid response for emergency repair service. Minimal instrument downtime is experienced through the use of these contracts.

B6.B Laboratory Instrument Maintenance – STL Chicago

As part of the QA Program Plan, a routine preventative maintenance program is conducted by STL to minimize the occurrence of instrument failure and other system malfunctions. The analysts regularly perform routine instrument maintenance tasks (or coordinate with the vendor). All maintenance that is performed is in accordance with the manufacturer's specifications and is documented in the laboratory's preformatted and bound maintenance logbooks.

Each analytical instrument is assigned an instrument maintenance logbook. All maintenance activities are recorded in the maintenance log. The information entered in the maintenance log includes:

- Date of service or maintenance.
- Person performing service or maintenance.
- Type of service performed and reason for service.
- Replacement parts installed (if appropriate).
- Documentation of the re-establishment of working order.
- Miscellaneous information.

If service is performed by the manufacturer, a copy of the service record (when available) is affixed to the notebook page, or cross-referenced in the notebook to a separate maintenance file. The service record should include sufficient detail to describe the service performed (e.g., not just "service call," but "replaced pump motor gear"). If the service record does not define this information, it must be written separately into the maintenance log. There must also be a reference to the file number, notebook page, etc., that substantiates re-establishment of working order.

Preventative maintenance and repairs that cannot be performed by laboratory staff are contracted to the manufacturer's service section or to an authorized maintenance vendor. Laboratory service agreements provide for preventive maintenance, emergency service, and emergency

shipping of spare parts. Annual service of the laboratory balances is an example of contracted preventive maintenance.

Examples of maintenance procedures and suggested frequencies for major analytical instrumentation are summarized in Table 13, "Example Laboratory Equipment and Maintenance." Instrument specific information is provided in the respective instrument manuals and in the laboratory SOPs (Appendix D).

B6.C Laboratory Instrument Maintenance – Battelle

Battelle has provided a Work/Quality Assurance Project Plan which is located in Appendix A. Battelle's procedures and QA/QC methods and practices are based on this QAPP. Please refer to Section 1.1.3.2 of this plan for details on Battelle's instrument maintenance policy.

B7. Instrument Calibration

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

B7.A Field Instruments

Calibration of field instruments will be limited to the laboratory calibration and daily calibration of the Foxboro TVA-1000 used to perform sediment headspace vapor analysis. Details of the calibration procedures for this instrument are provided in the sediment Headspace Vapor Monitoring SOP in Appendix F.

B7.B Laboratory Instruments – STL Chicago

Calibration procedures for a specific laboratory instrument will consist of initial calibrations (3 or 5-points), initial calibration verifications and continuing calibration verification. For a description of the calibration procedures for a specific laboratory instrument, refer to Sections 6 and 7 of the applicable SOPs in Appendix D of this QAPP. The SOP for each analysis performed in the laboratory describes the calibration procedures, their frequency, acceptance criteria and the conditions that will require recalibration. Initial calibration will be verified using an independently prepared calibration verification solution.

The laboratory maintains an analysis logbook (hardcopy or electronic) for each instrument which contains the following information: instrument identification, date of calibration, analyst, calibration solutions run and the samples associated with these calibrations.

Table 14, "Example of Calibration and Corrective Action Procedures" provides a summary of the laboratory's calibration procedures for the analyses to be performed at the Ashland/NSP Lakefront Site.

B7.C Laboratory instruments – Battelle

Please refer to Table 4 for Battelle's instrument quality control descriptions, frequency, acceptance criteria and corrective action response.

B8. Supply Lists and Sources

For this project, critical supplies will be tracked through SEH's field management system and STL's system in the following manner:

B8.A Field Supplies and Consumables

Critical Supplies and Consumables	Inspection/ Acceptance Testing Requirements	Acceptance Criteria	Testing Method	Frequency	Responsible Individual	Handling/ Storage Conditions
Calibration Gases	Refer to manufacturer's Certificate of Analysis.					
Bottles and Preservatives	Refer to manufacturer's Certificate of Cleanliness.					

B8.A.(1) Laboratory Supplies and Consumables

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, and the overall quality of their services. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents meet with the requirements of the specific method and testing procedures for which they are being purchased. The measurements for evaluation and selection of suppliers; the acceptance of supplies and services; and certificates of conformance is defined in the laboratory's procurement SOP.

B8.A.(2) Solvent and Acid Lot Verification

Pre-purchase approval is performed for solvents and acids purchased in large quantities unless a certificate of conformance has been furnished. These may include acetone, ethyl ether, hexane, methylene chloride, nitric acid, hydrochloric acid, sulfuric acid, and hydrogen peroxide. Each lot of incoming supplies requiring pre-approval is checked against the previously approved lot number. If the lot number is not approved, the lot is refused. If the lot number is an approved lot number, it is accepted and documented. Solvents and acids are pre-tested in accordance with STLs Corporate procedure.

Items have traceable documentation (e.g., labels or logbooks) for date received, date opened, and date expired.

Critical Supplies and Consumables	Inspection/ Acceptance Testing Requirements	Acceptance Criteria	Testing Method	Frequency	Responsible Individual	Handling/ Storage Conditions
Standards	Refer to the Manufacturer's Certificate of Analysis.					
Acids	< RL's for common lab contaminants	< RL's all elements	SW-846	Each Lot	Receiving / Laboratory Personnel	Vented Acid Cabinets
Solvents	< RL's for common lab contaminants	< RL's for common lab contaminants	SW-846	Each Lot	Receiving / Laboratory Personnel	Vented Solvent Cabinets

B9. Data Acquisition Requirements

This section identifies the sources of previously collected data and other information that will be used to make project decisions. More than 73 documents have been developed for this site to date. A list of documents for the site can be found in Appendix C. For the purposes of this investigation, previously collected data specific to OU #4 was generated in the following documents:

- #14 – Sediment Investigation Work Plan, SEH, Feb. 1996
- #16 – Sediment Investigation Report, SEH, July 1996
- #27 – Ecological Risk Assessment: Problem Formulation, SEH 1998
- #28 – Baseline Human Health Risk Assessment, SEH, June 1998D
- #32 – Ecological Risk Assessment: Ashland Lakefront Property (Final Draft), SEH March 1999
- #49 – Sediment Sample Results Vol I of III, URS June, 2001
- #50 – Sediment Sample Results Vol II of III, URS, June 2001

- #51 – Sediment Sample Results Vol III of III, URS, June 2001
- #65 – Ecological Risk Assessment Supplement, SEH, Feb 2002

Data validation on the analytical data contained in these documents was performed by Battelle of Duxbury, Massachusetts and USEPA Region 5. The limitations of historical analytical data are based upon the CLP level for these data determined during the data validation process.

B10. Data Management

B10.A Data Recording

B10.A.(1) Documentation of Field Data

Refer to Group A6.A.(8) for field documentation and reports.

B10.A.(2) Documentation of Laboratory Data

Refer to Group A6 and the laboratory's SOPs.

B10.B Data Validation

Refer to Group D for data review, validation and verification methods

B10.C Data Transformation/Data Reduction

Refer to Group A6 and the laboratory's SOPs.

B10.D Data Transmittal/Transfer

Refer to Group A6 and the laboratory's SOPs.

B10.E Data Analysis

Refer to Group A6 and the laboratory's SOPs.

B10.F Data Assessment

Refer to Group C for assessment and oversight methods.

B10.G Data Storage and Retrieval

Refer to Group A6 and the laboratory's SOPs.

B10.H Data Security

Refer to Group A6 and the laboratory's SOPs.

B11. Health & Safety

Field activities will be performed in accordance with SEH's Site Health and Safety Plan which is presented in Appendix G, "Site Health and Safety Plan."

Group C

C Assessment and Oversight

This section of the QAPP describes the review procedures that will be used to ensure proper implementation of the QAPP. Performance and system audits of field and laboratory activities verify that sampling and analysis are performed in accordance with the procedures established in the QAPP. This section describes the response actions as the result of deviations from the QAPP.

C1. Assessment and Response Actions

Assessments will be conducted periodically throughout the project to ensure that usable data will be generated. Internal audits will be conducted by the QA officers from SEH and contract laboratories. External data validation audits will be conducted by Marcia Kuehl from MAKuehl Company.

C1.A Planned Assessments

Table 15, "Planned Assessments," identifies the type and frequency of planned assessments of quality assurance procedures.

C1.A.(1) Field Sampling Technical System Audit (TSA)

The SEH Field Team Leader will conduct an audit of field activities, covering both sampling and measurements. The purposed of the field audit will be to evaluate and document adherence to procedures described in the QAPP. The audit will be performed at the start of field sampling activities and again on the first day of subsequent mobilizations. The audit will examine sample collection equipment, instrumentation including calibration procedures, availability of supplies and backup equipment, sampling procedures, COC and sample tracking, field logbooks, data handling, and data verification procedures.

The results of the Field Sampling TSA will be communicated verbally to the SEH field technician and contract sampling crew.

C1.A.(2) Performance Evaluation

QC samples will be collected for performance evaluation (PE). QC samples will be statistically analyzed to evaluate laboratory performance, and to measure the overall accuracy and bias of the laboratory method.

QC performance acceptance criteria and corrective action is summarized on Table 14. The performance evaluation will be based on data generated from duplicate samples, field replicates, matrix spikes and equipment blanks.

The SEH QA Director will conduct the performance evaluation and present the results to the SEH Project Director. The SEH Project Director will determine adherence to DQOs and submit recommendations, if any, to the WDNR Project Manager via a project memorandum.

C1.A.(3) Data Package TSA

The Data Package TSA is a limited review of the complete analytical data package generated by the fixed laboratory. The STL QA Manager will prepare and submit the complete analytical data package to the SEH Project Manager. It will include the following:

- Narrative including statement of samples received, description of any deviations from procedure, explanation of qualification regarding data quality, and any other significant problems encountered during analysis;
- Sample data package;
- Calibration data associated with sample analysis; and
- Field and laboratory COC documentation pertaining to each sample delivery group analyzed.

All data generated will be tabulated in a format organized to facilitate data review and evaluation. Upon receipt of the analytical data package from the laboratory, the SEH Project Manager will check the following items:

- Completeness of data package deliverables;
- Correct analytical methodology;
- Sample holding times;
- QAPP-specified data verification procedures; and
- The presence of flagged or qualified data.

The review of the completeness of the data package will assess if all items specified in the QAPP are present. At a minimum, deliverables will include sample COC forms, analytical results, and QC summaries. All summary tables and figures produced will be checked for errors with the original data reports prior to including them in final reports.

C1.A.(4) Data Validation TSA

The Data Validation TSA is a review of the complete Data Validation Report. The Data Validation serves to ensure that the data validation procedures and actions identified in Group D are followed, the method and laboratory QC criteria are achieved, and that the performance and data validation criteria met the standards proposed in the DQOs. Included in the review are the tabulated and raw data from the Level IV or Level II analytical data packages prepared by the laboratories. The data will include the results of tuning, calibration, lab blanks, lab duplicates, spikes, laboratory control standards, sample condition upon receipt, surrogate spike recoveries and raw data. The Data Validation TSA will be conducted by MAKuehl Company.

Data validation will be done in accordance with the EPA-540/R-94/012, "National Functional Guidelines for Inorganic Data Review," dated February, 1994, EPA-540/R-94-013; and "National Functional Guidelines for Organic Data Review," dated October 1999, EPA-540/R-99/008 modified as appropriate to include the specific requirements for the SW 846 analytical methods required for the project. The data validation report will be in the form of a Technical Memorandum and will be delivered to the SEH Project Manager within 10 business days of receipt of the complete EPA Level IV or Level II data packages from the laboratory. The SEH Project Manager will forward the Data Validation TSA report to the WDNR and EPA Project Managers.

C1.B Findings and Corrective Action Responses

Deviations and project deficiencies that are identified will be addressed using the procedures identified in this section. In general, formal corrective action programs will be eschewed in favor of issue-specific responses and memorandums. The corrective action responses will be implemented at the time a problem is identified. The first level of notification will alert the SEH Project Manager, with subsequent notification of the WDNR and EPA Project Managers. Implementation of corrective actions will be confirmed via project memorandum through the same channels.

Implementation of corrective actions will be implemented and documented in the field record book.

C1.B.(1) Field Sampling

The SEH Field Supervisor or designee will be responsible for reporting all suspected technical or QA non-conformances, or suspected deficiencies of any field sampling activity by reporting the situation to the SEH Project Manager. The Field Supervisor will record the initial findings in the field logbook. The SEH Project Manager will assess the

initial findings and discuss with the Field Supervisor the appropriate corrective action. Corrective actions for field sampling activities may include:

- Repeat the measurement;
- Check for proper adjustments for ambient conditions such as temperature;
- Check battery levels;
- Re-calibrate field meters;
- Check the calibration;
- Replace the instrument or measurement device; or
- Stop work.

The SEH Field Supervisor will record the implementation of corrective actions in the field logbook, with the exception of the Stop Work order. Upon issuance of a Stop Work order the SEH Project Manager will initiate a non-conformance memorandum documenting the situation and justification for termination of field sampling. The non-conformance memo will be submitted to the WDNR and EPA Project Managers.

The content of the non-conformance memo will include:

- Date/time of initial findings
- Name and title of reporting entity
- Description of problem
- Recommended corrective action and proposed timeline.

The implementation of corrective actions recommended in the nonconformance report will be documented in memo format and included in the Comprehensive Remedial Investigation report that will be submitted to the WDNR and EPA Project Managers following completion of all field investigation tasks comprising the Winter 2003 Sediment Sampling QAPP.

The SEH Field Supervisor or designee is responsible for all site activities. In this role, the Field Supervisor may be required to adjust the field sampling program to accommodate site-specific needs. The Field Supervisor will notify the SEH Project Manager by phone of the adjustment and will implement the change upon obtaining the approval of the Project Manager. The change in the field sampling program and appropriate rationale will be documented and signed by involved field personnel and documented in the field log book. The SEH Project Manager will summarize changes to the field sampling program in the

Comprehensive Remedial Investigation report that will be submitted to the WDNR and EPA Project Managers following completion of all field investigation tasks comprising the Winter 2003 Sediment Sampling QAPP.

C1.B.(2) Performance Evaluation

The SEH Project Manager will notify the laboratory Project Manager of missing deliverables by phone or email, and request copies. Copies of missing deliverables can be submitted electronically, as long as a hard copy is mailed to the SEH Project Manager. Draft data will not be acceptable for this purpose. In the event that data is not available, for example, due to sample breakage or laboratory error, re-sampling may be required to generate the data.

Data acceptability will be judged utilizing precision and accuracy information in the QC samples. The SEH QA Director may deem corrective actions necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the QA Department during internal or external audits, or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

The nature of each corrective action will be determined by the method performed, the matrix type and the end-use of the data. In some instances, a re-analysis, re-extraction, or recalibration may be necessary to correct the problem. In the event that the SEH QA Director determines that corrective actions are required, the SEH QA Director will notify the SEH Project Manager, who will in turn notify the laboratory Project Manager. The notification will consist of a project memorandum.

Corrective actions for laboratory problems are specified in laboratory SOPs, included in Appendix F. These include specific QC procedures designed to help analysts determine the need for corrective action. The essential steps in the corrective action system are as follows:

- Identify and define the problem;
- Investigate the problem;
- Determine the root cause of the problem;
- Determine a corrective action to eliminate the problem;
- Assign and/or accept responsibility for implementing the corrective action;
- Establish effectiveness of the corrective action and incorporate in into the day-to-day procedures; and
- Verify that the corrective action has eliminated the problem.

The corrective action for Forensic Method QC exceedances similarly includes a review of peak integrations, notification of the Project Manager, and disclosure in the laboratory report as necessary. If necessary, the Project Manager can request additional corrective actions, like sample reanalysis. All project deliverables are independently reviewed according to the laboratory quality assurance plan prior to release to the client.

This scheme is generally accomplished with the assistance of the laboratory QA Department. Upon notification by SEH the laboratory Project Manager will assign responsibility for investigating the problem and its cause. Once the cause is determined, the laboratory QA Manager, in consultation with the SEH QA Director, will approve an appropriate corrective action. SEH and the laboratory may elect to resample to obtain completely valid data rather than perform other corrective actions.

C2. QA Management Reports

The proposed field sampling will last for two weeks. No management reports are proposed for this stage of the site investigation due to the short duration and relatively simple scope. The comprehensive site Remedial Investigation (RI) report that will include investigation and evaluation of all OUs will include a QA/QC section that summarizes all project QA/QC programs, audits, project memorandum and corrective actions. The QA/QC section will discuss the following issues:

- Summary of project QA/QC programs and associated training;
- Conformance of project activities to QAPP requirements;
- Status of project and schedule delays;

- Deviations from the QAPP and copies of approved QAPP amendments;
- Results and trends of PE samples by laboratory, further broken down by parameter, matrix and concentration level;
- Description and finings of all TSA and other assessments;
- The amount of usable data generated as determined by Data Validation studies;
- Required corrective actions and effectiveness of corrective action implementation;
- Data quality assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity; and
- Limitations, if any, on the use of measurement data generated.

Group D

D Data Verification/Validation and Usability

D1. Review, Validation, and Verification Criteria

SEH, Inc. will perform QA activities to ensure that the collected data are scientifically defensible, of known quality, properly documented, and meet the project objectives. All analytical data collected for the project will be verified and validated to assure that sound QC practices were performed by STL. The following three steps will be followed to ensure that project data quality needs are met:

D1.A.(1) Data Verification

Data verification is a process of evaluating the completeness, correctness, and contractual compliance of the data against the EPA or other reference method , or laboratory or field specific SOP. Laboratory data verification will be performed by MAKuehl Company with consultation with SEH. Both are external entities to the laboratory data generator. Field data verification will be done only by the MAKuehl Company, if SEH conducts the field sampling activities.

D1.A.(2) Data Validation

Data validation is an analyte- and sample-specific process that extends the qualification of data beyond method and procedural compliance (i.e., data verification) to determine the analytical quality of the data. Data validation criteria are based on the measurement performance criteria specified in QAPP. MAKuehl Company will perform data validation for this project.

D1.A.(3) Data Usability Assessment

Data usability assessment is the process of evaluating validated data to determine if the data can be used to make environmental decisions. Data usability assessments will consist of the following steps:

- Individual data sets will be evaluated to identify the measurement performance/usability issues or problems affecting the ultimate achievement of project DQOs.
- An overall evaluation of all data generated for the project will be performed.
- The project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs.

To facilitate the data usability assessment, the reported data will be supported by complete data packages which will include sample receipt and tracking information, COC records, tabulated data summary forms, and raw analytical data for all field samples, standards, QC checks and QC samples, and all other project-specific documents that have been generated.

D1.B Validation and Verification Methods

MAKuehl Company and SEH will complete the data verification and validation to evaluate the data quality. An assessment of the potential effect that each deviation from the QAPP may have on the usability of associated data, its contribution to the quality of reduced and analyzed data, and its effects on the decision will also be made. MAKuehl Company and SEH as indicated below will implement the following procedure to verify and validate data collected during the project:

D1.B.(1) Sampling Design

SEH will evaluate how closely a sample result represents the actual site conditions. Was the sample collected from correct location and is of the right matrix?

Each sample will be checked for compliance with the specifications, including type and location. SEH will note deviations from the specifications in Group B1, and discuss them with the US EPA project manager.

D1.B.(2) *Sampling Collection Procedures*

SEH will evaluate how closely sample collection procedures identified in this QAPP were followed. SEH will note deviations from the sample collection procedures described in field SOPs and Group B2 and discuss them with the US EPA project manager.

D1.B.(3) Sample Handling

Deviations from the planned sample handling procedures in Group B3 will be noted on the COC forms and in the field books. Data collection activities will indicate the events that occur during sample handling affecting the integrity of the samples. SEH field personnel will evaluate the sample containers and the preservation methods used and ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Checks on the identity of the sample will be made to ensure that the sample continues to be representative of site conditions as it is analyzed by STL.

D1.B.(4) Analytical Procedures

MAKuehl Company will verify that the procedures used to generate the data were implemented as specified in Group B4 for each sample. Data validation activities will be used to determine how seriously a sample deviated beyond the acceptance limit so that the potential effects of the deviation can be assessed.

D1.B.(5) Quality Control

MAKuehl Company will evaluate each QC check that was performed during sample collection, handling, and analysis. For each specified QC check in Group B5, the procedures, acceptance criteria, and corrective action will be evaluated. During data validation, the corrective actions that were taken, which samples were affected, and the potential effect of the actions on the validity of the data will be documented.

D1.B.(6) Calibration

Field and laboratory instrument calibrations as specified in Group B7 will be verified by the MAKuehl Company to ensure that calibrations were performed within an acceptance time prior to measurements and were performed in proper sequence. The documentation will reference the number of calibration points and use of a standard that bracketed the range of reported measurements. The record will indicate whether acceptable linearity checks and other checks were completed to ensure that the measurement system was stable when calibration was performed. If calibration problems are identified, any samples data quantified using the suspect calibration event will be re-analyzed with a compliant calibration.

D1.B.(7) Data Reduction and Processing

Checks on data quality will be performed to ensure the accuracy of raw data and to eliminate data entry errors.

D1.C Instructions for Validation and Verification Methods

D1.C.(1) Verification

The SEH QA Director will verify sample collection, handling and field screening procedures as described in this QAPP and the SOPs included in Appendix F. The laboratory reports will be reviewed to determine that the minimal level of documentation has been provided. The laboratory report shall include at the minimum: copy of the signed COC form, sample results with sample identification numbers, units of measurements, sampling dates, preservatives used, sample preparation methods, sample preparation dates, analyses dates, analytical methods, levels of detection, levels of quantification, and signature of chemist. The laboratory report shall also include a case report narrative that explains any QA/QC or analysis problems encountered in the laboratory

and what corrective actions were taken. The QA Manager will also verify the use of blanks (field, methanol, and trip) and field duplicates. All applicable reference and identification codes and numbers will be reviewed as part of the documentation. If any information is missing, the laboratory will be contacted immediately.

D1.C.(2) Validation

All sampling, handling, field analytical data, and STL data will be validated by SEH and MAKuehl Company. The validation procedure will specify the verification process of every QC measure used in the field and laboratory. All STL data packages will be reviewed for compliance with the applicable analytical method and for the quality of the data reported.

The data package contents will comply with the U.S. EPA Contract Laboratory Program (CLP) list of deliverables, but tailored to fit the outputs for the reference analytical method used (i.e. 8260, 8270, 6010, 7471, 7196, 9010/9014). Data validation of the assembled data packages will be done in accordance with (USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, Publication 9240.1-05A, EPA-540/IR-99/008 (October 1999); and USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Publication 9240.1-05-01; EPA-540/R-94/013, PB94-963502, February, 1994) and the most current EPA Region V Standard Operating Procedures for validation of CLP organic (November 2002) and inorganic data (September 1993 or later). Compliance of the data against the laboratory SOPs, EPA reference method and data validation criteria will be done for the data packages as specified by SEH and a Data Validation Technical Memorandum written that documents the results of the data validation. Only qualifiers as defined in EPA-540/IR-99/008 and EPA-540/R-94/013 will be used to qualify the data.

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Table 1
STL Laboratory Parameters

Matrix	Parameter	Analytical Method
Sediments	Volatiles	SW-846 8260B SW-846 5035;5030B
	PAHs	SW-846 8270C SW-846 3550B
	Metals	SW-846 6010B; 7471A
	Chromium, Hexavalent	SW-846 7196A
	Cyanide	SW-846 9010B/9014
	Total Organic Carbon	Lloyd Kahn Method

Table 2
Analyte List and Analytical Sensitivity Requirements

Analytical Parameters	PRGs[2] (mg/kg) (dry wt.)	Sediments					
		Target Lab DL (mg/kg)	STL CHI RL (mg/kg) wet wt.	STL CHI MDL (mg/kg)	Control Limits	RPD	Surrogate Limits
SVOCs by SW846 8270C			(5973)	(5973)			
*Acenaphthene	0.0067	0.0067	0.0167	0.0014	61-100	20	
*Acenaphthylene	0.0059	0.0059	0.0167	0.00091	60-102	20	
*Anthracene	0.572	0.010	0.0167	0.00086	63-107	20	
*Benzo(a)Anthracene	0.108	0.010	0.0167	0.0012	62-109	20	
*Benzo(a)Pyrene	0.15	0.010	0.0167	0.0022	53-121	20	
*Benzo(e)Pyrene	0.15	0.010	NA	NA	NA	NA	
*Benzo(b)Fluoranthene	0.24	0.010	0.0167	0.0021	52-124	20	
*Benzo(k)Fluoranthene	0.24	0.010	0.0167	0.0028	44-130	20	
*Benzo(g,h,i)Perylene	0.17	0.010	0.0167	0.0019	48-139	20	
*Chrysene	0.166	0.010	0.0167	0.0018	60-106	20	
*Dibeno(a,h)Anthracene	0.033	0.010	0.0167	0.0022	55-131	20	
*Fluoranthene	0.423	0.010	0.0167	0.0011	56-116	20	
*Fluorene	0.0774	0.010	0.0167	0.0016	64-103	20	
*Indeno(1,2,3-cd)Pyrene	0.20	0.010	0.0167	0.0021	49-136	20	
1-Methyl Naphthalene		0.010	NA	NA	NA	NA	
*2-Methyl Naphthalene	0.0202	0.010	0.0167	0.0015	53-100	20	
*Naphthalene	0.176	0.010	0.0167	0.0018	57-100	20	
*Phenanthrene	0.204	0.010	0.0167	0.001	64-108	20	
*Pyrene	0.195	0.010	0.0167	0.002	51-123	20	
~~*Total PAHs (dry wt.)~~[1]	2-20						
*Dibenzofuran	0.15	0.010	0.0167	0.0012	62-108	20	
*Phenol	4.20	0.010	0.0167	0.0016	45-109	20	
2-Methyl Phenol	6.70	0.010	0.0167	0.0043	50-102	20	
3-Methyl Phenol (3/4-Methylphenol)		0.010	0.0167	0.0034	49-109	20	
4-Methyl Phenol (co-elutes w/ 3-MethylPhenol)		0.010	---	---	---	---	
Surrogates:							
2,4,6-Tribromophenol							20-150
2-Fluorobiphenyl							41-108
2-Fluorophenol							35-118
Nitrobenzene-d5							22-108
Phenol-d5							21-129
Terphenyl-d14							37-137

Table 2 (Continued)
Analyte List and Analytical Sensitivity Requirements

Analytical Parameters	PRGs[2] (mg/kg) (dry wt.)	Sediments										
		Target Lab DL (mg/kg)	STL CHI RL (mg/kg) wet wt.		STL CHI MDL (mg/kg)		Control Limits		RPD		Surrogate Limits	
VOCs by SW846 8260B			5030B	5035H	5030B	5035H	5030B	5035H	5030B	5035H		
*Benzene	0.0570	0.010	0.005	0.03	0.00066	0.014	72-128	67-122	20	30		
*sec-Butylbenzene			0.005	0.1	0.00081	0.0205	77-128	69-139	20	30		
*Ethylbenzene		0.010	0.005	0.1	0.0011	0.0225	79-123	78-128	20	30		
Styrene		0.010	0.005	0.1	0.001	0.0285	85-126	80-129	20	30		
*Toluene	0.890	0.010	0.005	0.1	0.001	0.018	75-125	72-123	20	30		
*1,2,4-Trimethylbenzene		0.010	0.005	0.1	0.00082	0.023	74-133	69-122	20	30		
*1,3,5-Trimethylbenzene		0.010	0.005	0.1	0.00058	0.0195	72-128	66-125	20	30		
*Total Xylenes	0.0250	0.010	0.005	0.1	0.0029	0.05	82-125	77-131	20	30		
~~* Total VOCs~~[1]	0.972											
Surrogates:											5030B	5035H
1,2-Dichloroethane-d4											50-145	43-139
4-Bromofluorobenzene											60-140	57-124
Dibromofluoromethane											60-140	64-132
Toluene-d8											66-141	70-128
Inorganics												
*Arsenic	9.80	3.0	1		0.38		80 - 120		30			
Aluminum		40	20		3.3		80 - 120		30			
Antimony	2.0	2.00	2		1.4		80 - 120		30			
Barium		40	1		0.092		80 - 120		30			
Beryllium		1.0	0.4		0.045		80 - 120		30			
Cadmium	0.99	0.99	0.2		0.099		80 - 120		30			
Calcium		1000	10		9.2		80 - 120		30			
Chromium(+3)[3]	43.0	2.0	Total - Cr+6		---		80 - 120		30			
Chromium(+6)[3]	43.0	2.0	5		2.8		80 - 120		30			
Cobalt		10	0.5		0.2		80 - 120		30			
Copper	32.0	5.0	1		0.37		80 - 120		30			
Cyanide		1.0	0.5		0.25		80 - 120		30			
Iron	20,000.00	20	5		2.5		80 - 120		30			
*Lead	36.0	2.0	0.5		0.38		80 - 120		30			
Magnesium		1000	10		3.2		80 - 120		30			
Manganese	460.0	3.0	1		0.075		80 - 120		30			
Mercury	0.18	0.10	0.033		0.0054		80 - 120		30			
Nickel	23.00	8.0	1		0.22		80 - 120		30			
Potassium		1000	50		15.7		80 - 120		30			
Selenium		7.0	1		0.46		80 - 120		30			

Table 2 (Continued)
Analyte List and Analytical Sensitivity Requirements

Analytical Parameters	PRGs[2] (mg/kg) (dry wt.)	Sediments					
		Target Lab DL (mg/kg)	STL CHI RL (mg/kg) wet wt.	STL CHI MDL (mg/kg)	Control Limits	RPD	Surrogate Limits
Silver	1.60	1.60	0.5	0.19	80 - 120	30	
Sodium		1000	100	52.5	80 - 120	30	
Thallium		5.0	1	0.51	80 - 120	30	
Vanadium		10	0.5	0.22	80 - 120	30	
Zinc	120.00	12	2	0.73	80 - 120	30	
Total Organic Carbon			125	64	53-140	30	

STL Chicago will initiate standards for Benzo(e)Pyrene and 1-Methylnaphthalene
Report limits will vary depending on sample size, dilution factors, and dry weight reporting
MDLs are determined on an annual basis and are subject to change.
* = Chemicals with an asterisk next to the name are those which demonstrated risk at the site in at least some situations
Total PAHs is the sum of the 19 individual PAH listed above
[1] = PRGs based on project specific discussions between WDNR and EPA
[2] = PRGs based on Draft WDNR Draft Consensus Based Sediment Quality Guidelines (Version January 2002)
[3] = PRG for total chromium in sediments = 43 mg/kg

Table 3
Forensic Laboratory Parameters

Matrix	Parameter	Instrument	Method
Soil, Sediment, Groundwater	High-Resolution Hydrocarbon Fingerprint	GC/FID	Battelle 5-202 (EPA 8015B Mod.)
	PAH (parent, alkylated, heteroatomic)	GC/MS/SIM	Battelle 5-157 (EPA 8720C Mod.)
	Biomarkers	GC/MS/SIM	Battelle 5-157 (EPA 8720C Mod.)

Table 4
Minimum Forensic Quantitative Analytes

PAH Analyte	Abbreviation	Ring Number	Water RL (ug/L)	Water MDL (ug/L)	Soil/Sediment RL (mg/kg dry)	Soil/Sediment MDL (mg/kg dry)
Naphthalene	NO	2	0.010	0.020	0.010	0.0045
C1-Naphthalenes	N1	2	0.010		0.010	
C2-Naphthalenes	N2	2	0.010		0.010	
C3-Naphthalenes	N3	2	0.010		0.010	
C4-Naphthalenes	N4	2	0.010		0.010	
Biphenyl	B	2	0.010	0.00050	0.010	0.000051
Acenaphthylene	AY	3	0.010	0.00050	0.010	0.000078
Acenaphthene	AE	3	0.010	0.00064	0.010	0.000047
Dibenzofuran	DF	3	0.010	0.00079	0.010	0.00027
Fluorene	FO	3	0.010	0.00059	0.010	0.000068
C1-Fluorenes	F1	3	0.010		0.010	
C2-Fluorenes	F2	3	0.010		0.010	
C3-Fluorenes	F3	3	0.010		0.010	
Dibenzothiophene	DBT0	3	0.010		0.010	
C1-Dibenzothiophenes	DBT1	3	0.010		0.010	
C2-Dibenzothiophenes	DBT2	3	0.010		0.010	
C3-Dibenzothiophenes	DBT3	3	0.010		0.010	
C4-Dibenzothiophenes	DBT4	3	0.010		0.010	
Anthracene	A0	3	0.010	0.00042	0.010	0.000073
Phenanthrene	P0	3	0.010	0.00045	0.010	0.000091
C1-Phenanthrenes/Anthracenes	PA1	3	0.010		0.010	
C2-Phenanthrenes/Anthracenes	PA2	3	0.010		0.010	
C3-Phenanthrenes/Anthracenes	PA3	3	0.010		0.010	
C4-Phenanthrenes/Anthracenes	PA4	3	0.010		0.010	
Fluoranthene	FL0	4	0.010	0.00053	0.010	0.000074
Pyrene	PY0	4	0.010	0.00057	0.010	0.000060
C1-Fluoranthenes/Pyrenes	FP1	4	0.010		0.010	
C2-Fluoranthenes/Pyrenes	FP2	4	0.010		0.010	
C3-Fluoranthenes/Pyrenes	FP3	4	0.010		0.010	
Benzo(a)anthracene	BA0	4	0.010	0.00083	0.010	0.000050
Chrysene	C0	4	0.010	0.00044	0.010	0.000039
C1-Chrysenes	BC1	4	0.010		0.010	
C2-Chrysenes	BC2	4	0.010		0.010	
C3-Chrysenes	BC3	4	0.010		0.010	
C4-Chrysenes	BC4	4	0.010		0.010	
Benzo(b)fluoranthene	BB	5	0.010	0.00051	0.010	0.000055
Benzo(j/k)fluoranthene	BJK	5	0.010	0.00052	0.010	0.000038
Benzo(a)fluoranthene	BAF	5	0.010		0.010	
Benzo(e)pyrene	BEP	5	0.010	0.00054	0.010	0.000036
Benzo(a)pyrene	BAP	5	0.010	0.00078	0.010	0.000063
Perylene	PER	5	0.010	0.00084	0.010	0.000044
Indeno(1,2,3-c,d)pyrene	IND	6	0.010	0.0011	0.010	0.000029
Dibenz(a,h)anthracene	DA	5	0.010	0.0013	0.010	0.000054
Benzo(g,h,i)perylene	GHI	6	0.010	0.00068	0.010	0.000039

Table 5
Major Components in Creosote

Peak No.	Component	Whole Creosote (Approx. %)	Boiling Point [1] (°C)
1	Naphthalene	3.0	218
2	2-Methylnaphthalene	1.2	241.05
3	1-Methylnaphthalene	0.9	244.64
4	Biphenyl	0.8	255.9
5	Dimethylnaphthalenes	2.0	268
6	Acenaphthene	9.0	279
7	Dibenzofuran	5.0	287
8	Fluorene	10.0	293-295
9	Methylfluorenes	3.0	318
10	Phenanthrene	21.0	340
11	Anthracene	2.0	340
12	Carbazole	2.0	355
13	Methylphenanthrenes	3.0	354-355
14	Methylanthracenes	4.0	360
15	Fluoranthene	10.0	382
16	Pyrene	8.5	393
17	Benzofluorenes	2.0	413
18	Chrysene	3.0	448

[1] = Values from Handbook of Chemistry and Physics, 1971-72, 52nd ed., Chemical Rubber Publishing Co., Cleveland, Ohio
Source: Management of Manufactured Gas Plant Sites, Gas Research Institute document GRI-87/0260.1.

Table 6
Wastes and Chemicals of Interest at MGP Sites

WASTES				
Free tars, oils, and lampblack	Organic-contaminated soils • Heavily contaminated • Lightly contaminated	Organic-contaminated vessel, surface, and groundwaters	Purifier wastes	Mixed wastes and fill
CHEMICALS				
Ammonia Cyanide Nitrate Sulfate Sulfide Thiocyanates	Aluminum Antimony Arsenic Barium Cadmium Chromium Copper Iron Lead Manganese Mercury Nickel Selenium Silver Vanadium Zinc	Benzene Ethyl Benzene Toluene Total Xylenes	Phenol 2-Methylphenol 4-Methylphenol 2,4-Dimethylphenol	Acenaphthene Acenaphthylene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g, h, i,)perylene Benzo (k) fluoranthene Chrysene Debenzo (a, h) anthracene Dibenzofuran Fluoranthene Fluorene Naphthalene Phenanthrene Pyrene 2-Methylnaphthalene

Source: Management of Manufactured Gas Plant Sites, Gas Research Institute document GRI-87/0260.1.

Table 7
Analytical Parameters and STL Chicago SOPs

Parameter	SW-846 Method	STL SOP No.
Volatiles	8260B/5035; 5030B	UMV-8260B (w/5030B) USP-5035
PAHs	8270C/3550B	UMB-8270C USP-3550
Metals	6010B/ 3050B; 7471A	UME-6010B UME-245.1 USP-3000
Chromium, Hexavalent	7196A	UWC-3500CrD
Cyanide	9010B/9014	UWC-335.2
Total Organic Carbon	Lloyd Kahn Method	UWC-002

Table 8
QC Samples

Control Sample Type	Details	
Method Blank (MB)	Use	Monitors for potential contamination introduced during the sample preparation and analytical processes.
	Typical Frequency [1]	1 per batch of ≤ 20 samples per matrix type per sample extraction or preparation method.
	Description	Organics: Laboratory pure water for water samples or a purified solid matrix for soil or solid samples (when available or when requested); solid matrices commonly include sodium sulfate, vendor or agency supplied soil or solid, or purchased sand; these solids may require purification at the laboratory prior to use. Inorganics: Laboratory pure water for both water and soil or sediment samples. Volume/weights are selected to approximately equal the typical sample volume/weight used in sample preparation; and final results in a soil/solid batch may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison to actual field samples.
Laboratory Control Sample (LCS)	Use	Measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects.
	Typical Frequency [1]	1 per batch of ≤ 20 samples per matrix type per sample extraction or preparation method.
	Description	Prepared from a reference source of known concentration and processed through the preparation and analysis steps concurrently with the field samples. Final results are calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the actual field samples.
Matrix Spike (MS)	Use	Measures the effect of site sample matrix on the accuracy of the method.
	Typical Frequency [1]	1 per batch of ≤ 20 samples per matrix.
	Description	Aliquot of a field sample which is spiked with the analytes or select compounds. The determination of MS percent recovery (% R) requires an analysis of a fortified sample and a non-fortified sample under the same procedural conditions (e.g., sample volumes, dilutions, procedural conditions, etc.). The concentration determined in the non-fortified sample is subtracted from the fortified sample concentration before determining the %R. The degree of homogeneity of the sample, particularly in the case on non-aqueous samples or samples with particulates, may affect the ability to obtain representative recoveries.

Table 8 (Continued)
QC Samples

Control Sample Type	Details	
Matrix Spike Duplicate (MSD)	Use	Measures effect of site sample matrix on precision of method.
	Typical Frequency [1]	1 per batch of ≤ 20 samples per matrix.
	Description	Alternative to sample duplicate. Generally, inorganic protocols specify an MD/MS and organic protocols specify an MS/MSD.
Surrogate Spike	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Every QC and analytical sample.
	Description	Select compounds similar to the target analytes in structure, composition and chromatography, but not typically found in the environment, are added to each QC and analytical sample, prior to preparation (e.g., extraction). If the surrogates in an analytical batch do not all conform to established control limits, the pattern of conformance in investigative and control samples is examined to determine the presence of matrix interference or the need for corrective action.
Internal Standards (GC/MS Methods Only)	Use	Monitor the qualitative aspect of organic analytical measurements.
	Typical Frequency [1]	All GC/MS methods.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

Table 9
STL Record Types

Controlled Documents	QC Records	Project Records
LQMs/ QAPPs	Audits/ Responses	COC Documentation
QMP (Corporate)	Certifications	Contracts and Amendments
Metals	SDRs/RDRs	Correspondence
SOPs	Logbooks*	QAPP
	Method & Software Validation, Verification	SAP
	Standards Certificates	Telephone Logbooks
Work Instructions	MDL/IDL/IDC Studies	E-mails
	PTs	Electronic Data
	Statistical Evaluations	Report

*Examples of Logbook types: Maintenance, Instrument, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, and Balance Calibration.

Table 10
STL Record Retention

Record Type		**Archival Requirement (or as otherwise requested by clients)**
Raw Data	All (Electronic Data Reports (.pdf & EDD)	5 Years from completion
Controlled Documents	All	5 Years from document retirement date
QC	All	5 Years from archival
Project	All	5 Years from project completion
Administrative	Personnel/Training	Indefinitely
	Accounting	10 years

Table 11
Preventative Maintenance

Instrument	Maintenance Procedures/Schedule	Spare Parts
Foxboro TVA-1000 PID/FID	1. Calibrate at beginning of each day and as necessary during use. 2. Check battery and recharge when low. 3. Clean UV lamp if PID readings become erratic.	1. Battery charger 2. Spare lamp 3. Spare tips 4. Spare carbon for methane filter
Magellen Platinum Pro GPS Receiver	5. Check batteries daily and replace when low	6. Spare AA batteries
Peristaltic Pump	7. Check that equipment is in good working order prior to each use.	8. Spare clean tubing 9. Spare battery connectors

Table 12
Sample Containers, Sample Volumes, Preservation, and Holding Times for Sediment Samples

Analyte	Container	Preservative	Maximum Hold Time
Volatiles	60-mL jar* 2-oz. jar **	Cool 4±2°C	
PAHs	32-oz. jar	Cool 4± 2°C	14 days to extract 40 days to analyze
Metals	32-oz. jar	Cool 4± 2°C	6 months (except Hg) 28 days (Hg)
Chromium, Hexavalent	32-oz. jar	Cool 4± 2°C	28 days to digest 96 hrs. from digestion to analysis (in alk. state)
Cyanide	32-oz. jar	Cool 4± 2°C	14 days
Total Organic Carbon	32-oz. jar	Cool 4± 2°C	14 days

Notes:
All parameters, except volatiles, can be taken from 1 - 32 oz. glass jar. Additional sample may be required for MS/MSD.
*Pre-weighed sample container that is methanol-preserved for a 25 gram sample.
**Zero-headspace. Samples ranging from 10-30 percent solids will be analyzed via the jar, using the low-level 5030B preparation. For these samples the lab will increase the sample weight such that the dry weight is at least half the weight required by the method.

Table 13
Example Laboratory Equipment and Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear	Daily
	Fill rinse tank with 10 percent HCl	Daily
	Insert clean drying tube filled with Magnesium Perchlorate	Daily
	Fill reductant bottle with 10 percent Stannous Chloride	Daily
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check torch	Daily
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required
	Replace pump tubing	As required
UV-Vis Spectrophotometer	Clean ambient flow cell	As required
	Precision check/alignment of flow cell	As required
	Wavelength verification check	Semi-annually
Hewlett Packard GC/MS	Ion gauge tube degassing	As required
	Pump oil-level check	Monthly
	Pump oil changing	Semi-annually
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	As required
	COMPUTER SYSTEM AND PRINTER:	
	Air filter cleaning	As required
	Change data system air filter	As required
	Printer head carriage lubrication	As required
	Paper sprocket cleaning	As required
	Drive belt lubrication	As required
Balances	Class "S" traceable weight check	Daily, when used
	Clean pan and check if level	Daily
	Field service	At least Annually
Deionized/Distilled Water	Check conductivity	Daily
	Check deionizer light	Daily
	Monitor for VOA's	Daily
	System cleaning	As required
	Replace cartridge & large mixed bed resins	As required
Drying Ovens	Temperature monitoring	Daily
	Temperature adjustments	As required
Refrigerators/ Freezers	Temperature monitoring	Daily
	Temperature adjustment	As required
	Defrosting/cleaning	As required
Water baths	Temperature monitoring	Daily
	Water replaced	Monthly or as needed

Table 14
Example of Calibration and Corrective Action Procedures

Analysis	EPA Method	Calibration Technique	Frequency	Acceptance Criteria	Corrective Action
Volatiles	8260B	Calibration Curve (5-6 Point minimum)	Initially; thereafter as the continuing calibration fails	CCCs < 30 percent; RF's for all SPCCs >0.300 (except Chloromethane, Bromoform; 1,1-DCA @ 0.100). Calibration Curves of area ratio vs. conc. using a first or higher order regression may be used for compounds with a percent RSD >15 percent.	1) Evaluate System 2) Recalibrate as necessary
		BFB Tune	Prior to the ICAL	Must meet mass vs. ion abundance criteria as listed in the method.	1) Evaluate System. 2) Re-tune the instrument.
		Continuing Calibration	Every 12 hours	CCCs < 20 percent Drift; RF's for SPCCs >0.300 (except Chloromethane, Bromoform, 1,1-DCA @ 0.100).	1) Evaluate System 2) Clean system 3) Reanalyze affected samples
		Method Blank	Every 20 samples or following CC	< RL (except acetone & DCM @ 5x RL)	1) Rerun 2) Evaluate Batch (CAR/Narrate) 3) Reanalyze as necessary
		LCS	Every 20 samples	Refer to Table 2	1) Rerun 2) Evaluate batch (CAR/Narrate) 3) Reanalyze as necessary
		MS/MSD	Every 20 samples	Refer to Table 2	1) Rerun MS/MSD (used to assess matrix interference) 2) Evaluate batch (CAR/Narrate)
		Surrogate	Every sample	Refer to Table 2	1) Rerun 2) Reanalyze as necessary (CAR/Narrate)
		RT's for Internal Standards	Each initial and continuing calibration	± 30 seconds	1) Analyst judgment if real or not.
Semi-VOAs	8270C	Calibration Curve (5-6 Point minimum)	As continuing calibration (mid-point standard) fails	CCCs ≤ 30 percent RSD SPCC ≥ 0.05 Calibration Curves of area ratio vs. conc. using a first or higher order regression may be used for compounds with a percent RSD >15 percent.	1) Evaluate System 2) Recalibrate as necessary
		DFTPP Tune	Prior to ICAL	Must meet the ion ratios listed in the method.	1) Evaluate System. 2) Re-tune the instrument.
		Continuing Calibration	Every 12 hours	CCCs ≤ 20 percent Drift SPCC ≥ 0.05	1) Evaluate System 2) Recalibrate
		Method Blank	1 per Extraction Batch	< RL (5X phthalate esters)	1) Rerun 2) Evaluate Batch (CAR/Narrate) 3) Re-extract as necessary
		LCS	1 per Extraction Batch	Refer to Table 2	1) Rerun 2) Evaluate batch (CAR/Narrate) 3) Re-extract as necessary
		MS/MSD	Every batch (≤20 samples/batch)	Refer to Table 2	1) Rerun MS/MSD (used to assess matrix interference) 2) Evaluate assoc. MS/MSD 3) Evaluate batch (CAR/Narrate)
		Surrogate	Every sample	Refer to Table 2 (One surrogate failure per fraction is acceptable.)	1) Rerun 2) Re-extract as necessary (CAR/Narrate)
		RT's for Internal Standards	Every sample	±30 seconds	1) Analyst judgment if real or not.
Metals	6010B	Calibration Curve	Each analytical batch	>/= 0.995 correlation	1) Evaluate system 2) Recalibrate as necessary.
		Initial Calibration Blank	Every 10 samples and at the end of every run	< RL	1) Rerun 2) Clean system 3) Reanalyze affected samples.

Table 14 (Continued)
Example of Calibration and Corrective Action Procedures

Analysis	EPA Method	Calibration Technique	Frequency	Acceptance Criteria	Corrective Action
Metals (cont'd)	6010B	Continuing Calibration	Every 10 samples and at the end of every run	90-110 percent of true value	1) Evaluate system 2) Repeat calibration check 3) Recalibrate as necessary
		Method Blank	Every 20 samples	< RL	1) Rerun 2) Evaluate batch 3) Re-digest as necessary (CAR/Narrate)
		LCS	Every 20 samples	80-120 percent of true value	1) Rerun 2) Evaluate batch 3) Re-digest as necessary (CAR/Narrate)
		MS / MSD	Every 20 samples	70-130 percent of true value	1) Rerun 2) Evaluate batch 3) Re-digest as necessary (CAR/Narrate)
		Interference Check Standard (ICSA/B)	After initial calibration	80-120 percent of true value	1) Restandardize. 2) Samples associated with the out-of-control element(s) are reanalyzed.
		Serial Dilution (5X)	5 percent of all samples	If analyte conc. > 10X IDL, results must be within ± 10 percent of the original sample result.	1) Re-prepare to verify proper preparation 2) CAR / Narrate
Mercury	7471A	Calibration Curve (Blank + 5 Stds.)	Each analytical batch	>/= 0.995 correlation	1) Evaluate system 2) Recalibrate as necessary.
		Initial Calibration Blank	Every 10 samples and at the end of every run	< RL	1) Rerun 2) Clean system 3) Reanalyze affected samples.
		Continuing Calibration	Every 10 samples and at the end of every run	80-120 percent of true value	1) Evaluate system 2) Repeat calibration check 3) Recalibrate as necessary
		Method Blank	Every 20 samples	< RL	1) Rerun 2) Evaluate batch 3) Re-digest as necessary (CAR/Narrate)
		LCS	Every 20 samples	80-120 percent of true value	1) Rerun 2) Evaluate batch 3) Re-digest as necessary (CAR/Narrate)
		MS / MSD	Every 20 samples	70-130 percent of true value	1) Rerun 2) Evaluate batch 3) Re-digest as necessary (CAR/Narrate)
TOC	Lloyd Kahn	Initial Calibration	Initially	>/= 0.995 correlation	1) Evaluate system 2) Recalibrate as necessary.
		Initial Calibration Verification (ICV)	After ICAL	85-115%	1) Evaluate system 2) Repeat calibration check 3) Recalibrate as necessary.
		Initial Blank Calibration (ICB)	After ICV	< Reporting Limit	1) Rerun 2) Clean system 3) Recalibrate as necessary
		Cont. Calibration Verification (CCV)	Every 10 samples	85-115%	1) Evaluate system 2) Repeat calibration check 3) Reanalyze affected samples.
		Cont. Calibration Blank (CCB)	After CCV	<RL	1) Rerun 2) Evaluate batch 3) Re-prep/analyze as necessary (CAR/Narrate)

Table 14 (Continued)
Example of Calibration and Corrective Action Procedures

Analysis	EPA Method	Calibration Technique	Frequency	Acceptance Criteria	Corrective Action
Cyanide, Chromium, Hexavalent	9014 7196A	Method Blank	Every 20 samples	< RL	1) Rerun 2) Evaluate batch 3) Re-prep/analyze as necessary (CAR/Narrate)
		LCS	Every 20 samples	80-120 percent of true value	1) Rerun 2) Evaluate batch 3) Re-prep/analyze as necessary (CAR/Narrate)
		MS/MSD	Every 20 samples	70-130 percent of true value	1) Rerun 2) Evaluate batch 3) Re-prep/analyze as necessary (CAR/Narrate)

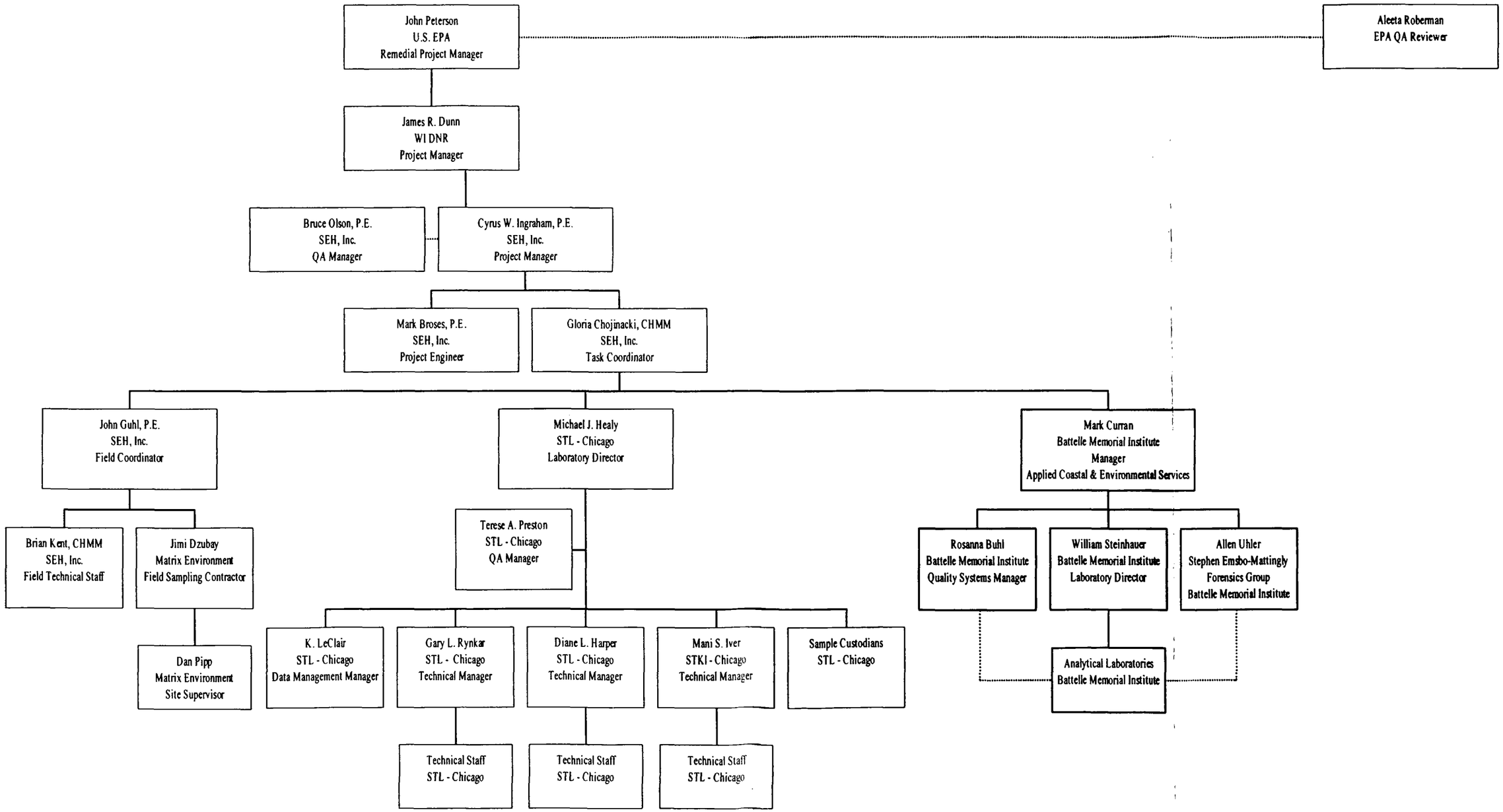
Note: Matrix Spikes: Acceptance Criteria is not applicable if the sample concentration exceeds the spike level by 4 times.

Table 15
Planned Assessments

Type of Assessment	Frequency	Organization	Staff Title, Name
Field Sampling TSA	1/mobilization	SEH	Field Coordinator, John Guhl
Performance Evaluation	1/sampling event	SEH	QA Director, Bruce Olson,
		WDNR	WDNR Project Manager, Jamie Dunn
Data Validation TSA	1/sampling event	MAKuehl Co.	Independent QA Analyst, Marcia A. Kuehl
Data Package TSA	1/sampling event	SEH	QA Director, Bruce Olson

Figures

Figure 1 – Project Responsibilities Chart
Figure 2 – Site Location
Figure 3 – Site Features
Figure 4 – Operable Units
Figure 5 – Previous Sediment Sample Locations - CLP Level II Validation
Figure 6 – Previous Sediment Sample Locations - CLP Level IV Validation
Figure 7 – Proposed Sediment Sampling Locations
Figure 8 – OU #4 Winter 2003 Sediment Sampling Schedule


John Peterson
U.S. EPA
Remedial Project Manager
Aleeta Roberman
EPA QA Reviewer
James R. Dunn
WI DNR
Project Manager
Bruce Olson, P.E.
SEH, Inc.
QA Manager
Cyrus W. Ingraham, P.E.
SEH, Inc.
Project Manager
Mark Broses, P.E.
SEH, Inc.
Project Engineer
Gloria Chojinacki, CHMM
SEH, Inc.
Task Coordinator
John Guhl, P.E.
SEH, Inc.
Field Coordinator
Michael J. Healy
STL - Chicago
Laboratory Director
Mark Curran
Battelle Memorial Institute
Manager
Applied Coastal & Environmental Services
Brian Kent, CHMM
SEH, Inc.
Field Technical Staff
Jimi Dzubay
Matrix Environment
Field Sampling Contractor
Terese A. Preston
STL - Chicago
QA Manager
Rosanna Buhl
Battelle Memorial Institute
Quality Systems Manager
William Steinhauer
Battelle Memorial Institute
Laboratory Director
Allen Uhler
Stephen Emsbo-Mattingly
Forensics Group
Battelle Memorial Institute
Dan Pipp
Matrix Environment
Site Supervisor
K. LeClair
STL - Chicago
Data Management Manager
Gary L. Rynkar
STL - Chicago
Technical Manager
Diane L. Harper
STL - Chicago
Technical Manager
Mani S. Iver
STKI - Chicago
Technical Manager
Sample Custodians
STL - Chicago
Analytical Laboratories
Battelle Memorial Institute
Technical Staff
STL - Chicago
Technical Staff
STL - Chicago
Technical Staff
STL - Chicago

REPRODUCED FROM

USGS ASHLAND WEST QUADRANGLE

WISCONSIN – ASHLAND CO. 7.5 MINUTE SERIES

1964, PHOTOREVISED 1975

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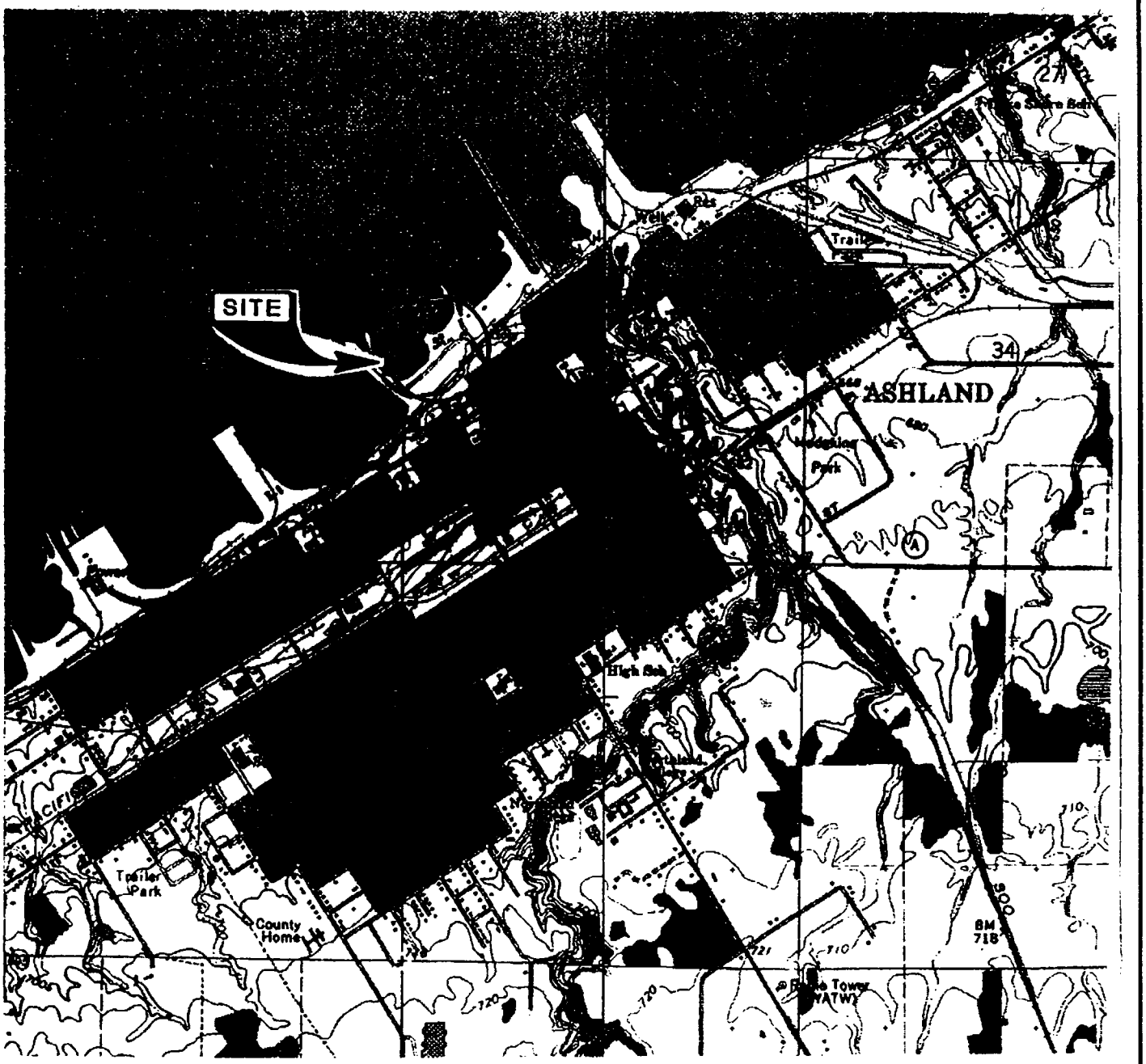

15\2003 SED SAMPLING\FIGURE2.DWG

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SEH

ASHLAND/NSP LAKEFRONT SITE
OU #4 WINTER 2003 SEDIMENT SAMPLING

FIGURE 2
SITE LOCATION

PROJ. NO. WDNR9401.15

DATE 02/04/03

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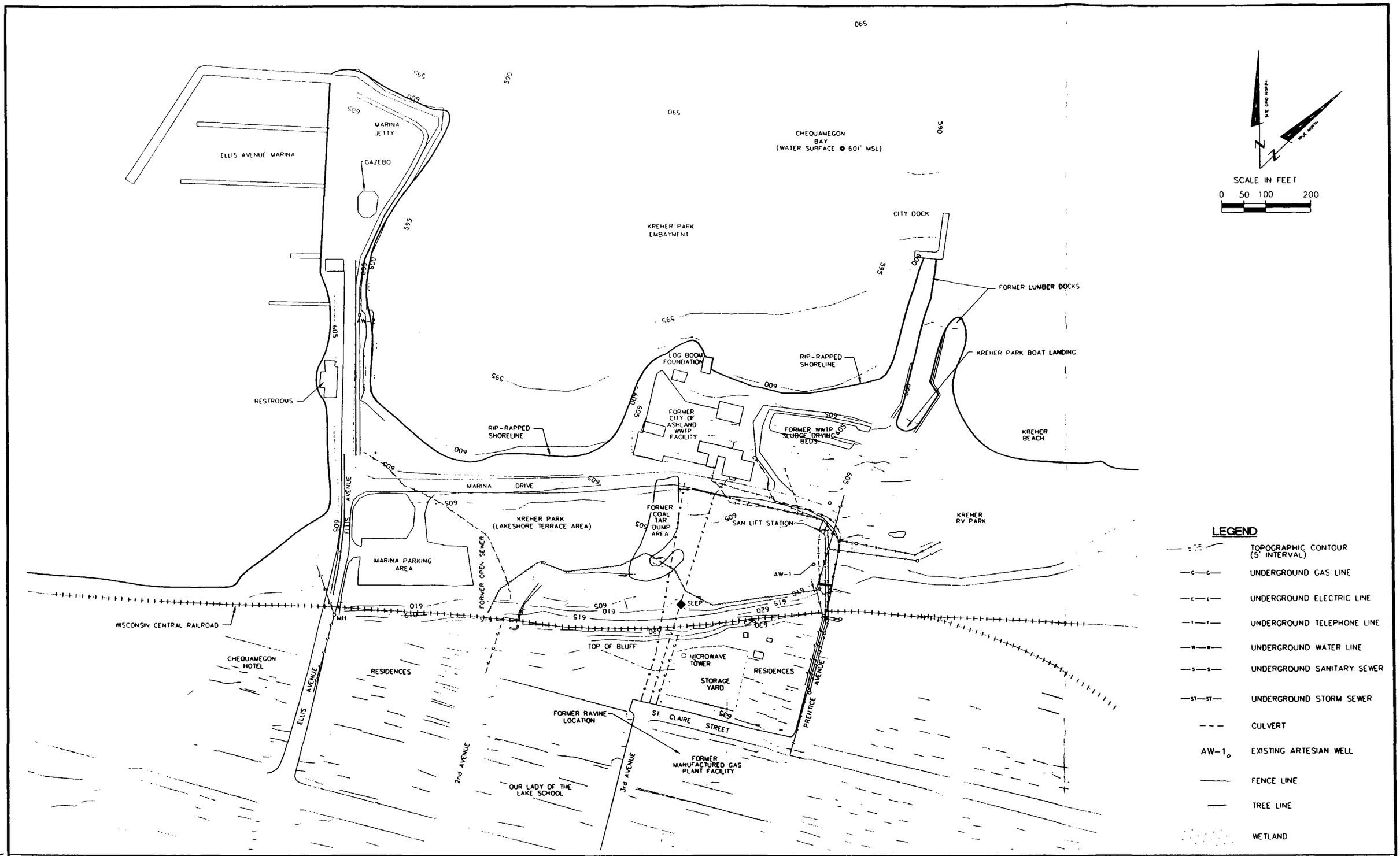

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SEH

ASHLAND/NSP LAKEFRONT SITE
OU #4 WINTER 2003 SEDIMENT SAMPLING

FIGURE 3
SITE FEATURES

PROJ. NO. WDNR9401 15
DATE 02/04/03
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DRAWING FILENAME FIGURE
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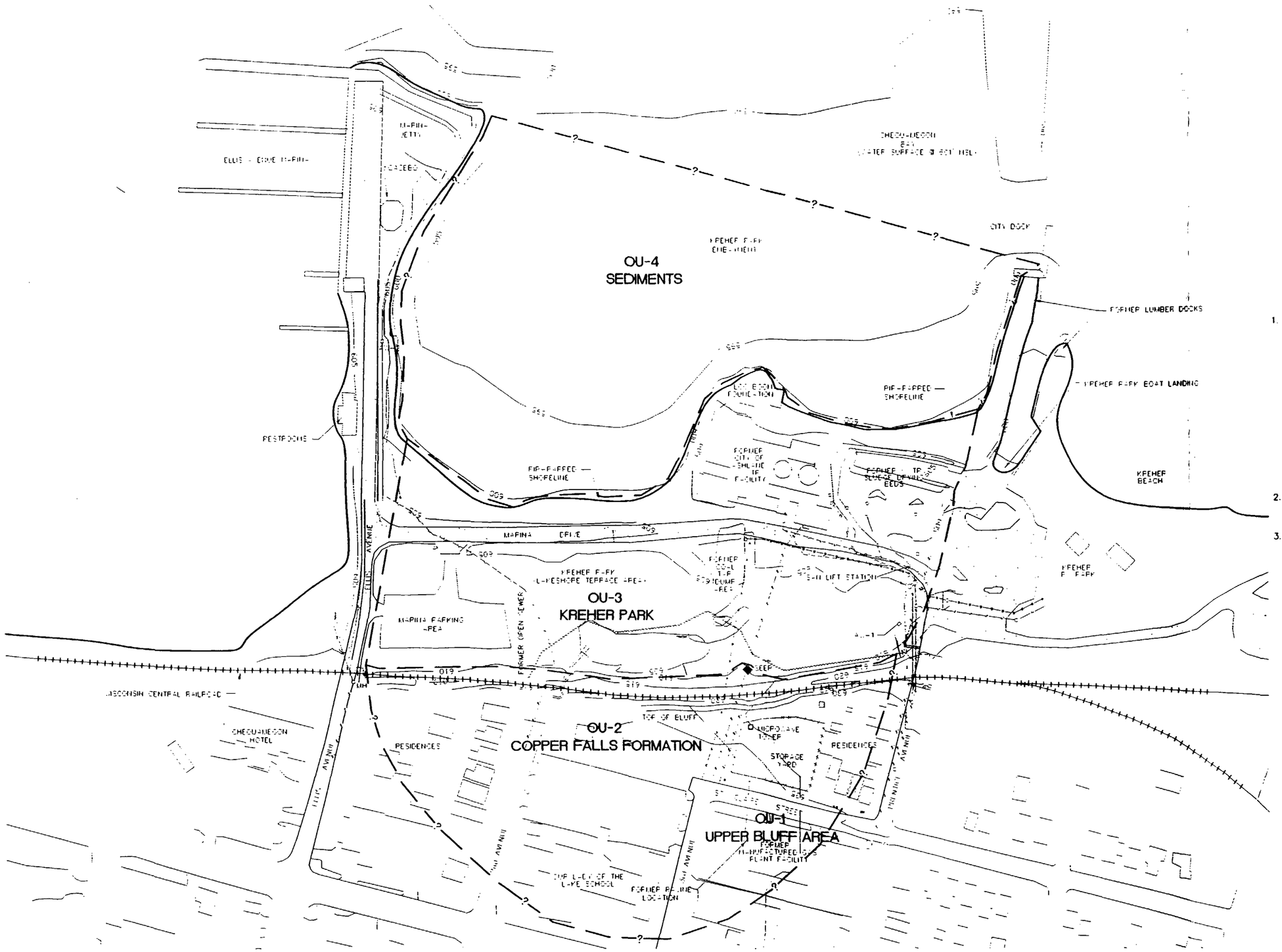

NOTES:

1. OPERABLE UNIT BOUNDARIES:

   OU-1....EXTENT OF SITE CONTAMINATION ABOVE AND INCLUDING MILLER CREEK FORMATION AND SOUTH OF WISCONSIN CENTRAL RAIL LINE.

   OU-2.....SITE CONTAMINATION LOCATED BELOW MILLER CREEK FORMATION.

   OU-3.....EXTENT OF SITE CONTAMINATION ABOVE AND INCLUDING MILLER CREEK FORMATION, NORTH OF THE WISCONSIN CENTRAL RAIL LINE, AND SOUTH OF THE CHEQUAMEGON BAY SHORELINE.

   OU-4.....EXTENT OF SITE CONTAMINATION ABOVE AND INCLUDING MILLER CREEK FORMATION AND NORTH OF CHEQUAMEGON BAY SHORELINE.

2. OU-2 (DEEP AQUIFER) IS PRESENT AT DEPTH BENEATH OU-1, OU-3, AREAS OUTSIDE ANY OPERABLE UNIT AND POTENTIALLY OU-4.

3. THE UPPER SURFACE OF OU-2 IS THE BOTTOM OF THE MILLER CREEK FORMATION.

LEGEND

605	TOPOGRAPHIC CONTOUR (5' INTERVAL)
G	UNDERGROUND GAS LINE
E	UNDERGROUND ELECTRIC LINE
T	UNDERGROUND TELEPHONE LINE
W	UNDERGROUND WATER LINE
S	UNDERGROUND SANITARY SEWER
ST	UNDERGROUND STORM SEWER
	CULVERT
-1	EXISTING ARTESIAN WELL
	FENCE LINE
	TREE LINE
	WETLAND

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1	02/04/03	DRAFT ISSUED TO CLIENT FOR REVIEW	RJH	02/03	JEG	02/03				

SEH

ASHLAND/NSP LAKEFRONT SITE
OU #4 WINTER 2003 SEDIMENT SAMPLING

FIGURE 4
OPERABLE UNITS

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DATE 02/04/03

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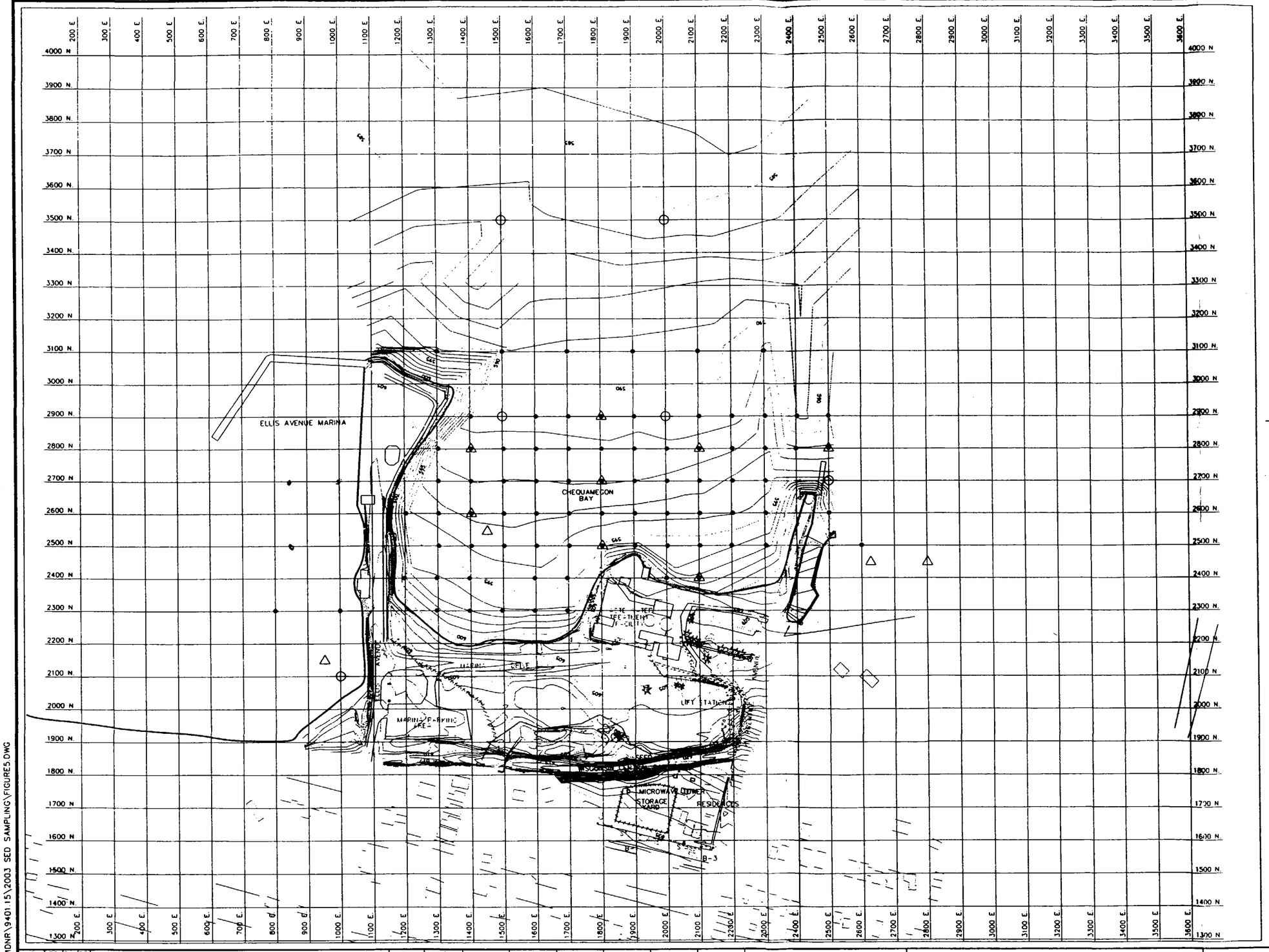

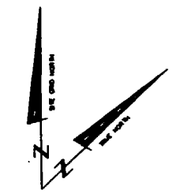

SCALE IN FEET

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LEGEND

- DEEP SEDIMENT SAMPLING LOCATION (SEH 1996)
- DEEP SOIL BORING LOCATION (SEH 1996)
- SHALLOW SEDIMENT SAMPLING LOCATON (SEH 1998)
- AW-1 EXISTING ARTESIAN WELL LOCATION AND NUMBER (CITY OF ASHLAND)
- 605 TOPOGRAPHIC CONTOUR (1' INTERVAL, SITE DATUM)
- HYDRANT
- SANITARY SEWER MANHOLE
- STORM SEWER MANHOLE
- TELEPHONE PEDISTAL
- POWER POLE
- GUY ANCHOR
- LIGHT POLE
- POWER POLE WITH LIGHT
- UNDERGROUND GAS LINE
- UNDERGROUND ELECTRIC LINE
- UNDERGROUND TELEPHONE LINE
- CULVERT
- PINE TREE
- TREE
- SHRUB / HEDGE
- SWAMP

NOTES:

1. TOPOGRAPHIC AND OFFSHORE BATHYMETRIC SURVEY PERFORMED BY SEH.
2. ELEVATIONS PRESENTED IN SITE DATUM.

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1	02/04/03		RJH 02/03			

SEH ENGINEERS ■ ARCHITECTS ■ PLANNERS

ASHLAND/NSP LAKEFRONT SITE
OU #4 WINTER 2003 SEDIMENT SAMPLING

FIGURE 5
PREVIOUS SEDIMENT SAMPLE LOCATIONS
CLP LEVEL II VALIDATION

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DATE 02/04/03

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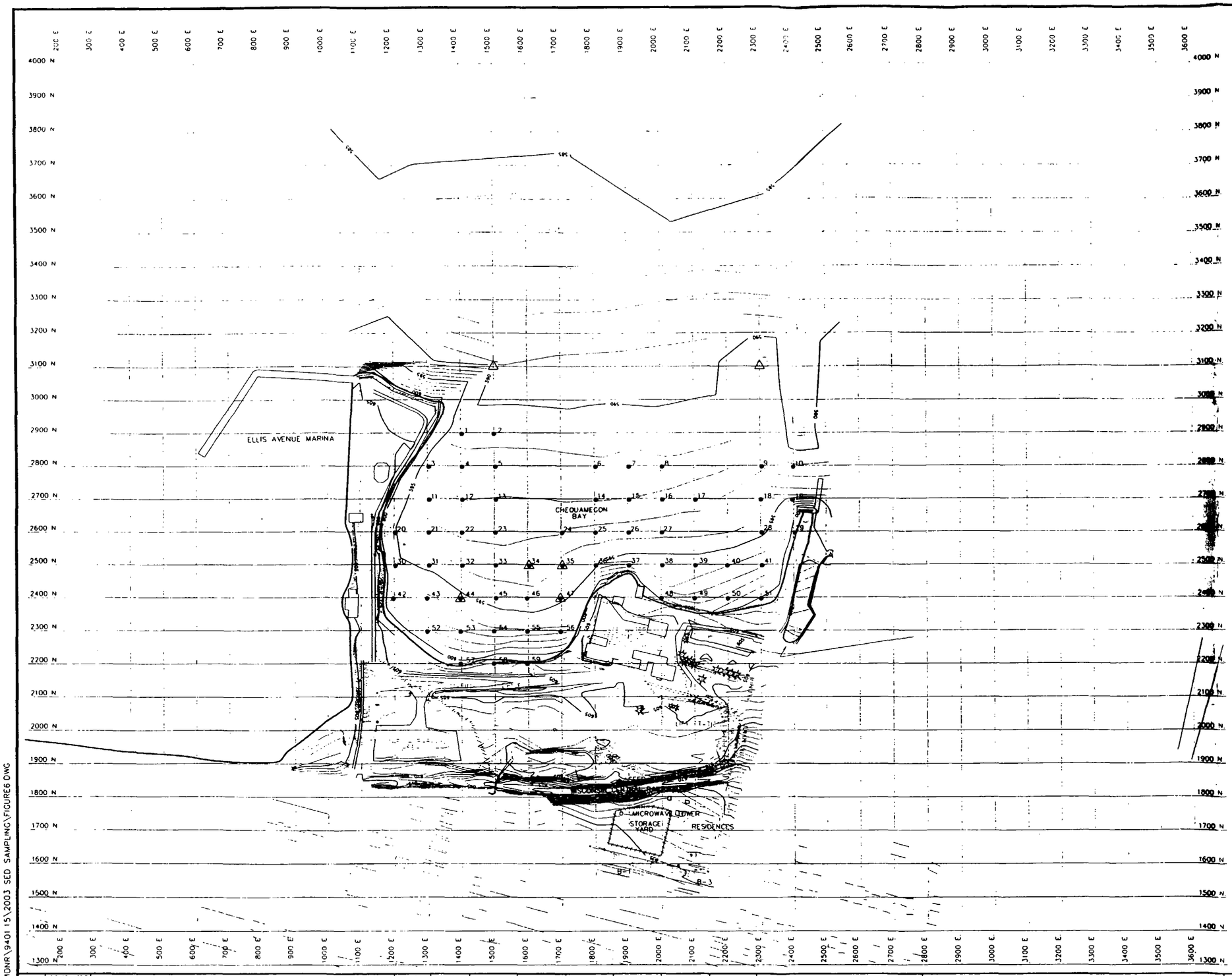
E:\WASTE\WDNR\9401.15\2003 SED SAMPLING\FIGURE5.DWG



SCALE IN FEET

0 75 150 300

LEGEND

- DEEP SEDIMENT SAMPLING LOCATION (SEH 2001)
- SHALLOW SEDIMENT SAMPLING LOCATON (SEH 2001)
- AW-1 EXISTING ARTESIAN WELL LOCATION AND NUMBER (CITY OF ASHLAND)
- 605 TOPOGRAPHIC CONTOUR (1' INTERVAL, SITE DATUM)
- HYDRANT
- SANITARY SEWER MANHOLE
- STORM SEWER MANHOLE
- TELEPHONE PEDISTAL
- POWER POLE
- GUY ANCHOR
- LIGHT POLE
- POWER POLE WITH LIGHT
- UNDERGROUND GAS LINE
- UNDERGROUND ELECTRIC LINE
- UNDERGROUND TELEPHONE LINE
- CULVERT
- PINE TREE
- TREE
- SHRUB / HEDGE
- SWAMP

NOTES:

1. TOPOGRAPHIC AND OFFSHORE BATHYMETRIC SURVEY PERFORMED BY SEH.
2. ELEVATIONS PRESENTED IN SITE DATUM.

NO	DATE	ISSUE/REVISIONS	DRAWN BY	DESIGN	FIELD REVIEW	QC CHECK
1	02/04/03		RJH 02/03			

SEH ENGINEERS ■ ARCHITECTS ■ PLANNERS

ASHLAND/NSP LAKEFRONT SITE
OU #4 WINTER 2003 SEDIMENT SAMPLING

FIGURE 6
PREVIOUS SEDIMENT SAMPLE LOCATIONS
CLP LEVEL IV VALIDATION

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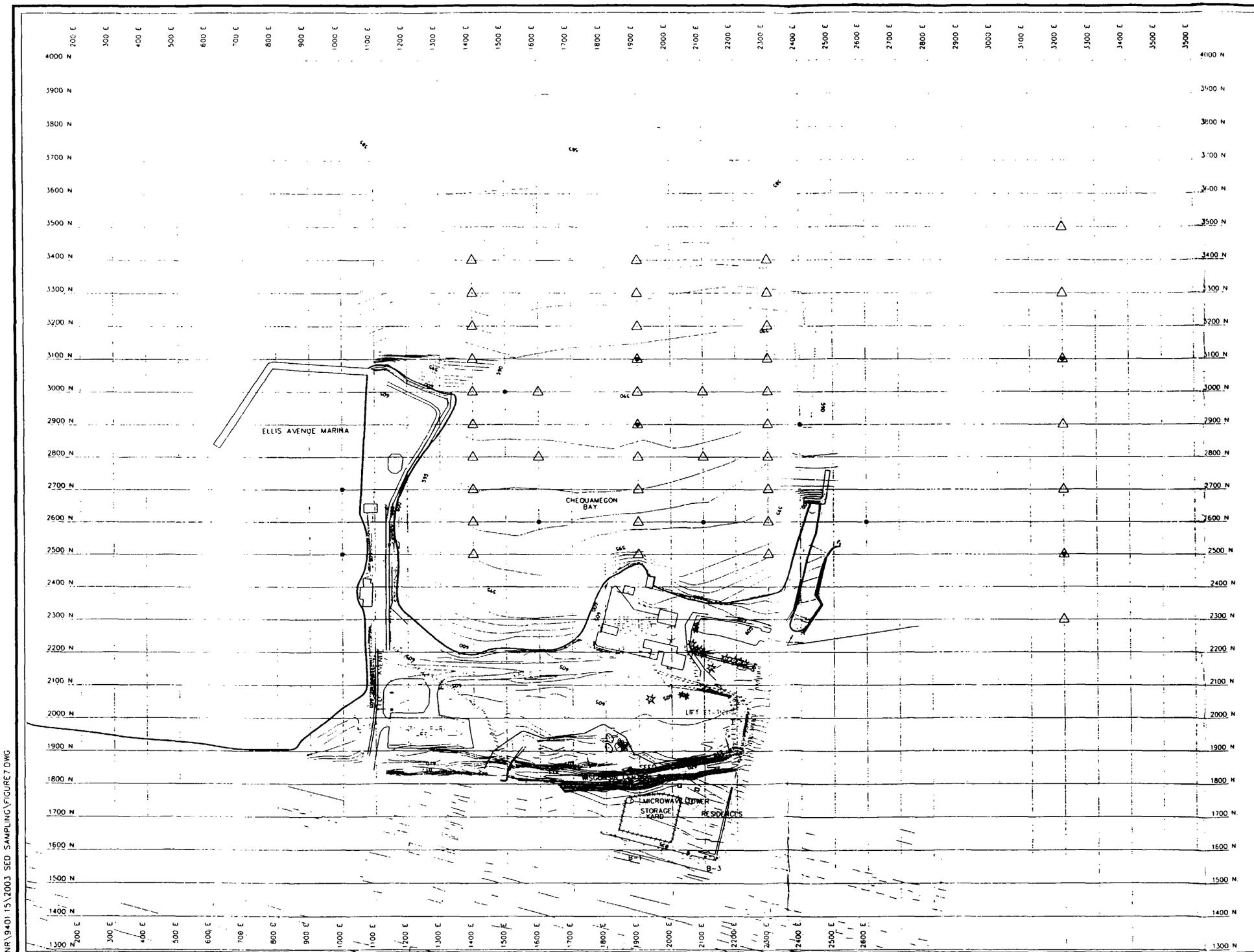
DATE 02/04/03

6 / 8

E:\WASTE\WDNR\9401 15\2003 SED SAMPLING\FIGURE6.DWG



SCALE IN FEET

0 75 150 300

LEGEND

- PROPOSED DEEP SEDIMENT SAMPLING LOCATION
- PROPOSED SHALLOW SEDIMENT SAMPLING LOCATON
- AW-1 EXISTING ARTESIAN WELL LOCATION AND NUMBER (CITY OF ASHLAND)
- 605 TOPOGRAPHIC CONTOUR (1' INTERVAL, SITE DATUM)
- HYDRANT
- SANITARY SEWER MANHOLE
- STORM SEWER MANHOLE
- TELEPHONE PEDISTAL
- POWER POLE
- GUY ANCHOR
- LIGHT POLE
- POWER POLE WITH LIGHT
- UNDERGROUND GAS LINE
- UNDERGROUND ELECTRIC LINE
- UNDERGROUND TELEPHONE LINE
- CULVERT
- PINE TREE
- TREE
- SHRUB / HEDGE
- SWAMP

NOTES.

1. TOPOGRAPHIC AND OFFSHORE BATHYMETRIC SURVEY PERFORMED BY SEH.
2. ELEVATIONS PRESENTED IN SITE DATUM

NO	DATE	ISSUE/REVISIONS	DRAWN BY	DESIGN	FIELD REVIEW	QC CHECK
1	02/04/03		RJH 02/03			

SEH ENGINEERS ■ ARCHITECTS ■ PLANNERS

ASHLAND/NSP LAKEFRONT SITE
OU #4 WINTER 2003 SEDIMENT SAMPLING

FIGURE 7
PROPOSED SEDIMENT SAMPLING LOCATIONS

PROJ. NO. WDNR9401 15
DATE 02/04/03

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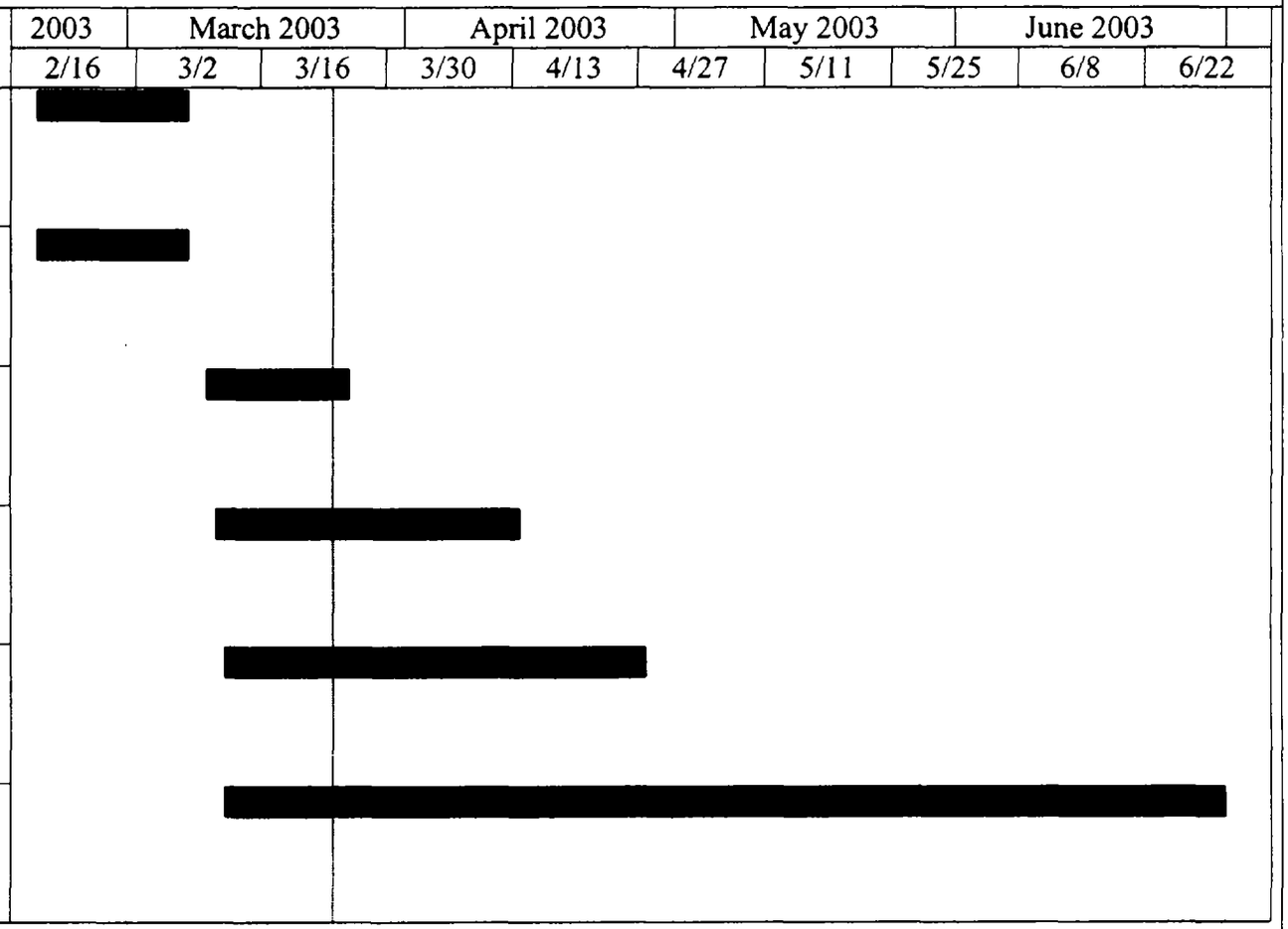
E:\WASTE\WDNR\9401.15\2003 SED SAMPLING\FIGURE7.DWG

Ashland/NSP
Lakefront Site

OU # 4 Winter 2003
Sediment Sampling Schedule

ID	Task Name
1	Approval of QAPP
2	GPS Location of Sampling PTS
3	Sample Collection
4	Sample Chemical Analysis
5	Sample Validation
6	Sample Forensic Analysis



Appendix A

Battelle QAPP

BATTELLE
WORK/QUALITY ASSURANCE PROJECT PLAN

GENERAL PROJECT INFORMATION

Project Title:	Ashland MGP
Project Number:	N004602
Client:	Jamie Dunn, Ph.D. Wisconsin Department of Natural Resources Northern Region Headquarters 810 West Maple Street Spooner, WI 54801 Phone: (715) 635-4049 Fax: (715) 635-4106
QAPP Effective Date:	July 9, 2001
Version Number:	3.0
Program Manager:	Stephen Emsbo-Mattingly
Project Manager:	Richard Uhler
Analytical Due Date:	4 Weeks from verified time of sample receipt (VTSR)
Report Due Date:	TBD by Project Manager.

Prepared By:	_____	_____
	Stephen Emsbo-Mattingly	Date
Reviewed By:	_____	_____
	Allen Uhler	Date
QA Reviewed By:	_____	_____
	Rosanna Buhl	Date

1.0 SCOPE OF WORK

Background

The Ashland MGP operated from the late 1800's to the 1940's as a carbureted water gas plant. Coal, coke and petroleum were presumably delivered to the facility via railroad. Down gradient from the site, a lumber mill operated on the shore of Lake Superior. This lumber mill generated a considerable quantity of wood scrap that was distributed throughout the local coastline area. Approximately 100 feet of shoreline immediately down gradient from the Ashland MGP was filled since the MGP began operating. Recent site investigation efforts have revealed a pipeline that connected the MGP plant with the former shoreline of Lake Superior. This pipeline contains non-aqueous phase liquid (NAPL) at various locations.

Today, the subsurface soils, groundwater and sediments down gradient from the Ashland MGP are contaminated with polycyclic aromatic hydrocarbons (PAH), dense non-aqueous phase liquids (DNAPL), and light non-aqueous phase liquid (LNAPL) sheens. Currently, it is not known if the PAH detected around the Lake Superior shoreline is from one or more sources.

Objectives

The purpose of this project is to characterize the nature of the PAH contamination in the NAPL, soil, sediment and water collected from the site. NAPL and/or PAH arising from tar sources will be identified. A planning phase is recommended in order to ensure that an adequate number of samples are collected to represent all known or suspected sources and to support the technical requirements of the forensic investigation. A work plan will be required to describe the phased analytical approach for determining the source of PAH in the various environmental media. The limited analytical sensitivity and analyte specificity of traditional EPA methods necessitates the use of more robust forensic methods, tailored to identify and differentiate among hydrocarbon products, as described below.

In the first batch, an estimated 4 NAPL and 4 soil samples will be received. Later this summer, an additional 22 NAPL, sediment, soil and water samples will be received for analysis. The laboratory will analyze soil/sediment and NAPL samples for a suite of parameters, including:

Total Petroleum Hydrocarbons
High-resolution GC/FID fingerprints
PAH and selected heteroatomic compounds by GC/MS/SIM
Biomarkers by GC/MS/SIM -quantitative
Selected GC/MS Fingerprints - qualitative

This QAPP contains a detailed description of the laboratory components of the study, applicable quality assurance/quality control (QA/QC) activities, data reduction and reporting procedures, and schedule for this work.

1.1 Technical Approach

1.1.1 Sample Collection

Battelle will supply bottles, coolers, blue ice, packing material and chains-of-custody to the sample collection team.

The general sample requirements are matrix-specific. The analyses of NAPL samples will require only a few milliliters of sample. We recommend that if at all possible more NAPL be collected. Our recommendation is to collect duplicate 40 ml VOA bottles of any NAPL to be submitted for analysis. Filling them to the top should minimize the headspace in the sample vials. The analysis of any solid or particulate samples will require about 8 ounces of sample. These can be collected in 8-oz wide mouth glass jars certified for low level organic chemical analysis. Water samples will be re-sampled with one-liter amber bottles at locations where sheen samples were previously collected and analyzed. The purpose of this analysis is an evaluation of the chemical similarities and differences between DNAPL samples and the sheens that form from them. Consequently, water samples must be collected in such a way that the maximum amount of sheen material enters the bottle.

The sample collection team will arrange for the shipment of the samples to Battelle. Samples must be packaged securely in coolers, chilled to 4°C ± 2°C, and shipped overnight to Battelle. Blue ice is recommended. If ice is used to cool the samples during shipment, it must be double-bagged in multiple zip-lock bags. Individual bottles should be safely wrapped in order to minimize the risk of breakage. A properly completed chain-of-custody and custody seals should accompany the samples. Saturday delivery of coolers should be avoided if possible or arranged with the laboratory manager. Our address is Battelle, 397 Washington St., Duxbury, MA 02332. Attn: Mr. Robert Lizotte.

1.1.2 Receipt, Storage, and Handling

For estimating purposes only, we have assumed that the following samples will be received for analysis in the first shipment: 4 NAPL and 4 soils. The extraction holding time is measured from the time of sample collection as follows: 7 days for water samples and 14 days for soil and sediment samples. NAPL samples are not constrained by a sample preparation holding time. All extracts and dilutions must be analyzed within 40 days of sample preparation. Samples should be held at 4°C until analysis.

Table 1: Sample Storage and Holding Times

Sample Type	Preservation	Storage	Holding Times
NAPL	Ice	Refrigerated at 4 °C	Preparation: not applicable Analysis: 40 days from preparation
Soils/ Sediments	Ice	Refrigerated at 4 °C	Preparation: 14 days from collection Analysis: 40 days from preparation
Water	Ice	Refrigerated at 4 °C	Preparation: 7 days from collection Analysis: 40 days from preparation

Unexpended water sample will be discarded after their holding times have expired. Battelle may dispose of all samples and extracts 6 months after the release of the final report. The electronic data generated by the instruments and all hard-copy data will be archived for a period of at least three years.

The chain of custody forms and a listing of samples will be distributed as the samples arrive. The sample custodian will notify the project manager by telephone immediately upon receipt of samples for inspection.

1.1.3 Sample Preparation

Sediment, soil and water samples will be solvent extracted. A Procedural Blank (PB), Laboratory Control Sample (LCS), Matrix Spike (MS) and Sample Duplicate (Dup) will accompany each batch of 20 or fewer soil, water and sediment samples. NAPL samples will be diluted with solvent. A PB, LCS and Dup will accompany each batch of 20 of fewer NAPL samples. The batch QC are summarized below:

Table 2. Quality Control Samples

QC sample Type	*Required (check)*	*Comments*
Blank	√	Extracted and Diluted Samples
LCS	√	Extracted and Diluted Samples
LCSDUP		
MS	√	Extracted Samples
MSD		
SRM		
Field Sample Duplicates	√	Extracted and Diluted Samples
Field Sample Triplicates		
Independent Check (IC)	√	Extraction Surrogates and Internal Standard
Other:	√	North Slope Crude ~10 mg/ml (XQ50NSC-D or equivalent), Diesel ~10 mg/ml (XP92-D or equivalent), and Coal Tar ~1 mg/ml (SRM 1597 or equivalent). Quantitate for internal use only, no control charts

1.1.3.1 Preparation and Analysis – semi-volatile analysis

- NAPL – TPH, GC/FID fingerprints, PAH characterization, biomarkers. NAPL samples will be extracted for TPH, fingerprints, PAH and biomarkers as described in Battelle SOP 5-203, *Extraction of Sediment/Soil Samples for Petroleum Analysis*. Samples will be spiked as per Tables 3 and 4.

- Initial Extract Preparation:
  1) Sample preparation: weigh 100 mg into tared vial
  2) Filter through Na_2SO_4/glass wool into 10 ml volumetric, adjust volume and perform garv analysis
  3) Prep 2 dilutions:
     Dilution #1: PIV: 1.0 ml-100 ul extract, RIS, SIS, balance DCM
     Dilution #2: PIV: 1.4 ml- 1 ml extract, RIS,SIS
- Cleanup: as per soil and sediment procedures in the method. The sample preparation chemist must match the matrix and cleanup column packing material appropriately.
- Fractionation: None

NAPL – whole oil fingerprints. NAPL samples will be prepared for a full scan, C5-C40 chromatographic fingerprint. 1 ml of whole NAPL will be measured into a GC vial (using a 1 ml syringe) for analysis. These 1 ml whole oil samples will not be spiked with any surrogates or internal standards.

- Sample volume: 1 ml

Soils and Sediments – TPH, GC/FID fingerprints, PAH characterization, biomarkers. Soil samples will be extracted for TPH, fingerprints, PAH and biomarkers as described in Battelle SOP 5-203, *Extraction of Sediment/Soil Samples for Petroleum Analysis*. Samples will be spiked as per Tables 3 and 4. Sample will be split after being fortified with RIS compounds.

- Extraction weight: 30 g – use 2-10 g for highly contaminated samples.
- PIV: 1.0 ml
- Cleanup: as per soil and sediment procedures in the method. The sample preparation chemist must match the matrix and cleanup column packing material appropriately.
- Pre-and post-column gravimetric determination of total extractable hydrocarbons (TEH).
- Determine the percent extractable according to the SOP.
- Determine the percent of material recovered from the column.
- Dilutions: by analyst judgment, but discuss with project manager.

Water – GC/FID fingerprints/PAH characterization. Water samples will be extracted for fingerprints and PAH by separatory funnel techniques as described in Battelle SOP 5-200, *Water Extraction for Trace Level Semi-Volatile Organic Contaminant Analysis*. Samples will be spiked as per Tables 3 and 4. Sample will be split **AFTER RIS** spiking.

- Extraction volume: 1-l
- Rinse bottle with portion of first solvent aliquot.
- PIV: 0.5 ml
- Cleanup: None anticipated (if samples warrant)
- Gravimetric determination of TEH if samples warrant

Table 3: SIS and LCS/MS Spiking Levels

Standard Type	Standard Contents	Standard ID	Spike Volume	Spike Amount
SIS	Naphthalene-d8 Phenanthrene-d10 Chrysene-d12 OTP	FJ40 (10xSample) FL34 (1xQC) or equivalent	200 µl soils and QC	~20µg PAH_{Sample} ~400µg OTP_{Sample} ~2.0 µg PAH QC ~40.0 µg OTP QC
Matrix Spike	PAH and SHC Target compounds	FN96	500 ul	~ 2.0 µg PAH ~ 25.0 µg SHC
PAH (LCS)	PAH and SHC Target compounds	FN96 or equivalent	100 µl LCS	~ 0.5 µg PAH ~ 5.0 µg SHC

Table 4: RIS Spiking Levels

Standard Type	Standard Contents	Standard ID	Spike Volume	Spike Amount
RIS	Acenaphthene-d10 Fluorene-d10 Benzo[a]pyrene-d12 5α-Androstane	FN78 or equivalent	200 µl all samples	~ 2.0 µg PAH ~ 40 µg 5α-Androstane

1.1.3.2 Instrumental Analysis, Calibration, and Maintenance

Organics -- GC/FID Analysis. Samples will be analyzed by GC/FID for total petroleum hydrocarbons (soils and NAPL only) and chromatographic fingerprints. Instrumental methods, maintenance, and QC procedures for the GC/FID analysis of samples will be performed according to Battelle SOP No. 5-202, a modification of EPA Method 8015. Analytical instruments will be calibrated before sample analysis with a 5-point calibration (minimum).

- Mass discrimination <20% (1-(C36/C22)*100)
- The calibration solution will be composed of selected aliphatic hydrocarbons within the C8 through C36 carbon range, with TPH will be calculated based on the mass integrated from C8 to C36.
- Generation of a detailed chromatographic fingerprint.
- Check standards will bracket the analytical run of authentic and quality control samples.

Organics -- GC/MS Analysis for PAH, heteroatoms and biomarkers. Samples will be quantified based on recovery internal standards. Surrogate recoveries will be quantified and reported for each sample. Instrumental methods, maintenance, and QC procedures for the GC/MS analysis of samples for PAH will be performed according to Battelle SOP No. 5-157. Analytical instruments will be calibrated before sample analysis with a 5-point calibration (minimum), using the 0.01 ug/ml low standard concentration. In the absence of dilutions, the reporting limit of 0.5 ug/kg will be used for all soil/sediment samples and 5 mg/kg for NAPL.

- Mass discrimination <25% (1-(Qt Ion Area [Benzo(ghi)perylene/Phenanthrene])*100). Review with project manager before analysis.
- The instrument will be operated in the Select Ion Mode (SIM). Make sure the following ions are acquired for the entire run: 83 and 85.
- Quantification will be performed using the RIS compounds for PAH, heteroatoms and biomarkers (Attachment 1).
- A minimum of two extracts will be produced for every NAPL sample: PAH and biomarkers will be quantitated on the 1:100 dilution. All target analytes not detected within the instrument calibration range will be quantitated using the 1:10 dilution after consultation with the PM. Benzo(g,h,i)perylene and Indeno(1,2,3-c,d)pyrene are to be used as a marker for this analysis, with both compounds being within the calibration range. See PM for further clarification/discussion during analytical run.

- Check standards at least every 12 hr. GC/MS run time. Bracket the analytical run with calibration standards.

Organics -- GC/MS Analysis for full scan fingerprint. Whole oil samples will be run for a chromatographic picture only. Instrumental methods, maintenance, and QC procedures for the GC/MS qualitative analysis of oil samples for this analysis will be performed according to Battelle SOP No. 5-157. An alkane standard (from the STOCK GC/FID CALIBRATION SOLUTION) and North Slope Crude will be run prior to any samples to demonstrate good chromatography with low mass discrimination. Use a narrow bore GC liner packed with glass wool. The following GC conditions are used for this analysis:

Injection port: 275°C
Initial temperature: 35°C; Ramp 1: 2°C/minute to 65°C
Initial hold: 15 minutes; Ramp 2: 6°C/minute to 320°C.

- If the NAPL is too viscous, dilute with a few drops of DCM.

- Produce extracted ion profile chromatograms as requested by the Battelle project manager.

1.2 Forensic Evaluation

Forensic investigations are site specific. However, the general approach to interpreting these data will include five steps. First, the quality control performance is evaluated and data limitations noted. Second, the geotechnical and GC/FID hydrocarbon fingerprints will reveal the overall distribution of hydrocarbons, migration potential and states of weathering at the site. Third, statistical tools, like principal components analysis (PCA), will help identify the multidimensional relationships among the data for the purpose of chemical differentiation. Fourth, The source signatures will be simplified, if possible, and portrayed graphically; e.g., double ratio plots. Finally, source and release area samples will be compared using all of the data. The results are reviewed with the client and a report is generated.

1.3 Deliverables

The client will receive a verbal summary of the results. Thereafter, a final report will be produced. The contents of the report will be specified by the client. Typical reports include a summary of the geotechnical and chemical data including statistical figures, final data tables and QC data. Four copies of this report will be sent to the WDNR Northern Regional Headquarters in Spooner, WI and 4 copies will be sent to WDNR Bureau of Remediation and Redevelopment in Madison, WI.

The final data report package will include:

- Tabulated results of analyses for field samples and QC samples
  - PAH/heteroatomic compounds in water ng/L
  - PAH/heteroatomic compounds in soil µg/kg
  - PAH/heteroatomic compounds in NAPL mg/kg
- High-resolution GC/FID hydrocarbon fingerprints
- Full Scan GC/MS chromatographic fingerprints for all NAPL samples
- GC/MS chromatograms for selected biomarker compounds
- Histograms of PAH distributions for each sample
- Results of analysis in Microsoft Excel spreadsheet

The final data report package will include an electronic copy summary Excel tables for all field and QC data. Copies of all acquisition and reduced data files for all Calibrations, QC and samples should be placed in the appropriate subdirectory.

The data will be qualified as described in Attachment 3.

The following header information should be used, listed in this order on the tables:

Table 5. Table Header Information

Header Information	*Required (check)*	*Comments*
Client Sample ID	√	
Battelle Sample ID	√	
Client Description	√	If on COC
Battelle Batch ID	√	
Analytical Method	√	
Collection Date	√	
Receipt Date	√	
Extraction Date	√	
Analysis Date	√	
Dilution Factor	√	
% Moisture	√	
% Dry Weight		
Sample Dry Weight (g)	√	
Sample Wet Weight		
Units	√	mg/kg (NAPL), ug/kg (soil), ng/l (water)
% Lipid		

Deliverables will include:

Sample Preparation:
Pre- and post column gravimetric measurements of TEH.

GC/FID:
TPH table as a target. (format to be discussed with PM).
GC chromatograms with client ID, OTP and Androstane identified.

GC/MS Semi-volatile:
Data table (format to be discussed with PM).
Histograms (from data table) for samples and reference materials (use PM template).
Selected Total and Extracted Chromatograms

GC/MS Semi-volatile (whole oil):
GC chromatogram (TIC) with client ID.

2.0 QUALITY

2.1 Quality Assurance

The Quality Assurance Unit (QAU) at Battelle will remain independent of all work activities pertaining to this project. The QAU will monitor the Battelle components of the project according to existing Battelle SOPs to ensure the accuracy, integrity, and completeness of the data. Additionally, the QAU will monitor the project activities to ensure consistency with the applicable requirements described in this QAPP. The QAU scope may includes system inspections, data audits, and reviews of documents and deliverables.

Final reports will receive a senior level review prior to delivery.

2.2 Quality Control

Project staff will be responsible for ensuring that sample tracking, sample preparation, and analytical instrument operation all meet the quality control criteria detailed in the applicable analytical SOPs. The type and frequency of analysis of QC samples is specified in Section 2.

The data quality objectives (DQO) are outlined in Attachment 2. Analytical results that do not meet the listed DQOs will be submitted to and reviewed with the Project Manager in a timely manner for assessment of the potential impact of the results. Affected samples may be reanalyzed at the Project Manager's discretion. Quality control sample data that are accepted outside these criteria will be indicated with the appropriate data qualifier, and the rationale for accepting the analysis will be documented in the project files.

2.3 Documentation

All laboratory records, including all sample preparation forms/records and analytical data, will be maintained in three-ring binders. All data will be recorded in black ink, entries signed and dated on date of entry, and any changes initialed, dated, and explained. All raw and reduced analytical data will be archived with the study record.

3.0 ORGANIZATION AND COMMUNICATION

Task-specific communication should initially be directed to the Task Leaders. The task leaders will keep the Project Manager informed of the status of the project and any technical issues will be brought to the Project Manager's attention in a timely manner. The Battelle project team and responsibilities are as follows:

Table 6. Project Team and Roles

Staff Member	Role
Stephen Emsbo-Mattingly	Program Manager
Dick Uhler	Project Manager
Mike Meara/TBD	Task Leader - Sample Preparation
	Task Leader: GC/MS-PAH Analysis
Ted Healey	Task Leader: GC/MS-whole oil Analysis
Lyle Roberts	Task Leader: GC/FID Analysis
Bob Beimer	Laboratory Manager
Rosanna Buhl	Quality Systems Manager
Mark Guilmain	Quality Assurance Chemical Analysis
Allen Uhler	Senior Reviewer

4.0 SCHEDULE

The approximate schedule of activities is as follows:

Table 7. Schedule of Project Activities

Activity	Start Date	Status Check Date	End Date
Sample Receipt	Friday July 27, 2001		
Sample Extraction/Preparation	July 30, 2001	Real time	TBD + 5 days
Instrumental Analysis	August 3, 2001	Real time	August 17, 2001
Quality Assurance	August 18, 2001	Real time	August 22, 2001

Status Check Date is when the PM will check on the status of the project, to determine sample/deliverable status.

[1] This reflects data packages as FINAL (through QA, with all appropriate signatures).

ATTACHMENTS

Attachment 1: Target Analytes
Attachment 2: Data Quality Objectives
Attachment 3: Data Qualifiers
Attachment 4: Project Manager Review Form
Attachment 5: Chain of Custody

ACRONYMNS

%D	Percent Difference
C#	Carbon Number for normal alkanes
COC	Chain of Custody
DCM	Dichloromethane
DNAPL	Dense NAPL
DQO	Data Quality Objectives
Dup	Duplicate
EPA	US Environmental Protection Agency
/FID	Flame Ionization Detector
GC	Gas Chromatograph
IC	Independent Check
LCS	Laboratory Control Sample
LNAPL	Light NAPL
MGP	Manufactured Gas Plant
/MS	Mass Spectrometer
MS	Matrix Spike
NAPL	Non-Aqueous Phase Liquid
OTP	ortho-Terphenyl
PB	Preparation Blank
PIV	Final Volume for Sample Preparation
PM	Project Manager (Battelle)
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QAU	Quality Assurance Unit
QC	Quality Control
RIS	Recovery Internal Standard
RSD	Relative Standard Deviation
/SIM	Selected Ion Monitoring
SIS	Surrogate Internal Standard
SOP	Standard Operating Procedure
SRM	Standard Reference Material
TBD	To Be Determined
TBD	To Be Determined
TEH	Total Extractable Hydrocarbons (gravimetric)
TIC	Total Ion Chromatogram
TPH	Total Petroleum Hydrocarbons (GC/FID)
VOA	Volatile Organic Analysis
VTSR	Verified Time of Sample Receipt
WDNR	Wisconsin Department of Natural Resources

Attachment 1

Target Analytes – PAH and Heteroatomics

Analyte/Analyte Groups	Abbr.	Analyte/Analyte Groups	Abbr.
Decalin	DC	Dibenzothiophene	D
C1-decalins	DC1	C1-dibenzothiophenes	D1
C2-decalins	DC2	C2-dibenzothiophenes	D2
C3-decalins	DC3	C3-dibenzothiophenes	D3
C4-decalins	DC4	C4-dibenzothiophenes	D4
Benzo(b)thiophene	BT	Fluoranthene	FL
C1-benzo(b)thiophenes	BT1	Pyrene	PY
C2-benzo(b)thiophenes	BT2	C1-fluoranthenes/pyrenes	FP1
C3-benzo(b)thiophenes	BT3	C2-fluoranthenes/pyrenes	FP2
C4-benzo(b)thiophenes	BT4	C3-fluoranthenes/pyrenes	FP3
Naphthalene	N	Benz(a)anthracene	BA
C1-naphthalenes	N1	Chrysene	C
C2-naphthalenes	N2	C1-chrysenes	C1
C3-naphthalenes	N3	C2-chrysenes	C2
C4-naphthalenes	N4	C3-chrysenes	C3
Biphenyl	BI	C4-chrysenes	C4
Acenaphthylene	ACY	Benzo(b)fluoranthene	BB
Acenaphthene	ACE	Benzo(k)fluoranthene	BK
Dibenzofuran	DI	Benzo(e)pyrene	BE
Fluorene	F	Benzo(a)pyrene	BAP
C1-fluorenes	F1	Perylene	PER
C2-fluorenes	F2	Indeno(1,2,3-c,d)pyrene	IP
C3-fluorenes	F3	Dibenz(a,h)anthracene	DA
Anthracene	A	Benzo(g,h,i)perylene	GHI
Phenanthrene	P		
C1-phenanthrenes/anthracenes	P1		
C2-phenanthrenes/anthracenes	P2		
C3-phenanthrenes/anthracenes	P3		
C4-phenanthrenes/anthracenes	P4	TPAH = sum N through GHI	TPAH

Target Analytes – Biomarkers

TRITERPANES	Quant. Ion	Key
C23 Tricyclic terpane	191	-
C24 Tricyclic terpane	191	-
C25 Tricyclic terpane	191	-
C26 Tricyclic terpanes	191	-
C28 Tricyclic terpanes	191	1
C29 Tricyclic terpanes	191	2
18α(H)-22,29,30-trisnorhopane (Ts)	191	3
17α(H)-22,29,30-trisnorhopane (Tm)	191	4
C30 Tricyclic terpanes	191	5
17α(H),21β(H)-28,30-bisnorhopane (Tent. - A)	191	6
C29 25-nor-17α(H)-hopane (Tent. – B)	191	7
17α(H),21β(H)-30-norhopane	191	8
18α(H)-30-norneohopane (C29Ts)	191	9
17β(H),21α(H)-normoretane	191	10
18α(H) and 18β(H) oleanane	191	11
17α(H),21β(H)-hopane	191	12
17β(H),21α(H)-moretane	191	13
22S-17α(H),21β(H)-30-homohopane	191	14
22R-17α(H),21β(H)-30-homohopane	191	15
gammacerane	191	-
22S-17α(H),21β(H)-30-bishomohopane	191	-
22R-17α(H),21β(H)-30-bishomohopane	191	-
22S-17α(H),21β(H)-30-trishomohopane	191	-
22R-17α(H),21β(H)-30-trishomohopane	191	-
22S-17α(H),21β(H)-30-tetrakishomohopane	191	-
22R-17α(H),21β(H)-30-tetrakishomohopane	191	-
22S-17α(H),21β(H)-30-pentakishomohopane	191	-
22R-17α(H),21β(H)-30-pentakishomohopane	191	-

RF of 17β(H),21α(H)-moretane applied

Target Analytes – Biomarkers (continued)

STERANES	Quant. Ion	Key
13β,17α-diacholestane(20S)	217	16
13β,17α-diacholestane(20R)	217	17
5α,14β,17β-cholestane(20R)	218	18
5α,14β,17β-cholestane(20S)	218	19
5α,14α,17α-cholestane(20R)	217	20
5α,14β,17β,24-methylcholestane(20R)	218	21
5α,14β,17β,24-methylcholestane(20S)	218	22
5α,14α,17α,24-methylcholestane(20R)	217	23
5α,14α,17α,24-ethylcholestane(20S)	217	24
5α,14β,17β,24-ethylcholestane(20R)	218	25
5α,14β,17β,24-ethylcholestane(20S)	218	26
5α,14α,17α,24-ethylcholestane(20R)	217	27

RF of 5 β Cholane applied

Attachment 2

Data Quality Objectives

QC Measurement	Frequency	Acceptability Limits	Corrective Action
ICC	1 per batch	±15%	Re-analysis, re-calibration, maintenance/justify
Procedural Blank	1 per analytical batch	<5X RL[1]	Re-extraction, Re-analysis, and/or Qualification of data (typically "B" if < 5x conc. of blank)[2]
LCS	1 per analytical batch	40% - 120% PAH/TPH	Re-analysis[2]
Field Duplicates	1 per 10	30% RPD for analytes 10X RL	Qualification of data[2]
Surrogate Recovery	per sample	40% - 120% PAH/TPH	Qualification of data[2]
Instrument Calibration[3]	Initial - once Continuing - at least every ten samples	**Initial:** ≤25% RSD **Continuing:** 15%D (average) No more than 5 analytes >25%D	Re-calibration Maintenance/justify

[1]RL = Low Standard Concentration x PIV x 1/Sample Size x HPLC Split x any dilution factors
[2] Project Manager will determine if re-analysis or other corrective action is necessary.
[3]All calibrations reviewed with project manager prior to running authentic samples. Mid check calibration standard run and reviewed prior to initial calibrations.

Attachment 3

Data Qualifiers

Qualifier	Use
J	Analyte detected below the RL.
B	Analyte detected at level greater than 5 X RL in the PB (procedural blank value is qualified).
D	Analyte reported from a diluted run.
ME	Significant matrix interference — estimated value
MI	Significant matrix interference — value could not be determined or estimated
U	Analyte not detected.
&	QC value outside the accuracy or precision data quality objective. (e.g., LCS/SIS recoveries).

Attachment 4: Project Manager Review Form

Staff Member Reviewed:	Assignment or Task Title:
Reviewer:	Reviewer's Project Title:
Period of Performance:	

Unsatisfactory -1-	Needs Improvement -2-	Effective Achievement -3-	Excellent -4-	Outstanding -5-	Not Applicable NA

Note: Use this form to evaluate Project Manager on a project. Please evaluate the staff member only on the job dimensions that are relevant to your interaction with him/her.

Criteria – Project Manager

Rating	Resource Manager Evaluation
	Client feedback
	Staff feedback

Project Design and Initiation

	Work Plan: prepared and distributed clear, accurate, and detailed work plans
	Start-up: Communicated project objectives and coordinated appropriate staff and equipment needs through kick-off meeting or other means of communication (e.g., memo)
	Staff mentoring and training activities: built into project design and implemented effectively

Project/Technical Performance

	Client communication: (oral and written) e.g., progress, problems, deliverables and follow-on work
	Staff communication (oral and written) e.g., changes in scope or schedule; available and approachable to staff
	Technical leadership: provided technical insight; conducted assessments of work in progress
	Innovation: identified and/or applied new technology, technique or ideas
	Issues and Corrective Action: anticipated/identified problems, directed corrective action in real time, notified resource manager of potential overruns, schedule/scope problems, and safety issues
	Attitude (e.g., willingness to provide assistance, positive attitude)
	Multi-tasking: manage multiple projects/tasks simultaneously (e.g., number of projects managed)
	Deliverable Quality: well-written (per Battelle technical/editorial or other review), and timely; incorporates current science, met or exceeded client's expectations (accurate, complete)

Project Closure

	Project Debriefing: conducted debriefings/evaluations, and identified lessons learned with project staff and resource manager, documentation
	Project Performance Reviews: completed technical and support staff reviews
	Closeout: e.g., lab cleanup, data archive, electronic file storage, sample disposal/storage

Record supporting comments (mandatory) on the other side for additional comments.

Reviewer:	Date:

Attachment 5: Chain of Custody

Appendix B

Historic Laboratory Data

Table 5 1998 & 2001 Sediment Bioactive Zone Chemical Data - Dry Weight and Normalized to Organic Carbon

	Winter 98 Samples										Spring 98 Samples				Spring 2001 Samples												
Grid Location	2800N 2100E	2800N 1400E	2600N 2100E	2600N 1400E	2400N 2100E	2500N 1800E	2400N 1400E	2430N 2630E	2420N 2790E	2100N 0800E	2400N 1460E	2580N 1450E	2800N 2100E	2800N 2500E	2100N/2300E	2100N/2300E	2500N/1700E	2500N/1700E	2500N/1400E	2500N/1000E	2100N/1000E	3100N/1500E	2400N/1400E	2400N/1400E	2400N/1700E	2400N/1700E	2400N/1700E Duplicate
Depth (inches)	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"	0-6"
ID:	SD-1	SD-3	SD-4	SD-6	SD-7	SD-8	SD-9	EB-W	EB-E	WB-E	CW	CS	RW	RS	Ref. Sand	Ref. Sand	Sand #1	Sand #1	Sand #2	Sand #2	Ref. Wood	Ref. Wood	Wood #1	Wood #1	Wood #2	Wood #2	Wood #2 Dup.
Date Collected:	Jan-98	Jan-98	Jan-98	Jan-98	Jan-98	Jan-98	Feb-98	Jan-98	Jan-98	Jan-98	May-98	May-98	May-98	May-98	Mar-01	Apr-01	Mar-01	Apr-01	Mar-01	Apr-01	Mar-01	Apr-01	Mar-01	Apr-01	Mar-01	Apr-01	Apr-01
Total Organic Carbon																											
TOC (mg/kg)		43,000	12,000	53,000	50,000	54,000	38,000	1,000	930	89,000	17,000	2,500	57,000	4,600	22,000	21,000	18,000	36,000	1,600	1,900	46,800	190,000	280,000	480,000	250,000	280,000	190,000
TOC (%)		4.3%	1.2%	5.3%	5.0%	5.4%	3.8%	0.1%	0.1%	8.9%	1.7%	0.3%	5.7%	0.5%	2.2%	2.1%	1.8%	3.6%	0.2%	0.2%	4.8%	19.0%	28.0%	48.0%	25.0%	28.0%	19.0%
Dry Weight Values																											
PAH (ug/kg)																											
Acenapthene		440	ND	2,000	450	230	19,000	ND	ND	ND	17,000	110	48	ND	ND	16	30,000	88,000	11,000	28,000	32	100	22,000	48,000	3,000	7,500	7,400
Acenapthylene		900	ND	1,400	ND	ND	ND	ND	ND	ND	3,800	ND	85	ND	32	96	2,000	5,200	650	1,400	74	410	4,100	8,800	550	1,200	1,300
Anthracene		560	ND	2,400	700	160	160,000	ND	ND	ND	15,000	81	130	ND	21	52	16,000	23,000	5,100	7,900	51	220	18,000	34,000	1,800	3,300	3,700
Benzo(a)anthracene		4,000	54	9,200	6,700	550	45,000	ND	ND	2,300	24,000	59	450	51	78	280	6,600	18,000	2,400	5,300	200	1,100	18,000	44,000	2,200	5,600	6,500
Benzo(a)pyrene		5,500	ND	10,000	8,200	540	35,000	ND	ND	2,700	28,000	73	540	62	120	350	6,200	14,000	2,400	4,100	290	1,400	20,000	36,000	2,800	4,800	5,100
Benzo(e)pyrene																250		9,100		2,400		990		21,000		2,900	3,300
Benzo(b)flouranthene		3,500	ND	5,700	7,600	580	14,000	ND	ND	ND	16,000	38	560	50	78	210	2,700	8,300	860	1,900	150	860	7,000	18,000	1,400	3,300	3,400
Benzo(k)flouranthene		2,600	ND	5,700	5,900	430	23,000	ND	ND	ND	16,000	46	370	37	100	230	6,700	11,000	2,300	3,000	240	910	15,000	22,000	2,000	3,300	3,800
Benzo (ghi) perylene		3,200	ND	5,400	5,300	240	16,000	ND	ND	3,100	11,000	ND	280	31	76	270	2,900	8,500	1,000	2,300	160	940	8,200	18,000	1,300	2,800	3,000
Chrysene		3,100	46	7,200	6,200	630	36,000	ND	ND	2,400	21,000	54	470	46	88	230	7,500	18,000	2,500	4,900	200	910	16,000	32,000	2,000	4,300	4,800
Dibenzoa(a,h) Anthracene		ND	ND	ND	ND	ND	ND	ND	ND	ND	3,000	ND	85	ND	ND	58	ND	1,500	ND	380	ND	240	1,600	3,500	280	710	780
Flouranthene		2,900	93	10,000	6,800	550	97,000	ND	ND	3,700	36,000	97	910	39	110	260	18,000	51,000	6,300	15,000	240	1,100	34,000	87,000	3,300	9,800	10,000
Fluorene		480	ND	1,600	ND	ND	100,000	ND	ND	ND	10,000	62	85	ND	ND	14	13,000	30,000	4,200	9,700	30	77	12,000	23,000	1,300	3,100	3,400
Indeno(123-cd)pyrene		2,500	ND	4,700	4,800	250	14,000	ND	ND	ND	9,400	ND	260	27	52	180	1,600	5,700	650	1,500	110	740	5,700	13,000	930	2,200	2,400
1-Methylnaphthalene		340	ND	900	ND	190	ND	ND	ND	ND	12,000	99	170	ND		25		73,000		20,000		110		29,000		7,900	7,700
2-Methylnaphthalene		650	ND	1,200	ND	240	470,000	ND	ND	ND	15,000	120	240	ND		38		120,000		34,000		180		41,000		8,100	8,600
Naphthalene		810	ND	1,500	ND	ND	770,000	ND	ND	ND	19,000	160	230	ND	32	31	85,000	160,000	17,000	33,000	170	190	21,000	31,000	6,100	9,200	9,400
Phenanthrene		1,600	71	8,600	ND	650	340,000	ND	ND	3,200	46,000	270	690	23	78	120	45,000	120,000	18,000	38,000	160	520	51,000	120,000	4,900	12,000	14,000
Pyrene		5,200	140	20,000	9,800	1,100	140,000	ND	ND	4,500	68,000	190	940	58	120	400	25,000	72,000	8,500	22,000	280	1,600	46,000	130,000	3,800	12,000	13,000
Total PAHs		38,280	404	97,500	62,450	6,340	2,279,000	ND	ND	21,900	370,200	1,459	6,543	424	985	3,110	268,200	836,300	82,860	234,780	2,367	12,597	299,600	759,300	37,260	103,810	111,580
Heterocyclic Aromatic Hydrocarbons (ug/kg)																											
Dibenzothiophene																ND		5,100		1,900		ND		12,000		1,500	980
Carbazole																ND		2,200		210		ND		ND		580	490
Dibenzofuran																ND		3,000		830		52		3,700		980	600
Phenolic Compounds (ug/kg)																											
2-Fluorobiphenyl																77		73		69		75		77		74	72
4-Methylphenol																ND		ND		ND		690		ND		350	200
Phenol																93		ND		ND		980		1,900		450	250
Volatile Organic Compounds (ug/kg)																											
Benzene	ND	ND	ND	ND	130	ND	1,200	ND	ND	ND	540	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2,000	530	630	150	140
Ethylbenzene	ND	ND	ND	ND	ND	ND	660	ND	ND	ND	85	ND	ND	ND	ND	ND	5,300	2,800	1,600	990	ND	ND	1,400	450	910	180	180
Toluene	72	270	260	270	420	ND	60	ND	ND	110	76	ND	320	44	ND	ND	ND	ND	ND	ND	ND	28	100	28	ND	41	41
Xylenes	ND	ND	ND	ND	ND	ND	670	ND	ND	ND	230	ND	ND	ND	ND	ND	5,200	2,590	1,900	960	ND	ND	1,640	530	850	180	184

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-7	SD-7	SD-7	SD-7	SD-8	SD-8	SD-8
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Benzene	<3,530	<32	<29	<30	<36	<31	<30
Bromobenzene	<3,530	<32	<29	<30	<36	<31	<30
Bromochloromethane	<3,530	<32	<29	<30	<36	<31	<30
Bromodichloromethane	<3,530	<32	<29	<30	<36	<31	<30
Bromoform	<3,530	<32	<29	<30	<36	<31	<30
Bromomethane	<14,100	<129	<117	<122	<141	<124	<121
n-Butylbenzene	<3,530	<32	<29	<30	<36	<31	<30
sec-Butylbenzene	<3,530	<32	<29	<30	<36	<31	<30
tert-Butylbenzene	<3,530	<32	<29	<30	<36	<31	<30
Carbon Tetrachloride	<3,530	<32	<29	<30	<36	<31	<30
Chlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
Chlorodibromethane	<3,530	<32	<29	<30	<36	<31	<30
Chloroethane	<4,940	<45	<41	<43	<49	<43	<42
Chloroform	<3,530	<32	<29	<30	<36	<31	<30
Chloromethane	<7,050	<64	<59	<61	<71	<62	<61
2-Chlorotolunene	<3,530	<32	<29	<30	<36	<31	<30
4-Chlorotolunene	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dibromo-3-Chloropropane	<7,050	<64	<59	<61	<71	<62	<61
1,2-Dibromethane (EDB)	<3,530	<32	<29	<30	<36	<31	<30
Dibromomethane	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,3-Dichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,4-Dichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
Dichlorodifluoromethane	<3,530	<32	<29	<30	<36	<31	<30
1,1-Dichloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dichloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,1-Dichloroethene	<3,530	<32	<29	<30	<36	<31	<30
cis-1,2-Dichloroethene	<3,530	<32	<29	<30	<36	<31	<30
trans-1,2-Dichloroethene	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dichloropropane	<3,530	<32	<29	<30	<36	<31	<30
1,3-Dichloropropane	<3,530	<32	<29	<30	<36	<31	<30
2,2-Dichloropropane	<3,530	<32	<29	<30	<36	<31	<30
1,1-Dichloropropene	<3,530	<32	<29	<30	<36	<31	<30
cis-1,3-Dichloropropene	<3,530	<32	<29	<30	<36	<31	<30
trans-1,3-Dichloropropene	<3,530	<32	<29	<30	<36	<31	<30
Di-isopropyl ether	<3,530	<32	<29	<30	<36	<31	<30
Ethylbenzene	<3,530	**72**	<29	<30	<36	<31	<30
Hexachlorobutadiene	<4,940	<45	<41	<43	<49	<43	<42
Isopropylbenzene	<3,530	<32	<29	<30	<36	<31	<30
p-Isopropyltoluene	<3,530	<32	<29	<30	<36	<31	<30
Methylene Chloride	<7,050	<64	**63 L**	**100 L**	<71	**65 L**	**85 L**
Methyl-t-butyl-ether	<3,530	<32	<29	<30	<36	<31	<30
Naphthalene	**59,200**	**656**	<29	<30	<36	<31	<30
n-Propylbenzene	<3,530	<32	<29	<30	<36	<31	<30
Styrene	<3,530	<32	<29	<30	<36	<31	<30
1,1,1,2-Tetrachloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,1,2,2-Tetrachloroethane	<3,530	<32	<29	<30	<36	<31	<30
Tetrachloroethane	<3,530	<32	<29	<30	<36	<31	<30
Toluene	<3,530	<32	<29	<30	<36	<31	<30
1,2,3-Trichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,2,4-Trichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,1,1-Trichloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,1,2-Trichloroethane	<3,530	<32	<29	<30	<36	<31	<30
Trichloroethene	<3,530	<32	<29	<30	<36	<31	<30
Trichlorofluoromethane	<3,530	<32	<29	<30	<36	<31	<30
1,2,3-Trichloropropane	<3,530	<32	<29	<30	<36	<31	<30
1,2,4-Trimethylbenzene	**3,670**	**33**	<29	<30	<36	<31	<30
1,3,5-Trimethylbenzene	<3,530	<32	<29	<30	<36	<31	<30
Vinyl Chloride	<3,530	<32	<29	<30	<36	<31	<30
Xylene, total	<4,940	**63**	<41	<43	<49	<43	<42
TOTAL VOCs + Naphthalene	62870	824	0	0	0	0	0

All units report in µg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-9	SD-9	SD-10	SD-10
Depth	4-6	6-8	4-6	6-8
Benzene	<31	<30	<32	<31
Bromobenzene	<31	<30	<32	<31
Bromochloromethane	<31	<30	<32	<31
Bromodichloromethane	<31	<30	<32	<31
Bromoform	<31	<30	<32	<31
Bromomethane	<125	<119	<128	<124
n-Butylbenzene	<31	<30	<32	<31
sec-Butylbenzene	<31	<30	<32	<31
tert-Butylbenzene	<31	<30	<32	<31
Carbon Tetrachloride	<31	<30	<32	<31
Chlorobenzene	<31	<30	<32	<31
Chlorodibromethane	<31	<30	<32	<31
Chloroethane	<44	<42	<45	<43
Chloroform	<31	<30	<32	<31
Chloromethane	<62	<60	<64	<62
2-Chlorotolunene	<31	<30	<32	<31
4-Chlorotolunene	<31	<30	<32	<31
1,2-Dibromo-3-Chloropropane	<62	<60	<64	<62
1,2-Dibromethane (EDB)	<31	<30	<32	<31
Dibromomethane	<31	<30	<32	<31
1,2-Dichlorobenzene	<31	<30	<32	<31
1,3-Dichlorobenzene	<31	<30	<32	<31
1,4-Dichlorobenzene	<31	<30	<32	<31
Dichlorodifluoromethane	<31	<30	<32	<31
1,1-Dichloroethane	<31	<30	<32	<31
1,2-Dichloroethane	<31	<30	<32	<31
1,1-Dichloroethene	<31	<30	<32	<31
cis-1,2-Dichloroethene	<31	<30	<32	<31
trans-1,2-Dichloroethene	<31	<30	<32	<31
1,2-Dichloropropane	<31	<30	<32	<31
1,3-Dichloropropane	<31	<30	<32	<31
2,2-Dichloropropane	<31	<30	<32	<31
1,1-Dichloropropene	<31	<30	<32	<31
cis-1,3-Dichloropropene	<31	<30	<32	<31
trans-1,3-Dichloropropene	<31	<30	<32	<31
Di-isopropyl ether	<31	<30	<32	<31
Ethylbenzene	**149**	<30	<32	<31
Hexachlorobutadiene	<44	<42	<45	<43
Isopropylbenzene	<31	<30	<32	<31
p-Isopropyltoluene	**32**	<30	**37**	<31
Methylene Chloride	<62	<60	**84 L**	**120 L**
Methyl-t-butyl-ether	<31	<30	<32	<31
Naphthalene	**2,490**	**57**	**77**	<31
n-Propylbenzene	<31	<30	<32	<31
Styrene	<31	<30	<32	<31
1,1,1,2-Tetrachloroethane	<31	<30	<32	<31
1,1,2,2-Tetrachloroethane	<31	<30	<32	<31
Tetrachloroethane	<31	<30	<32	<31
Toluene	<31	<30	**153**	<31
1,2,3-Trichlorobenzene	<31	<30	<32	<31
1,2,4-Trichlorobenzene	<31	<30	<32	<31
1,1,1-Trichloroethane	<31	<30	<32	<31
1,1,2-Trichloroethane	<31	<30	<32	<31
Trichloroethene	<31	<30	<32	<31
Trichlorofluoromethane	<31	<30	<32	<31
1,2,3-Trichloropropane	<31	<30	<32	<31
1,2,4-Trimethylbenzene	**137**	<30	<32	<31
1,3,5-Trimethylbenzene	**54**	<30	<32	<31
Vinyl Chloride	<31	<30	<32	<31
Xylene, total	**212**	<42	**92**	<43
TOTAL VOCs + Naphthalene	3074	57	359	0

All units report in µg/kg

TABLE 3
META ENVIRONMENTAL- SEDMIMENT SAMPLE RESULTS

Parameter	SD-9	SD-15	SD-34	SD-37	SD-47	SD-48	SD-50	SD-51	SD-54	SD-56
Depth	2-4	4-6	0-2	2-4	2-4	6-8	8-10	6-8	2-4	2-4
Solids (%)	54.0	81.0	85.0	74.0	80.0	85.0	85.0	79.0	75.0	61.0
VOCs										
Benzene	<0.10	<0.13	<0.12	<0.14	4.99	<0.11	0.64	<0.13	2.38	8.95
Toluene	0.70	<0.13	0.18	0.15	30.3	0.30	7.76	0.48	4.68	23.4
Ethylbenzene	6.33	1.54	5.34	3.20	64.6	3.07	28.4	3.16	23.0	50.2
m/p-Xylene	5.99	1.16	3.22	2.41	52.4	2.71	27.0	3.11	16.0	37.6
Stryene	0.80	<0.13	0.22	<0.14	2.41	0.22	3.28	0.21	0.58	1.78
o-Xylene	3.18	0.68	2.14	1.32	28.5	1.70	14.3	1.38	8.37	19.9
1,2,4-Trimethylbenzene	10.7	1.73	5.83	4.25	49.2	4.68	31.7	4.56	16.4	33.1
Total VOCs	27.70	5.11	16.93	11.33	232.40	12.68	113.08	12.90	71.41	174.93
SVOCs										
Naphthalene	116	30.7	210	62.5	1,280	54.0	859	56.1	318	974
2-Methylnaphthalene	117	27.5	86.3	58.9	1,070	53.3	733	55.2	258	786
1-Methylnaphthalene	90.0	18.7	58.1	41.6	783	40.1	546	43.1	114	172
Acenaphthylene	8.67	1.23	3.89	2.44	29.2	3.31	72.6	3.05	9.36	17.4
Acenaphthene	75.1	15.0	61.2	34.6	517	27.3	102	33.4	101	127
Dibenzofuran	9.97	1.57	3.18	3.99	33.5	4.44	25.7	4.33	10.2	24.6
Fluorene	38.2	6.43	24.9	16.1	89.7	13.3	77.3	15.8	47.5	63.1
Phenanthrene	94.2	16.8	65.3	36.2	556	32.0	541	38.9	107	406
Anthracene	41.2	7.32	24.9	16.7	250	13.8	211	16.1	47.6	63.7
Fluoranthene	41.0	6.05	29.0	13.0	65.5	12.3	69.9	15.4	42.1	50.4
Pyrene	54.3	7.89	41.0	16.9	77.3	16.3	90.9	20.4	57.5	62.7
Benzo(a)anthracene	22.6	3.08	14.1	6.87	33.3	6.68	36.9	7.82	21.3	26.6
Chrysene	20.3	2.77	12.8	6.07	29.6	5.90	33.6	7.18	19.7	22.9
Benzo(b)fluoranthene	10.7	1.35	5.49	3.15	15.2	2.95	14.8	2.86	8.72	10.6
Benzo(k)fluoranthene	10.4	1.51	7.74	3.16	13.7	3.29	19.4	4.23	10.7	11.5
Benzo(a)pyrene	19.4	2.43	13.1	5.31	25.6	5.61	32.0	6.38	19.4	19.0
Indeno (1,2,3-cd)pyrene	9.04	1.00	8.07	2.34	15.0	2.56	18.3	2.80	9.02	9.92
Dibenzo(a,h)anthracene	1.71	0.21	1.00	0.51	3.44	0.53	3.89	0.52	1.67	2.24
Benzo(g,h,I)perylene	8.11	0.88	5.56	1.94	11.8	2.12	16.4	2.48	8.17	7.27
TOTAL SVOCs	787.9	152.42	675.63	332.28	4898.84	299.79	3503.69	336.05	1210.94	2856.93

All units report in mg/kg

TABLE 3
META ENVIRONMENTAL- SEDMIMENT SAMPLE RESULTS

Parameter	SD-9	SD-15	SD-34	SD-37	SD-47	SD-48	SD-50	SD-51	SD-54	SD-56
Depth	2-4	4-6	0-2	2-4	2-4	6-8	8-10	6-8	2-4	2-4
Solids (%)	54.0	81.0	85.0	74.0	80.0	85.0	85.0	79.0	75.0	61.0
VOCs										
Benzene	<0.10	<0.13	<0.12	<0.14	4.99	<0.11	0.64	<0.13	2.38	8.95
Toluene	0.70	<0.13	0.18	0.15	30.3	0.30	7.76	0.48	4.68	23.4
Ethylbenzene	6.33	1.54	5.34	3.20	64.6	3.07	28.4	3.16	23.0	50.2
m/p-Xylene	5.99	1.16	3.22	2.41	52.4	2.71	27.0	3.11	16.0	37.6
Stryene	0.80	<0.13	0.22	<0.14	2.41	0.22	3.28	0.21	0.58	1.78
o-Xylene	3.18	0.68	2.14	1.32	28.5	1.70	14.3	1.38	8.37	19.9
1,2,4-Trimethylbenzene	10.7	1.73	5.83	4.25	49.2	4.68	31.7	4.56	16.4	33.1
Total VOCs	27.70	5.11	16.93	11.33	232.40	12.68	113.08	12.90	71.41	174.93
SVOCs										
Naphthalene	116	30.7	210	62.5	1,280	54.0	859	56.1	318	974
2-Methylnaphthalene	117	27.5	86.3	58.9	1,070	53.3	733	55.2	258	786
1-Methylnaphthalene	90.0	18.7	58.1	41.6	783	40.1	546	43.1	114	172
Acenaphthylene	8.67	1.23	3.89	2.44	29.2	3.31	72.6	3.05	9.36	17.4
Acenaphthene	75.1	15.0	61.2	34.6	517	27.3	102	33.4	101	127
Dibenzofuran	9.97	1.57	3.18	3.99	33.5	4.44	25.7	4.33	10.2	24.6
Fluorene	38.2	6.43	24.9	16.1	89.7	13.3	77.3	15.8	47.5	63.1
Phenanthrene	94.2	16.8	65.3	36.2	556	32.0	541	38.9	107	406
Anthracene	41.2	7.32	24.9	16.7	250	13.8	211	16.1	47.6	63.7
Fluoranthene	41.0	6.05	29.0	13.0	65.5	12.3	69.9	15.4	42.1	50.4
Pyrene	54.3	7.89	41.0	16.9	77.3	16.3	90.9	20.4	57.5	62.7
Benzo(a)anthracene	22.6	3.08	14.1	6.87	33.3	6.68	36.9	7.82	21.3	26.6
Chrysene	20.3	2.77	12.8	6.07	29.6	5.90	33.6	7.18	19.7	22.9
Benzo(b)fluoranthene	10.7	1.35	5.49	3.15	15.2	2.95	14.8	2.86	8.72	10.6
Benzo(k)fluoranthene	10.4	1.51	7.74	3.16	13.7	3.29	19.4	4.23	10.7	11.5
Benzo(a)pyrene	19.4	2.43	13.1	5.31	25.6	5.61	32.0	6.38	19.4	19.0
Indeno (1,2,3-cd)pyrene	9.04	1.00	8.07	2.34	15.0	2.56	18.3	2.80	9.02	9.92
Dibenzo(a,h)anthracene	1.71	0.21	1.00	0.51	3.44	0.53	3.89	0.52	1.67	2.24
Benzo(g,h,I)perylene	8.11	0.88	5.56	1.94	11.8	2.12	16.4	2.48	8.17	7.27
TOTAL SVOCs	787.9	152.42	675.63	332.28	4898.84	299.79	3503.69	336.05	1210.94	2856.93

All units report in mg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-1	SD-1	SD-1	SD-1	SD-2	SD-2	SD-2
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Solids (%)	77.5	78.4	79.3	82.3	70.6	80.7	81.7
Acenaphthene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Acenaphthylene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Antracene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Benzo(a)anthracene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Benzo(b)fluoranthene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Benzo(k)fluoranthene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Benzo(g,h,I)perylene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Benzo(a)pyrene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Chrysene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Dibenzo(a,h)anthracene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Fluoranthene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Fluorene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Indeno (1,2,3-cd)pyrene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
2-Methylnaphthalene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Naphthalene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Phenanthrene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
Pyrene	<0.43	<0.42	<0.42	<0.40	<0.47	<0.41	<0.40
TOTAL PAHs	0	0	0	0	0	0	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-1	SD-1	SD-1	SD-1	SD-2	SD-2	SD-2
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Benzene	<32	<32	<32	<30	<35	<31	<31
Bromobenzene	<32	<32	<32	<30	<35	<31	<31
Bromochloromethane	<32	<32	<32	<30	<35	<31	<31
Bromodichloromethane	<32	<32	<32	<30	<35	<31	<31
Bromoform	<32	<32	<32	<30	<35	<31	<31
Bromomethane	<129	<128	<126	<122	<142	<124	<122
n-Butylbenzene	<32	<32	<32	<30	<35	<31	<31
sec-Butylbenzene	<32	<32	<32	<30	<35	<31	<31
tert-Butylbenzene	<32	<32	<32	<30	<35	<31	<31
Carbon Tetrachloride	<32	<32	<32	<30	<35	<31	<31
Chlorobenzene	<32	<32	<32	<30	<35	<31	<31
Chlorodibromethane	<32	<32	<32	<30	<35	<31	<31
Chloroethane	<45	<45	<44	<43	<50	<43	<43
Chloroform	<32	<32	<32	<30	<35	<31	<31
Chloromethane	<65	<64	<63	<61	<71	<62	<61
2-Chlorotolunene	<32	<32	<32	<30	<35	<31	<31
4-Chlorotolunene	<32	<32	<32	<30	<35	<31	<31
1,2-Dibromo-3-Chloropropane	<65	<64	<63	<61	<71	<62	<61
1,2-Dibromethane (EDB)	<32	<32	<32	<30	<35	<31	<31
Dibromomethane	<32	<32	<32	<30	<35	<31	<31
1,2-Dichlorobenzene	<32	<32	<32	<30	<35	<31	<31
1,3-Dichlorobenzene	<32	<32	<32	<30	<35	<31	<31
1,4-Dichlorobenzene	<32	<32	<32	<30	<35	<31	<31
Dichlorodifluoromethane	<32	<32	<32	<30	<35	<31	<31
1,1-Dichloroethane	<32	<32	<32	<30	<35	<31	<31
1,2-Dichloroethane	<32	<32	<32	<30	<35	<31	<31
1,1-Dichloroethene	<32	<32	<32	<30	<35	<31	<31
cis-1,2-Dichloroethene	<32	<32	<32	<30	<35	<31	<31
trans-1,2-Dichloroethene	<32	<32	<32	<30	<35	<31	<31
1,2-Dichloropropane	<32	<32	<32	<30	<35	<31	<31
1,3-Dichloropropane	<32	<32	<32	<30	<35	<31	<31
2,2-Dichloropropane	<32	<32	<32	<30	<35	<31	<31
1,1-Dichloropropene	<32	<32	<32	<30	<35	<31	<31
cis-1,3-Dichloropropene	<32	<32	<32	<30	<35	<31	<31
trans-1,3-Dichloropropene	<32	<32	<32	<30	<35	<31	<31
Di-isopropyl ether	<32	<32	<32	<30	<35	<31	<31
Ethylbenzene	<32	<32	<32	<30	<35	<31	<31
Hexachlorobutadiene	<45	<45	<44	<43	<50	<43	<43
Isopropylbenzene	<32	<32	<32	<30	<35	<31	<31
p-Isopropyltoluene	<32	<32	<32	<30	<35	<31	<31
Methylene Chloride	<65	<64	**164 L**	**134 L**	<71	<62	<61
Methyl-t-butyl-ether	<32	<32	<32	<30	<35	<31	<31
Naphthalene	<32	<32	<32	<30	<35	<31	<31
n-Propylbenzene	<32	<32	<32	<30	<35	<31	<31
Styrene	<32	<32	<32	<30	<35	<31	<31
1,1,1,2-Tetrachloroethane	<32	<32	<32	<30	<35	<31	<31
1,1,2,2-Tetrachloroethane	<32	<32	<32	<30	<35	<31	<31
Tetrachloroethane	<32	<32	<32	<30	<35	<31	<31
Toluene	**46**	<32	<32	<30	<35	<31	<31
1,2,3-Trichlorobenzene	<32	<32	<32	<30	<35	<31	<31
1,2,4-Trichlorobenzene	<32	<32	<32	<30	<35	<31	<31
1,1,1-Trichloroethane	<32	<32	<32	<30	<35	<31	<31
1,1,2-Trichloroethane	<32	<32	<32	<30	<35	<31	<31
Trichloroethene	<32	<32	<32	<30	<35	<31	<31
Trichlorofluoromethane	<32	<32	<32	<30	<35	<31	<31
1,2,3-Trichloropropane	<32	<32	<32	<30	<35	<31	<31
1,2,4-Trimethylbenzene	<32	<32	<32	<30	<35	<31	<31
1,3,5-Trimethylbenzene	<32	<32	<32	<30	<35	<31	<31
Vinyl Chloride	<32	<32	<32	<30	<35	<31	<31
Xylene, total	<45	<45	<44	<43	<50	<43	<43
TOTAL VOCs + Naphthalene	46	0	0	0	0	0	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-3	SD-3	SD-3	SD-3	SD-4	SD-4	SD-4	SD-4
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Solids (%)	65.6	80.0	80.0	82.0	48.6	81.3	83.4	83.3
Acenaphthene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Acenaphthylene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Antracene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Benzo(a)anthracene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Benzo(b)fluoranthene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Benzo(k)fluoranthene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Benzo(g,h,I)perylene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Benzo(a)pyrene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Chrysene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Dibenzo(a,h)anthracene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Fluoranthene	0.5	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Fluorene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Indeno (1,2,3-cd)pyrene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
2-Methylnaphthalene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Naphthalene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Phenanthrene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
Pyrene	<0.50	<0.41	<0.41	<0.40	<0.68	<0.41	<0.40	<0.40
TOTAL PAHs	0.5	0	0	0	0	0	0	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-3	SD-3	SD-3	SD-3	SD-4	SD-4	SD-4	SD-4
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Benzene	<38	<31	<31	<30	<51	<31	<30	55
Bromobenzene	<38	<31	<31	<30	<51	<31	<30	<30
Bromochloromethane	<38	<31	<31	<30	<51	<31	<30	<30
Bromodichloromethane	<38	<31	<31	<30	<51	<31	<30	<30
Bromoform	<38	<31	<31	<30	<51	<31	<30	<30
Bromomethane	<152	<125	<125	<122	<206	<123	<120	<120
n-Butylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
sec-Butylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
tert-Butylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Carbon Tetrachloride	<38	<31	<31	<30	<51	<31	<30	<30
Chlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
Chlorodibromethane	<38	<31	<31	<30	<51	<31	<30	<30
Chloroethane	<38	<44	<44	<43	<72	<43	<42	<42
Chloroform	<38	<31	<31	<30	<51	<31	<30	<30
Chloromethane	<76	<62	<62	<61	<100	<62	<60	<60
2-Chlorotolunene	<38	<31	<31	<30	<51	<31	<30	<30
4-Chlorotolunene	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dibromo-3-Chloropropane	<76	<62	<62	<61	<100	<62	<60	<60
1,2-Dibromethane (EDB)	<38	<31	<31	<30	<51	<31	<30	<30
Dibromomethane	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,3-Dichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,4-Dichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
Dichlorodifluoromethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1-Dichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1-Dichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
cis-1,2-Dichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
trans-1,2-Dichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
1,3-Dichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
2,2-Dichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
1,1-Dichloropropene	<38	<31	<31	<30	<51	<31	<30	<30
cis-1,3-Dichloropropene	<38	<31	<31	<30	<51	<31	<30	<30
trans-1,3-Dichloropropene	<38	<31	<31	<30	<51	<31	<30	<30
Di-isopropyl ether	<38	<31	<31	<30	<51	<31	<30	<30
Ethylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Hexachlorobutadiene	<53	<44	<44	<43	<72	<43	<42	<42
Isopropylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
p-Isopropyltoluene	1,520	<31	<31	<30	267	<31	<30	<30
Methylene Chloride	<76	88 L	<31	159 L	<100	<62	88 L	420
Methyl-t-butyl-ether	<38	<31	<31	<30	<51	<31	<30	<30
Naphthalene	<38	<31	<31	<30	<51	<31	<30	<30
n-Propylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Styrene	<38	<31	<31	<30	<51	<31	<30	<30
1,1,1,2-Tetrachloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1,2,2-Tetrachloroethane	<38	<31	<31	<30	<51	<31	<30	<30
Tetrachloroethane	<38	<31	<31	<30	<51	<31	<30	<30
Toluene	<38	<31	<31	<30	391	<31	<30	<30
1,2,3-Trichlorobenzene	53	<31	<31	<30	<51	<31	<30	<30
1,2,4-Trichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,1,1-Trichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1,2-Trichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
Trichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
Trichlorofluoromethane	<38	<31	<31	<30	<51	<31	<30	<30
1,2,3-Trichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
1,2,4-Trimethylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,3,5-Trimethylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Vinyl Chloride	<38	<31	<31	<30	<51	<31	<30	<30
Xylene, total	<53	<44	<44	<43	<72	<43	<42	<42
TOTAL VOCs + Naphthalene	1573	0	0	0	658	0	0	475

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-3	SD-3	SD-3	SD-3	SD-4	SD-4	SD-4	SD-4
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Benzene	<38	<31	<31	<30	<51	<31	<30	55
Bromobenzene	<38	<31	<31	<30	<51	<31	<30	<30
Bromochloromethane	<38	<31	<31	<30	<51	<31	<30	<30
Bromodichloromethane	<38	<31	<31	<30	<51	<31	<30	<30
Bromoform	<38	<31	<31	<30	<51	<31	<30	<30
Bromomethane	<152	<125	<125	<122	<206	<123	<120	<120
n-Butylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
sec-Butylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
tert-Butylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Carbon Tetrachloride	<38	<31	<31	<30	<51	<31	<30	<30
Chlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
Chlorodibromethane	<38	<31	<31	<30	<51	<31	<30	<30
Chloroethane	<38	<44	<44	<43	<72	<43	<42	<42
Chloroform	<38	<31	<31	<30	<51	<31	<30	<30
Chloromethane	<76	<62	<62	<61	<100	<62	<60	<60
2-Chlorotolunene	<38	<31	<31	<30	<51	<31	<30	<30
4-Chlorotolunene	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dibromo-3-Chloropropane	<76	<62	<62	<61	<100	<62	<60	<60
1,2-Dibromethane (EDB)	<38	<31	<31	<30	<51	<31	<30	<30
Dibromomethane	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,3-Dichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,4-Dichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
Dichlorodifluoromethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1-Dichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1-Dichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
cis-1,2-Dichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
trans-1,2-Dichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
1,2-Dichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
1,3-Dichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
2,2-Dichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
1,1-Dichloropropene	<38	<31	<31	<30	<51	<31	<30	<30
cis-1,3-Dichloropropene	<38	<31	<31	<30	<51	<31	<30	<30
trans-1,3-Dichloropropene	<38	<31	<31	<30	<51	<31	<30	<30
Di-isopropyl ether	<38	<31	<31	<30	<51	<31	<30	<30
Ethylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Hexachlorobutadiene	<53	<44	<44	<43	<72	<43	<42	<42
Isopropylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
p-Isopropyltoluene	1,520	<31	<31	<30	267	<31	<30	<30
Methylene Chloride	<76	88 L	<31	159 L	<100	<62	88 L	420
Methyl-t-butyl-ether	<38	<31	<31	<30	<51	<31	<30	<30
Naphthalene	<38	<31	<31	<30	<51	<31	<30	<30
n-Propylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Styrene	<38	<31	<31	<30	<51	<31	<30	<30
1,1,1,2-Tetrachloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1,2,2-Tetrachloroethane	<38	<31	<31	<30	<51	<31	<30	<30
Tetrachloroethane	<38	<31	<31	<30	<51	<31	<30	<30
Toluene	<38	<31	<31	<30	391	<31	<30	<30
1,2,3-Trichlorobenzene	53	<31	<31	<30	<51	<31	<30	<30
1,2,4-Trichlorobenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,1,1-Trichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
1,1,2-Trichloroethane	<38	<31	<31	<30	<51	<31	<30	<30
Trichloroethene	<38	<31	<31	<30	<51	<31	<30	<30
Trichlorofluoromethane	<38	<31	<31	<30	<51	<31	<30	<30
1,2,3-Trichloropropane	<38	<31	<31	<30	<51	<31	<30	<30
1,2,4-Trimethylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
1,3,5-Trimethylbenzene	<38	<31	<31	<30	<51	<31	<30	<30
Vinyl Chloride	<38	<31	<31	<30	<51	<31	<30	<30
Xylene, total	<53	<44	<44	<43	<72	<43	<42	<42
TOTAL VOCs + Naphthalene	1573	0	0	0	658	0	0	475

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-5	SD-5	SD-5	SD-6	SD-6	SD-6	SD-6
Depth	2-4	4-6	6-8	0-2	2-4	4-6	8-10
Solids (%)	73.0	75.2	80.7	49.6	78.2	80.7	85.2
Acenaphthene	<0.45	<0.44	<0.41	**65**	<0.63	<0.41	<0.39
Acenaphthylene	<0.45	<0.44	<0.41	**6.0**	<0.63	<0.41	<0.39
Antracene	<0.45	<0.44	<0.41	**28**	<0.63	<0.41	<0.39
Benzo(a)anthracene	<0.45	<0.44	<0.41	**10**	<0.63	<0.41	<0.39
Benzo(b)fluoranthene	<0.45	<0.44	<0.41	**3.4**	<0.63	<0.41	<0.39
Benzo(k)fluoranthene	<0.45	<0.44	<0.41	**4.6**	<0.63	<0.41	<0.39
Benzo(g,h,I)perylene	<0.45	<0.44	<0.41	<3.2	<0.63	<0.41	<0.39
Benzo(a)pyrene	<0.45	<0.44	<0.41	**7.3**	<0.63	<0.41	<0.39
Chrysene	<0.45	<0.44	<0.41	**9.1**	<0.63	<0.41	<0.39
Dibenzo(a,h)anthracene	<0.45	<0.44	<0.41	<0.67	<0.63	<0.41	<0.39
Fluoranthene	<0.45	<0.44	<0.41	**26**	<0.63	<0.41	<0.39
Fluorene	<0.45	<0.44	<0.41	**30**	<0.63	<0.41	<0.39
Indeno (1,2,3-cd)pyrene	<0.45	<0.44	<0.41	<3.2	<0.63	<0.41	<0.39
2-Methylnaphthalene	<0.45	<0.44	<0.41	**160**	**0.66**	<0.41	<0.39
Naphthalene	<0.45	<0.44	<0.41	**222**	**0.97**	<0.41	<0.39
Phenanthrene	<0.45	<0.44	<0.41	**77**	**0.69**	<0.41	<0.39
Pyrene	<0.45	<0.44	<0.41	**34**	<0.63	<0.41	<0.39
TOTAL PAHs	0	0	0	549	2.32	0	0

All units report in mg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-5	SD-5	SD-5	SD-6	SD-6	SD-6	SD-6
Depth	2-4	4-6	6-8	0-2	2-4	4-6	8-10
Benzene	<34	<33	<31	<10,100	<32	<31	<29
Bromobenzene	<34	<33	<31	<10,100	<32	<31	<29
Bromochloromethane	<34	<33	<31	<10,100	<32	<31	<29
Bromodichloromethane	<34	<33	<31	<10,100	<32	<31	<29
Bromoform	<34	<33	<31	<10,100	<32	<31	<29
Bromomethane	<137	<133	<124	<40,300	<128	<124	<117
n-Butylbenzene	<34	<33	<31	<10,100	<32	<31	<29
sec-Butylbenzene	<34	<33	<31	<10,100	<32	<31	<29
tert-Butylbenzene	<34	<33	<31	<10,100	<32	<31	<29
Carbon Tetrachloride	<34	<33	<31	<10,100	<32	<31	<29
Chlorobenzene	<34	<33	<31	<10,100	<32	<31	<29
Chlorodibromethane	<34	<33	<31	<10,100	<32	<31	<29
Chloroethane	<48	<47	<43	<14,100	<45	<43	<41
Chloroform	<34	<33	<31	<10,100	<32	<31	<29
Chloromethane	<68	<66	<62	<20,200	<64	<62	<59
2-Chlorotolunene	<34	<33	<31	<10,100	<32	<31	<29
4-Chlorotolunene	<34	<33	<31	<10,100	<32	<31	<29
1,2-Dibromo-3-Chloropropane	<68	<66	<62	<20,200	<64	<62	<59
1,2-Dibromethane (EDB)	<34	<33	<31	<10,100	<32	<31	<29
Dibromomethane	<34	<33	<31	<10,100	<32	<31	<29
1,2-Dichlorobenzene	<34	<33	<31	<10,100	<32	<31	<29
1,3-Dichlorobenzene	<34	<33	<31	<10,100	<32	<31	<29
1,4-Dichlorobenzene	<34	<33	<31	<10,100	<32	<31	<29
Dichlorodifluoromethane	<34	<33	<31	<10,100	<32	<31	<29
1,1-Dichloroethane	<34	<33	<31	<10,100	<32	<31	<29
1,2-Dichloroethane	<34	<33	<31	<10,100	<32	<31	<29
1,1-Dichloroethene	<34	<33	<31	<10,100	<32	<31	<29
cis-1,2-Dichloroethene	<34	<33	<31	<10,100	<32	<31	<29
trans-1,2-Dichloroethene	<34	<33	<31	<10,100	<32	<31	<29
1,2-Dichloropropane	<34	<33	<31	<10,100	<32	<31	<29
1,3-Dichloropropane	<34	<33	<31	<10,100	<32	<31	<29
2,2-Dichloropropane	<34	<33	<31	<10,100	<32	<31	<29
1,1-Dichloropropene	<34	<33	<31	<10,100	<32	<31	<29
cis-1,3-Dichloropropene	<34	<33	<31	<10,100	<32	<31	<29
trans-1,3-Dichloropropene	<34	<33	<31	<10,100	<32	<31	<29
Di-isopropyl ether	<34	<33	<31	<10,100	<32	<31	<29
Ethylbenzene	<34	<33	<31	<10,100	**153**	<31	<29
Hexachlorobutadiene	<48	<47	<43	<14,100	<45	<43	<41
Isopropylbenzene	<34	<33	<31	<10,100	<32	<31	<29
p-Isopropyltoluene	**1,330**	<33	<31	<10,100	<32	<31	<29
Methylene Chloride	<68	<66	<62	<20,200	**73 L**	**90 L**	**73 L**
Methyl-t-butyl-ether	<34	<33	<31	<10,100	<32	<31	<29
Naphthalene	<34	<33	<31	**242,000**	**1,130**	**186**	<29
n-Propylbenzene	<34	<33	<31	<10,100	<32	<31	<29
Styrene	<34	<33	<31	<10,100	<32	<31	<29
1,1,1,2-Tetrachloroethane	<34	<33	<31	<10,100	<32	<31	<29
1,1,2,2-Tetrachloroethane	<34	<33	<31	<10,100	<32	<31	<29
Tetrachloroethane	<34	<33	<31	<10,100	<32	<31	<29
Toluene	<34	<33	<31	<10,100	<32	<31	<29
1,2,3-Trichlorobenzene	<34	<33	<31	<10,100	<32	<31	<29
1,2,4-Trichlorobenzene	<34	<33	<31	<10,100	<32	<31	<29
1,1,1-Trichloroethane	<34	<33	<31	<10,100	<32	<31	<29
1,1,2-Trichloroethane	<34	<33	<31	<10,100	<32	<31	<29
Trichloroethene	<34	<33	<31	<10,100	<32	<31	<29
Trichlorofluoromethane	<34	<33	<31	<10,100	<32	<31	<29
1,2,3-Trichloropropane	<34	<33	<31	<10,100	<32	<31	<29
1,2,4-Trimethylbenzene	<34	<33	<31	<10,100	**54**	<31	<29
1,3,5-Trimethylbenzene	<34	<33	<31	<10,100	<32	<31	<29
Vinyl Chloride	<34	<33	<31	<10,100	<32	<31	<29
Xylene, total	<48	<47	<43	<14,100	**141**	<43	<41
TOTAL VOCs + Naphthalene	1330	0	0	242000	1478	186	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-7	SD-7	SD-7	SD-7	SD-8	SD-8	SD-8
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Solids (%)	70.9	77.7	85.4	82.2	77.9	80.5	82.6
Acenaphthene	34	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Acenaphthylene	3.8	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Antracene	17	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Benzo(a)anthracene	8.2	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Benzo(b)fluoranthene	3.1	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Benzo(k)fluoranthene	3.9	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Benzo(g,h,I)perylene	2.7	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Benzo(a)pyrene	6.2	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Chrysene	7.2	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Dibenzo(a,h)anthracene	<2.3	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Fluoranthene	17	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Fluorene	17	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Indeno (1,2,3-cd)pyrene	2.5	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
2-Methylnaphthalene	69	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Naphthalene	82	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Phenanthrene	42	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
Pyrene	23	<0.42	<0.39	<0.40	<0.42	<0.41	<0.40
TOTAL PAHs	252.5	0	0	0	0	0	0

All units report in mg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-7	SD-7	SD-7	SD-7	SD-8	SD-8	SD-8
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Benzene	<3,530	<32	<29	<30	<36	<31	<30
Bromobenzene	<3,530	<32	<29	<30	<36	<31	<30
Bromochloromethane	<3,530	<32	<29	<30	<36	<31	<30
Bromodichloromethane	<3,530	<32	<29	<30	<36	<31	<30
Bromoform	<3,530	<32	<29	<30	<36	<31	<30
Bromomethane	<14,100	<129	<117	<122	<141	<124	<121
n-Butylbenzene	<3,530	<32	<29	<30	<36	<31	<30
sec-Butylbenzene	<3,530	<32	<29	<30	<36	<31	<30
tert-Butylbenzene	<3,530	<32	<29	<30	<36	<31	<30
Carbon Tetrachloride	<3,530	<32	<29	<30	<36	<31	<30
Chlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
Chlorodibromethane	<3,530	<32	<29	<30	<36	<31	<30
Chloroethane	<4,940	<45	<41	<43	<49	<43	<42
Chloroform	<3,530	<32	<29	<30	<36	<31	<30
Chloromethane	<7,050	<64	<59	<61	<71	<62	<61
2-Chlorotolunene	<3,530	<32	<29	<30	<36	<31	<30
4-Chlorotolunene	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dibromo-3-Chloropropane	<7,050	<64	<59	<61	<71	<62	<61
1,2-Dibromethane (EDB)	<3,530	<32	<29	<30	<36	<31	<30
Dibromomethane	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,3-Dichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,4-Dichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
Dichlorodifluoromethane	<3,530	<32	<29	<30	<36	<31	<30
1,1-Dichloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dichloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,1-Dichloroethene	<3,530	<32	<29	<30	<36	<31	<30
cis-1,2-Dichloroethene	<3,530	<32	<29	<30	<36	<31	<30
trans-1,2-Dichloroethene	<3,530	<32	<29	<30	<36	<31	<30
1,2-Dichloropropane	<3,530	<32	<29	<30	<36	<31	<30
1,3-Dichloropropane	<3,530	<32	<29	<30	<36	<31	<30
2,2-Dichloropropane	<3,530	<32	<29	<30	<36	<31	<30
1,1-Dichloropropene	<3,530	<32	<29	<30	<36	<31	<30
cis-1,3-Dichloropropene	<3,530	<32	<29	<30	<36	<31	<30
trans-1,3-Dichloropropene	<3,530	<32	<29	<30	<36	<31	<30
Di-isopropyl ether	<3,530	<32	<29	<30	<36	<31	<30
Ethylbenzene	<3,530	**72**	<29	<30	<36	<31	<30
Hexachlorobutadiene	<4,940	<45	<41	<43	<49	<43	<42
Isopropylbenzene	<3,530	<32	<29	<30	<36	<31	<30
p-Isopropyltoluene	<3,530	<32	<29	<30	<36	<31	<30
Methylene Chloride	<7,050	<64	**63 L**	**100 L**	<71	**65 L**	**85 L**
Methyl-t-butyl-ether	<3,530	<32	<29	<30	<36	<31	<30
Naphthalene	**59,200**	**656**	<29	<30	<36	<31	<30
n-Propylbenzene	<3,530	<32	<29	<30	<36	<31	<30
Styrene	<3,530	<32	<29	<30	<36	<31	<30
1,1,1,2-Tetrachloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,1,2,2-Tetrachloroethane	<3,530	<32	<29	<30	<36	<31	<30
Tetrachloroethane	<3,530	<32	<29	<30	<36	<31	<30
Toluene	<3,530	<32	<29	<30	<36	<31	<30
1,2,3-Trichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,2,4-Trichlorobenzene	<3,530	<32	<29	<30	<36	<31	<30
1,1,1-Trichloroethane	<3,530	<32	<29	<30	<36	<31	<30
1,1,2-Trichloroethane	<3,530	<32	<29	<30	<36	<31	<30
Trichloroethene	<3,530	<32	<29	<30	<36	<31	<30
Trichlorofluoromethane	<3,530	<32	<29	<30	<36	<31	<30
1,2,3-Trichloropropane	<3,530	<32	<29	<30	<36	<31	<30
1,2,4-Trimethylbenzene	**3,670**	**33**	<29	<30	<36	<31	<30
1,3,5-Trimethylbenzene	<3,530	<32	<29	<30	<36	<31	<30
Vinyl Chloride	<3,530	<32	<29	<30	<36	<31	<30
Xylene, total	<4,940	**63**	<41	<43	<49	<43	<42
TOTAL VOCs + Naphthalene	62870	824	0	0	0	0	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-9	SD-9	SD-10	SD-10
Depth	4-6	6-8	4-6	6-8
Solids (%)	80.3	83.7	78.3	80.8
Acenaphthene	**0.57**	<0.39	<0.42	<0.41
Acenaphthylene	<0.41	<0.39	<0.42	<0.41
Antracene	<0.41	<0.39	<0.42	<0.41
Benzo(a)anthracene	<0.41	<0.39	<0.42	<0.41
Benzo(b)fluoranthene	<0.41	<0.39	<0.42	<0.41
Benzo(k)fluoranthene	<0.41	<0.39	<0.42	<0.41
Benzo(g,h,I)perylene	<0.41	<0.39	<0.42	<0.41
Benzo(a)pyrene	<0.41	<0.39	<0.42	<0.41
Chrysene	<0.41	<0.39	<0.42	<0.41
Dibenzo(a,h)anthracene	<0.41	<0.39	<0.42	<0.41
Fluoranthene	<0.41	<0.39	<0.42	<0.41
Fluorene	<0.41	<0.39	<0.42	<0.41
Indeno (1,2,3-cd)pyrene	<0.41	<0.39	<0.42	<0.41
2-Methylnaphthalene	**1.1**	<0.39	<0.42	<0.41
Naphthalene	**1.5**	<0.39	<0.42	<0.41
Phenanthrene	<0.41	<0.39	<0.42	<0.41
Pyrene	<0.41	<0.39	<0.42	<0.41
TOTAL PAHs	2.6	0	0	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-9	SD-9	SD-10	SD-10
Depth	4-6	6-8	4-6	6-8
Benzene	<31	<30	<32	<31
Bromobenzene	<31	<30	<32	<31
Bromochloromethane	<31	<30	<32	<31
Bromodichloromethane	<31	<30	<32	<31
Bromoform	<31	<30	<32	<31
Bromomethane	<125	<119	<128	<124
n-Butylbenzene	<31	<30	<32	<31
sec-Butylbenzene	<31	<30	<32	<31
tert-Butylbenzene	<31	<30	<32	<31
Carbon Tetrachloride	<31	<30	<32	<31
Chlorobenzene	<31	<30	<32	<31
Chlorodibromethane	<31	<30	<32	<31
Chloroethane	<44	<42	<45	<43
Chloroform	<31	<30	<32	<31
Chloromethane	<62	<60	<64	<62
2-Chlorotolunene	<31	<30	<32	<31
4-Chlorotolunene	<31	<30	<32	<31
1,2-Dibromo-3-Chloropropane	<62	<60	<64	<62
1,2-Dibromethane (EDB)	<31	<30	<32	<31
Dibromomethane	<31	<30	<32	<31
1,2-Dichlorobenzene	<31	<30	<32	<31
1,3-Dichlorobenzene	<31	<30	<32	<31
1,4-Dichlorobenzene	<31	<30	<32	<31
Dichlorodifluoromethane	<31	<30	<32	<31
1,1-Dichloroethane	<31	<30	<32	<31
1,2-Dichloroethane	<31	<30	<32	<31
1,1-Dichloroethene	<31	<30	<32	<31
cis-1,2-Dichloroethene	<31	<30	<32	<31
trans-1,2-Dichloroethene	<31	<30	<32	<31
1,2-Dichloropropane	<31	<30	<32	<31
1,3-Dichloropropane	<31	<30	<32	<31
2,2-Dichloropropane	<31	<30	<32	<31
1,1-Dichloropropene	<31	<30	<32	<31
cis-1,3-Dichloropropene	<31	<30	<32	<31
trans-1,3-Dichloropropene	<31	<30	<32	<31
Di-isopropyl ether	<31	<30	<32	<31
Ethylbenzene	**149**	<30	<32	<31
Hexachlorobutadiene	<44	<42	<45	<43
Isopropylbenzene	<31	<30	<32	<31
p-Isopropyltoluene	**32**	<30	**37**	<31
Methylene Chloride	<62	<60	**84 L**	**120 L**
Methyl-t-butyl-ether	<31	<30	<32	<31
Naphthalene	**2,490**	**57**	**77**	<31
n-Propylbenzene	<31	<30	<32	<31
Styrene	<31	<30	<32	<31
1,1,1,2-Tetrachloroethane	<31	<30	<32	<31
1,1,2,2-Tetrachloroethane	<31	<30	<32	<31
Tetrachloroethane	<31	<30	<32	<31
Toluene	<31	<30	**153**	<31
1,2,3-Trichlorobenzene	<31	<30	<32	<31
1,2,4-Trichlorobenzene	<31	<30	<32	<31
1,1,1-Trichloroethane	<31	<30	<32	<31
1,1,2-Trichloroethane	<31	<30	<32	<31
Trichloroethene	<31	<30	<32	<31
Trichlorofluoromethane	<31	<30	<32	<31
1,2,3-Trichloropropane	<31	<30	<32	<31
1,2,4-Trimethylbenzene	**137**	<30	<32	<31
1,3,5-Trimethylbenzene	**54**	<30	<32	<31
Vinyl Chloride	<31	<30	<32	<31
Xylene, total	**212**	<42	**92**	<43
TOTAL VOCs + Naphthalene	3074	57	359	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-11	SD-11	SD-11	SD-11	SD-12	SD-12	SD-12
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Solids (%)	70.8	77.2	80.5	84.0	75.9	84.9	83.5
Acenaphthene	**1.1**	<0.43	<0.41	<0.39	**1.8**	<0.39	<0.40
Acenaphthylene	**0.49**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Antracene	**1.1**	<0.43	<0.41	<0.39	**0.59**	<0.39	<0.40
Benzo(a)anthracene	**1.1**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Benzo(b)fluoranthene	**0.61**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Benzo(k)fluoranthene	**0.73**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Benzo(g,h,I)perylene	**0.58**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Benzo(a)pyrene	**1.2**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Chrysene	**1.2**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Dibenzo(a,h)anthracene	<0.47	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
Fluoranthene	**2.3**	<0.43	<0.41	<0.39	**0.99**	<0.39	<0.40
Fluorene	<0.47	<0.43	<0.41	<0.39	**0.75**	<0.39	<0.40
Indeno (1,2,3-cd)pyrene	**0.56**	<0.43	<0.41	<0.39	<0.43	<0.39	<0.40
2-Methylnaphthalene	**1.4**	<0.43	<0.41	<0.39	**2.8**	<0.39	<0.40
Naphthalene	**1.6**	<0.43	<0.41	<0.39	**5.9**	<0.39	<0.40
Phenanthrene	**3.4**	<0.43	<0.41	<0.39	**2.4**	<0.39	<0.40
Pyrene	**4.0**	<0.43	<0.41	<0.39	**1.4**	<0.39	<0.40
TOTAL PAHs	13.26	0	0	0	14.24	0	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-11	SD-11	SD-11	SD-11	SD-12	SD-12	SD-12
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Benzene	<35	<32	<31	<30	<33	<29	<30
Bromobenzene	<35	<32	<31	<30	<33	<29	<30
Bromochloromethane	<35	<32	<31	<30	<33	<29	<30
Bromodichloromethane	<35	<32	<31	<30	<33	<29	<30
Bromoform	<35	<32	<31	<30	<33	<29	<30
Bromomethane	<141	<130	<124	<119	<132	<118	<120
n-Butylbenzene	<35	<32	<31	<30	<33	<29	<30
sec-Butylbenzene	<35	<32	<31	<30	<33	<29	<30
tert-Butylbenzene	<35	<32	<31	<30	<33	<29	<30
Carbon Tetrachloride	<35	<32	<31	<30	<33	<29	<30
Chlorobenzene	<35	<32	<31	<30	<33	<29	<30
Chlorodibromethane	<35	<32	<31	<30	<33	<29	<30
Chloroethane	<49	<45	<43	<42	<46	<41	<42
Chloroform	<35	<32	<31	<30	<33	<29	<30
Chloromethane	<71	<65	<62	<60	<66	<59	<60
2-Chlorotolunene	<35	<32	<31	<30	<33	<29	<30
4-Chlorotolunene	<35	<32	<31	<30	<33	<29	<30
1,2-Dibromo-3-Chloropropane	<74	<65	<62	<60	<66	<59	<60
1,2-Dibromethane (EDB)	<35	<32	<31	<30	<33	<29	<30
Dibromomethane	<35	<32	<31	<30	<33	<29	<30
1,2-Dichlorobenzene	<35	<32	<31	<30	<33	<29	<30
1,3-Dichlorobenzene	<35	<32	<31	<30	<33	<29	<30
1,4-Dichlorobenzene	<35	<32	<31	<30	<33	<29	<30
Dichlorodifluoromethane	<35	<32	<31	<30	<33	<29	<30
1,1-Dichloroethane	<35	<32	<31	<30	<33	<29	<30
1,2-Dichloroethane	<35	<32	<31	<30	<33	<29	<30
1,1-Dichloroethene	<35	<32	<31	<30	<33	<29	<30
cis-1,2-Dichloroethene	<35	<32	<31	<30	<33	<29	<30
trans-1,2-Dichloroethene	<35	<32	<31	<30	<33	<29	<30
1,2-Dichloropropane	<35	<32	<31	<30	<33	<29	<30
1,3-Dichloropropane	<35	<32	<31	<30	<33	<29	<30
2,2-Dichloropropane	<35	<32	<31	<30	<33	<29	<30
1,1-Dichloropropene	<35	<32	<31	<30	<33	<29	<30
cis-1,3-Dichloropropene	<35	<32	<31	<30	<33	<29	<30
trans-1,3-Dichloropropene	<35	<32	<31	<30	<33	<29	<30
Di-isopropyl ether	<35	<32	<31	<30	<33	<29	<30
Ethylbenzene	<35	<32	<31	<30	**40**	<29	<30
Hexachlorobutadiene	<49	<45	<43	<42	<46	<41	<42
Isopropylbenzene	<35	<32	<31	<30	<33	<29	<30
p-Isopropyltoluene	**282**	**142**	<31	<30	<33	<29	<30
Methylene Chloride	<71	<32	**71 L**	**190 L**	**72**	<29	**68 L**
Methyl-t-butyl-ether	<35	<32	<31	<30	<33	<29	<30
Naphthalene	<35	<32	<31	<30	**2,110**	<29	**407**
n-Propylbenzene	<35	<32	<31	<30	<33	<29	<30
Styrene	<35	<32	<31	<30	<33	<29	<30
1,1,1,2-Tetrachloroethane	<35	<32	<31	<30	<33	<29	<30
1,1,2,2-Tetrachloroethane	<35	<32	<31	<30	<33	<29	<30
Tetrachloroethane	<35	<32	<31	<30	<33	<29	<30
Toluene	**75**	**36**	<31	<30	<33	<29	<30
1,2,3-Trichlorobenzene	<35	<32	<31	<30	<33	<29	<30
1,2,4-Trichlorobenzene	<35	<32	<31	<30	<33	<29	<30
1,1,1-Trichloroethane	<35	<32	<31	<30	<33	<29	<30
1,1,2-Trichloroethane	<35	<32	<31	<30	<33	<29	<30
Trichloroethene	<35	<32	<31	<30	<33	<29	<30
Trichlorofluoromethane	<35	<32	<31	<30	<33	<29	<30
1,2,3-Trichloropropane	<35	<32	<31	<30	<33	<29	<30
1,2,4-Trimethylbenzene	<35	<32	<31	<30	**91**	<29	<30
1,3,5-Trimethylbenzene	<35	<32	<31	<30	<33	<29	<30
Vinyl Chloride	<35	<32	<31	<30	<33	<29	<30
Xylene, total	<49	<45	<43	<42	**71**	<41	<42
TOTAL VOCs + Naphthalene	357	178	0	0	2384	0	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-13	SD-14	SD-14	SD-14	SD-14
Depth	2-4	0-2	2-4	4-6	6-8
Solids (%)	79.8	26.8	76.8	79.0	84.3
Acenaphthene	<0.41	130	39	3.4	<0.39
Acenaphthylene	<0.41	4.1	3.3	<0.42	<0.39
Antracene	<0.41	32	14	1.5	<0.39
Benzo(a)anthracene	<0.41	10	7.7	0.66	<0.39
Benzo(b)fluoranthene	<0.41	3.6	3.0	<0.42	<0.39
Benzo(k)fluoranthene	<0.41	4.9	4.0	<0.42	<0.39
Benzo(g,h,I)perylene	<0.41	<3.3	2.7	<0.42	<0.39
Benzo(a)pyrene	<0.41	7.5	6.1	0.52	<0.39
Chrysene	<0.41	9.3	6.9	0.56	<0.39
Dibenzo(a,h)anthracene	<0.41	<3.3	<0.65	<0.42	<0.39
Fluoranthene	<0.41	28	16	1.5	<0.39
Fluorene	<0.41	52	14	<0.42	<0.39
Indeno (1,2,3-cd)pyrene	<0.41	<3.3	2.6	<0.42	<0.39
2-Methylnaphthalene	<0.41	280	70	5.8	<0.39
Naphthalene	<0.41	410	79	6.6	<0.39
Phenanthrene	<0.41	130	49	4.3	<0.39
Pyrene	<0.41	36	<0.65	1.8	<0.39
TOTAL PAHs	0	936	230.6	20	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-13	SD-14	SD-14	SD-14	SD-14
Depth	2-4	0-2	2-4	4-6	6-8
Benzene	<31	<18,700	<33	<32	<30
Bromobenzene	<31	<18,700	<33	<32	<30
Bromochloromethane	<31	<18,700	<33	<32	<30
Bromodichloromethane	<31	<18,700	<33	<32	<30
Bromoform	<31	<18,700	<33	<32	<30
Bromomethane	<31	<18,700	<130	<127	<119
n-Butylbenzene	<125	<74,600	<33	<32	<30
sec-Butylbenzene	<31	<18,700	<33	<32	<30
tert-Butylbenzene	<31	<18,700	<33	<32	<30
Carbon Tetrachloride	<31	<18,700	<33	<32	<30
Chlorobenzene	<31	<18,700	<33	<32	<30
Chlorodibromethane	<31	<18,700	<33	<32	<30
Chloroethane	<44	<26,100	<46	<44	<42
Chloroform	<31	<18,700	<33	<32	<30
Chloromethane	<63	<37,300	<65	<63	<59
2-Chlorotolunene	<31	<18,700	<33	<32	<30
4-Chlorotolunene	<31	<18,700	<33	<32	<30
1,2-Dibromo-3-Chloropropane	<63	<37,300	<65	<63	<59
1,2-Dibromethane (EDB)	<31	<18,700	<33	<32	<30
Dibromomethane	<31	<18,700	<33	<32	<30
1,2-Dichlorobenzene	<31	<18,700	<33	<32	<30
1,3-Dichlorobenzene	<31	<18,700	<33	<32	<30
1,4-Dichlorobenzene	<31	<18,700	<33	<32	<30
Dichlorodifluoromethane	<31	<18,700	<33	<32	<30
1,1-Dichloroethane	<31	<18,700	<33	<32	<30
1,2-Dichloroethane	<31	<18,700	<33	<32	<30
1,1-Dichloroethene	<31	<18,700	<33	<32	<30
cis-1,2-Dichloroethene	<31	<18,700	<33	<32	<30
trans-1,2-Dichloroethene	<31	<18,700	<33	<32	<30
1,2-Dichloropropane	<31	<18,700	<33	<32	<30
1,3-Dichloropropane	<31	<18,700	<33	<32	<30
2,2-Dichloropropane	<31	<18,700	<33	<32	<30
1,1-Dichloropropene	<31	<18,700	<33	<32	<30
cis-1,3-Dichloropropene	<31	<18,700	<33	<32	<30
trans-1,3-Dichloropropene	<31	<18,700	<33	<32	<30
Di-isopropyl ether	<31	<18,700	<33	<32	<30
Ethylbenzene	<31	<18,700	**2,730**	**354**	<30
Hexachlorobutadiene	<44	<26,100	<46	<44	<42
Isopropylbenzene	<31	<18,700	**469**	**58**	<30
p-Isopropyltoluene	<31	<18,700	**547**	**72**	<30
Methylene Chloride	<63	<37,300	**120 L**	<63	<59
Methyl-t-butyl-ether	<31	<18,700	<33	<32	<30
Naphthalene	<31	**295,000**	**66,400**	**7,720**	<30
n-Propylbenzene	<31	<18,700	**156**	<32	<30
Styrene	<31	<18,700	<33	<32	<30
1,1,1,2-Tetrachloroethane	<31	<18,700	<33	<32	<30
1,1,2,2-Tetrachloroethane	<31	<18,700	<33	<32	<30
Tetrachloroethane	<31	<18,700	<33	<32	<30
Toluene	<31	<18,700	<33	<32	<30
1,2,3-Trichlorobenzene	<31	<18,700	<33	<32	<30
1,2,4-Trichlorobenzene	<31	<18,700	<33	<32	<30
1,1,1-Trichloroethane	<31	<18,700	<33	<32	<30
1,1,2-Trichloroethane	<31	<18,700	<33	<32	<30
Trichloroethene	<31	<18,700	<33	<32	<30
Trichlorofluoromethane	<31	<18,700	<33	<32	<30
1,2,3-Trichloropropane	<31	<18,700	<33	<32	<30
1,2,4-Trimethylbenzene	<31	<18,700	**2,600**	**342**	<30
1,3,5-Trimethylbenzene	<31	<18,700	**820**	**120**	<30
Vinyl Chloride	<31	<18,700	<33	<32	<30
Xylene, total	<44	<26,100	**3,260**	**354**	<42
TOTAL VOCs + Naphthalene	0	295000	76982	9020	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-15	SD-15	SD-15	SD-16	SD-16	SD-16	SD-16
Depth	0-2	2-4	6-8	0-2	2-4	4-6	6-8
Solids (%)	46.5	76.2	88.2	60.1	89.4	85.6	82.6
Acenaphthene	73	45	<0.37	28	<0.37	18	<0.40
Acenaphthylene	<3.4	3.7	<0.37	<2.7	<0.37	1.8	<0.40
Antracene	32	18	<0.37	13	<0.37	7.0	<0.40
Benzo(a)anthracene	11	7.6	<0.37	5.5	<0.37	3.6	<0.40
Benzo(b)fluoranthene	<3.4	2.6	<0.37	<2.7	<0.37	1.3	<0.40
Benzo(k)fluoranthene	4.5	3.8	<0.37	2.7	<0.37	1.8	<0.40
Benzo(g,h,I)perylene	<3.4	2.5	<0.37	<2.7	<0.37	1.2	<0.40
Benzo(a)pyrene	6.9	5.6	<0.37	4.2	<0.37	2.7	<0.40
Chrysene	9.5	6.8	<0.37	5.2	<0.37	3.2	<0.40
Dibenzo(a,h)anthracene	<0.71	<2.1	<0.37	<2.7	<0.37	<0.39	<0.40
Fluoranthene	28	18	<0.37	13	<0.37	7.0	<0.40
Fluorene	34	26	<0.37	17	<0.37	6.9	<0.40
Indeno (1,2,3-cd)pyrene	<3.4	2.4	<0.37	<2.7	<0.37	1.2	<0.40
2-Methylnaphthalene	860	89	<0.37	52	0.41	30	<0.40
Naphthalene	1,180	110	<0.37	55	<0.37	33	<0.40
Phenanthrene	82	51	<0.37	37	<0.37	25	<0.40
Pyrene	37	21	<0.37	16	<0.37	8.2	<0.40
TOTAL PAHs	2221	317.4	0	190	0.41	111.3	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-15	SD-15	SD-15	SD-16	SD-16	SD-16	SD-16
Depth	0-2	2-4	6-8	0-2	2-4	4-6	6-8
Benzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
Bromobenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
Bromochloromethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
Bromodichloromethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
Bromoform	<10,800	<1,570	<32	<42	<28	<14,000	<30
Bromomethane	<43,000	<6,560	<125	<166	<112	<58,400	<121
n-Butylbenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
sec-Butylbenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
tert-Butylbenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
Carbon Tetrachloride	<10,800	<1,570	<32	<42	<28	<14,000	<30
Chlorobenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
Chlorodibromethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
Chloroethane	<15,100	<2,360	<43	<58	<39	<21,000	<42
Chloroform	<10,800	<1,570	<32	<42	<28	<14,000	<30
Chloromethane	<21,500	<3,280	<62	<83	<56	<29,200	<61
2-Chlorotolunene	<10,800	<1,570	<32	<42	<28	<14,000	<30
4-Chlorotolunene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2-Dibromo-3-Chloropropane	<21,500	<3,280	<62	<83	<56	<29,200	<61
1,2-Dibromethane (EDB)	<10,800	<1,570	<32	<42	<28	<14,000	<30
Dibromomethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2-Dichlorobenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,3-Dichlorobenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,4-Dichlorobenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
Dichlorodifluoromethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,1-Dichloroethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2-Dichloroethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,1-Dichloroethene	<10,800	<1,570	<32	<42	<28	<14,000	<30
cis-1,2-Dichloroethene	<10,800	<1,570	<32	<42	<28	<14,000	<30
trans-1,2-Dichloroethene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2-Dichloropropane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,3-Dichloropropane	<10,800	<1,570	<32	<42	<28	<14,000	<30
2,2-Dichloropropane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,1-Dichloropropene	<10,800	<1,570	<32	<42	<28	<14,000	<30
cis-1,3-Dichloropropene	<10,800	<1,570	<32	<42	<28	<14,000	<30
trans-1,3-Dichloropropene	<10,800	<1,570	<32	<42	<28	<14,000	<30
Di-isopropyl ether	<10,800	<1,570	<32	<42	<28	<14,000	<30
Ethylbenzene	<10,800	<1,570	<32	**2,000**	**179**	**30,400**	<30
Hexachlorobutadiene	<15,100	<2,360	<43	<58	<39	<21,000	<42
Isopropylbenzene	<10,800	<1,570	<32	**383**	<28	<14,000	<30
p-Isopropyltoluene	<10,800	<1,570	<32	**483**	<28	<14,000	<30
Methylene Chloride	**23,700 L**	<3,280	<62	**200 L**	<56	<29,200	<61
Methyl-t-butyl-ether	<10,800	<1,570	<32	<42	<28	<14,000	<30
Naphthalene	**301,000**	**52,500**	**204**	**91,500**	**872**	**1,060,000**	**169**
n-Propylbenzene	<10,800	<1,570	<32	**100**	<28	<14,000	<30
Styrene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,1,1,2-Tetrachloroethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,1,2,2-Tetrachloroethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
Tetrachloroethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
Toluene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2,3-Trichlorobenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2,4-Trichlorobenzene	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,1,1-Trichloroethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,1,2-Trichloroethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
Trichloroethene	<10,800	<1,570	<32	<42	<28	<14,000	<30
Trichlorofluoromethane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2,3-Trichloropropane	<10,800	<1,570	<32	<42	<28	<14,000	<30
1,2,4-Trimethylbenzene	<10,800	**2,100**	<32	**2,160**	**49**	**37,400**	<30
1,3,5-Trimethylbenzene	<10,800	<1,570	<32	**666**	<28	<14,000	<30
Vinyl Chloride	<10,800	<1,570	<32	<42	<28	<14,000	<30
Xylene, total	<15,100	<2,360	<43	**2,330**	**179**	<21,000	<42
TOTAL VOCs + Naphthalene	301000	54600	204	99622	1279	1127800	169

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-17	SD-17	SD-17	SD-18	SD-18
Depth	2-4	4-6	6-8	4-6	6-8
Solids (%)	81.8	84.8	83.6	79.6	81.3
Acenaphthene	<0.40	<0.39	<0.39	<0.41	<0.41
Acenaphthylene	<0.40	<0.39	<0.39	<0.41	<0.41
Antracene	<0.40	<0.39	<0.39	<0.41	<0.41
Benzo(a)anthracene	<0.40	<0.39	<0.39	<0.41	<0.41
Benzo(b)fluoranthene	<0.40	<0.39	<0.39	<0.41	<0.41
Benzo(k)fluoranthene	<0.40	<0.39	<0.39	<0.41	<0.41
Benzo(g,h,I)perylene	<0.40	<0.39	<0.39	<0.41	<0.41
Benzo(a)pyrene	<0.40	<0.39	<0.39	<0.41	<0.41
Chrysene	<0.40	<0.39	<0.39	<0.41	<0.41
Dibenzo(a,h)anthracene	<0.40	<0.39	<0.39	<0.41	<0.41
Fluoranthene	<0.40	<0.39	<0.39	<0.41	<0.41
Fluorene	<0.40	<0.39	<0.39	<0.41	<0.41
Indeno (1,2,3-cd)pyrene	<0.40	<0.39	<0.39	<0.41	<0.41
2-Methylnaphthalene	<0.40	<0.39	<0.39	<0.41	<0.41
Naphthalene	<0.40	<0.39	<0.39	1.6	<0.41
Phenanthrene	<0.40	<0.39	<0.39	<0.41	<0.41
Pyrene	<0.40	<0.39	<0.39	<0.41	<0.41
TOTAL PAHs	0	0	0	1.6	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-17	SD-17	SD-17	SD-18	SD-18
Depth	2-4	4-6	6-8	4-6	6-8
Benzene	<34	<33	<33	<35	<31
Bromobenzene	<34	<33	<33	<35	<31
Bromochloromethane	<34	<33	<33	<35	<31
Bromodichloromethane	<34	<33	<33	<35	<31
Bromoform	<34	<33	<33	<35	<31
Bromomethane	<134	<130	<132	<138	<31
n-Butylbenzene	<34	<33	<33	<35	<123
sec-Butylbenzene	<34	<33	<33	<35	<31
tert-Butylbenzene	<34	<33	<33	<35	<31
Carbon Tetrachloride	<34	<33	<33	<35	<31
Chlorobenzene	<34	<33	<33	<35	<31
Chlorodibromethane	<34	<33	<33	<35	<31
Chloroethane	<46	<45	<45	<48	<43
Chloroform	<34	<33	<33	<35	<31
Chloromethane	<67	<65	<66	<69	<62
2-Chlorotolunene	<34	<33	<33	<35	<31
4-Chlorotolunene	<34	<33	<33	<35	<31
1,2-Dibromo-3-Chloropropane	<67	<65	<66	<69	<62
1,2-Dibromethane (EDB)	<34	<33	<33	<35	<31
Dibromomethane	<34	<33	<33	<35	<31
1,2-Dichlorobenzene	<34	<33	<33	<35	<31
1,3-Dichlorobenzene	<34	<33	<33	<35	<31
1,4-Dichlorobenzene	<34	<33	<33	<35	<31
Dichlorodifluoromethane	<34	<33	<33	<35	<31
1,1-Dichloroethane	<34	<33	<33	<35	<31
1,2-Dichloroethane	<34	<33	<33	<35	<31
1,1-Dichloroethene	<34	<33	<33	<35	<31
cis-1,2-Dichloroethene	<34	<33	<33	<35	<31
trans-1,2-Dichloroethene	<34	<33	<33	<35	<31
1,2-Dichloropropane	<34	<33	<33	<35	<31
1,3-Dichloropropane	<34	<33	<33	<35	<31
2,2-Dichloropropane	<34	<33	<33	<35	<31
1,1-Dichloropropene	<34	<33	<33	<35	<31
cis-1,3-Dichloropropene	<34	<33	<33	<35	<31
trans-1,3-Dichloropropene	<34	<33	<33	<35	<31
Di-isopropyl ether	<34	<33	<33	<35	<31
Ethylbenzene	<34	<33	<33	**239**	<31
Hexachlorobutadiene	<46	<45	<45	<48	<43
Isopropylbenzene	<34	<33	<33	<35	<31
p-Isopropyltoluene	<34	<33	<33	<35	<31
Methylene Chloride	**77 L**	**86 L**	**81 L**	<69	<62
Methyl-t-butyl-ether	<34	<33	<33	<35	<31
Naphthalene	**95**	**38**	<33	**2,010**	**74**
n-Propylbenzene	<34	<33	<33	<35	<31
Styrene	<34	<33	<33	<35	<31
1,1,1,2-Tetrachloroethane	<34	<33	<33	<35	<31
1,1,2,2-Tetrachloroethane	<34	<33	<33	<35	<31
Tetrachloroethane	<34	<33	<33	<35	<31
Toluene	<34	<33	<33	<35	<31
1,2,3-Trichlorobenzene	<34	<33	<33	<35	<31
1,2,4-Trichlorobenzene	<34	<33	<33	<35	<31
1,1,1-Trichloroethane	<34	<33	<33	<35	<31
1,1,2-Trichloroethane	<34	<33	<33	<35	<31
Trichloroethene	<34	<33	<33	<35	<31
Trichlorofluoromethane	<34	<33	<33	<35	<31
1,2,3-Trichloropropane	<34	<33	<33	<35	<31
1,2,4-Trimethylbenzene	<34	<33	<33	**120**	<31
1,3,5-Trimethylbenzene	<34	<33	<33	**40**	<31
Vinyl Chloride	<34	<33	<33	<35	<31
Xylene, total	<46	<45	<45	**276**	<43
TOTAL VOCs + Naphthalene	95	38	0	2685	74

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-19	SD-19	SD-19	SD-19	SD-20	SD-20	SD-20	SD-20
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Solids (%)	66.8	79.0	83.5	84.4	60.7	77.1	79.9	79.0
Acenaphthene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Acenaphthylene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Antracene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Benzo(a)anthracene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Benzo(b)fluoranthene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Benzo(k)fluoranthene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Benzo(g,h,I)perylene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Benzo(a)pyrene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Chrysene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Dibenzo(a,h)anthracene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Fluoranthene	<2.4	<0.42	<0.40	<0.39	12	<0.43	<0.41	<0.42
Fluorene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Indeno (1,2,3-cd)pyrene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
2-Methylnaphthalene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Naphthalene	<2.4	<0.42	<0.40	<0.39	<10	<0.43	<0.41	<0.42
Phenanthrene	<2.4	<0.42	<0.40	<0.39	13	<0.43	<0.41	<0.42
Pyrene	<2.4	<0.42	<0.40	<0.39	16	<0.43	<0.41	<0.42
TOTAL PAHs	0	0	0	0	41	0	0	0

All units reported in mg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-19	SD-19	SD-19	SD-19	SD-20	SD-20	SD-20	SD-20
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Benzene	<37	<35	<30	<30	<41	<32	<31	<32
Bromobenzene	<37	<35	<30	<30	<41	<32	<31	<32
Bromochloromethane	<37	<35	<30	<30	<41	<32	<31	<32
Bromodichloromethane	<37	<35	<30	<30	<41	<32	<31	<32
Bromoform	<37	<35	<30	<30	<41	<32	<31	<32
Bromomethane	<150	<139	<120	<118	<165	<130	<125	<127
n-Butylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
sec-Butylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
tert-Butylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
Carbon Tetrachloride	<37	<35	<30	<30	<41	<32	<31	<32
Chlorobenzene	<37	<35	<30	<30	<41	<32	<31	<32
Chlorodibromethane	<37	<35	<30	<30	<41	<32	<31	<32
Chloroethane	<52	<48	<42	<41	<58	<45	<44	<44
Chloroform	<37	<35	<30	<30	<41	<32	<31	<32
Chloromethane	<75	<70	<60	<58	<82	<65	<63	<63
2-Chlorotolunene	<37	<35	<30	<30	<41	<32	<31	<32
4-Chlorotolunene	<37	<35	<30	<30	<41	<32	<31	<32
1,2-Dibromo-3-Chloropropane	<75	<70	<60	<58	<82	<65	<63	<63
1,2-Dibromethane (EDB)	<37	<35	<30	<30	<41	<32	<31	<32
Dibromomethane	<37	<35	<30	<30	<41	<32	<31	<32
1,2-Dichlorobenzene	<37	<35	<30	<30	<41	<32	<31	<32
1,3-Dichlorobenzene	<37	<35	<30	<30	<41	<32	<31	<32
1,4-Dichlorobenzene	<37	<35	<30	<30	<41	<32	<31	<32
Dichlorodifluoromethane	<37	<35	<30	<30	<41	<32	<31	<32
1,1-Dichloroethane	<37	<35	<30	<30	<41	<32	<31	<32
1,2-Dichloroethane	<37	<35	<30	<30	<41	<32	<31	<32
1,1-Dichloroethene	<37	<35	<30	<30	<41	<32	<31	<32
cis-1,2-Dichloroethene	<37	<35	<30	<30	<41	<32	<31	<32
trans-1,2-Dichloroethene	<37	<35	<30	<30	<41	<32	<31	<32
1,2-Dichloropropane	<37	<35	<30	<30	<41	<32	<31	<32
1,3-Dichloropropane	<37	<35	<30	<30	<41	<32	<31	<32
2,2-Dichloropropane	<37	<35	<30	<30	<41	<32	<31	<32
1,1-Dichloropropene	<37	<35	<30	<30	<41	<32	<31	<32
cis-1,3-Dichloropropene	<37	<35	<30	<30	<41	<32	<31	<32
trans-1,3-Dichloropropene	<37	<35	<30	<30	<41	<32	<31	<32
Di-isopropyl ether	<37	<35	<30	<30	<41	<32	<31	<32
Ethylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
Hexachlorobutadiene	<52	<48	<42	<41	<58	<45	<44	<44
Isopropylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
p-Isopropyltoluene	**55**	<35	<30	<30	**264**	<32	<31	<32
Methylene Chloride	**120 L**	**99 L**	**100 L**	**118 L**	<82	**220 L**	**138 L**	**152 L**
Methyl-t-butyl-ether	<37	<35	<30	<30	<41	<32	<31	<32
Naphthalene	<37	<35	<30	<30	**82**	<32	<31	<32
n-Propylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
Styrene	<37	<35	<30	<30	<41	<32	<31	<32
1,1,1,2-Tetrachloroethane	<37	<35	<30	<30	<41	<32	<31	<32
1,1,2,2-Tetrachloroethane	<37	<35	<30	<30	<41	<32	<31	<32
Tetrachloroethane	<37	<35	<30	<30	<41	<32	<31	<32
Toluene	**67**	<35	<30	<30	**160**	<32	<31	<32
1,2,3-Trichlorobenzene	<37	<35	<30	<30	<41	<32	<31	<32
1,2,4-Trichlorobenzene	<37	<35	<30	<30	<41	<32	<31	<32
1,1,1-Trichloroethane	<37	<35	<30	<30	<41	<32	<31	<32
1,1,2-Trichloroethane	<37	<35	<30	<30	<41	<32	<31	<32
Trichloroethene	<37	<35	<30	<30	<41	<32	<31	<32
Trichlorofluoromethane	<37	<35	<30	<30	<41	<32	<31	<32
1,2,3-Trichloropropane	<37	<35	<30	<30	<41	<32	<31	<32
1,2,4-Trimethylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
1,3,5-Trimethylbenzene	<37	<35	<30	<30	<41	<32	<31	<32
Vinyl Chloride	<37	<35	<30	<30	<41	<32	<31	<32
Xylene, total	<52	<48	<42	<41	<58	<45	<44	<44
TOTAL VOCs + Naphthalene	122	0	0	0	506	0	0	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-21	SD-21	SD-21	SD-21	SD-21	SD-22	SD-22	SD-22
Depth	0-2	2-4	4-5	7-8	9-10	0-2	2-4	4-6
Solids (%)	46.4	83.0	85.0	82.3	79.6	51.0	74.9	83.5
Acenaphthene	120	40	247	<0.40	<0.41	190	10	<0.40
Acenaphthylene	<11	3.5	14	<0.40	<0.41	<8.7	0.47	<0.40
Antracene	43	14	81	<0.40	<0.41	57	3.2	<0.40
Benzo(a)anthracene	28	10	41	<0.40	<0.41	33	1.9	<0.40
Benzo(b)fluoranthene	11	4.2	15	<0.40	<0.41	15	0.81	<0.40
Benzo(k)fluoranthene	15	5.4	21	<0.40	<0.41	18	1.0	<0.40
Benzo(g,h,I)perylene	13	4.9	19	<0.40	<0.41	15	0.71	<0.40
Benzo(a)pyrene	30	11	38.8	<0.40	<0.41	31	1.9	<0.40
Chrysene	28	9.5	39	<0.40	<0.41	33	1.7	<0.40
Dibenzo(a,h)anthracene	<11	<1.9	3.6	<0.40	<0.41	<8.7	<0.44	<0.40
Fluoranthene	67	22	110	<0.40	<0.41	82	4.5	<0.40
Fluorene	52	19	110	<0.40	<0.41	92	5.2	<0.40
Indeno (1,2,3-cd)pyrene	13	4.3	18	<0.40	<0.41	12	0.60	<0.40
2-Methylnaphthalene	180	58	400	0.49	0.44	130	17	<0.40
Naphthalene	220	61	600	0.95	0.68	190	25	<0.40
Phenanthrene	150	58	294	<0.40	0.46	100	16	<0.40
Pyrene	99	33	153	<0.40	<0.41	140	6.9	<0.40
TOTAL PAHs	781	255.3	1685	1.44	1.58	746	75.2	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-21	SD-21	SD-21	SD-21	SD-21	SD-22	SD-22	SD-22
Depth	0-2	2-4	4-5	7-8	9-10	0-2	2-4	4-6
Benzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Bromobenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Bromochloromethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Bromodichloromethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Bromoform	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Bromomethane	<216	<120	<5,880	<122	<126	<19,600	<13,400	<120
n-Butylbenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
sec-Butylbenzene	<54	36	<1,410	<30	<31	<4,900	<3,340	<30
tert-Butylbenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Carbon Tetrachloride	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Chlorobenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Chlorodibromethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Chloroethane	<75	<42	<1,410	<43	<44	<6,860	<4,670	<42
Chloroform	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Chloromethane	<110	<60	<2,940	<61	<63	<9,800	<6,680	<60
2-Chlorotolunene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
4-Chlorotolunene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,2-Dibromo-3-Chloropropane	<110	<60	<2,940	<61	<63	<9,800	<6,680	<60
1,2-Dibromethane (EDB)	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Dibromomethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,2-Dichlorobenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,3-Dichlorobenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,4-Dichlorobenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Dichlorodifluoromethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,1-Dichloroethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,2-Dichloroethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,1-Dichloroethene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
cis-1,2-Dichloroethene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
trans-1,2-Dichloroethene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,2-Dichloropropane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,3-Dichloropropane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
2,2-Dichloropropane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,1-Dichloropropene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
cis-1,3-Dichloropropene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
trans-1,3-Dichloropropene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Di-isopropyl ether	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Ethylbenzene	2,070	2,290	43,500	255	88	19,200	<3,340	<30
Hexachlorobutadiene	<75	<42	<2,120	<43	<31	<6,860	<4,670	<42
Isopropylbenzene	668	554	6,350	44	<31	<4,900	<3,340	<30
p-Isopropyltoluene	1,440	1,570	8,000	60	<31	<4,900	<3,340	<30
Methylene Chloride	<110	<60	<2,940	<61	100 L	25,500 L	8,410 L	81 L
Methyl-t-butyl-ether	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Naphthalene	92,700	104,000	1,650,000	7,050	3,020	784,000	187,000	695
n-Propylbenzene	190	193	2,350	<30	<31	<4,900	<3,340	<30
Styrene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,1,1,2-Tetrachloroethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,1,2,2-Tetrachloroethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Tetrachloroethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Toluene	80	40	3,060	<30	<31	<4,900	<3,340	<30
1,2,3-Trichlorobenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,2,4-Trichlorobenzene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,1,1-Trichloroethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,1,2-Trichloroethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Trichloroethene	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Trichlorofluoromethane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,2,3-Trichloropropane	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
1,2,4-Trimethylbenzene	3,660	3,370	37,600	267	98	16,500	5,210	<30
1,3,5-Trimethylbenzene	884	988	6,940	56	<31	6,860	<3,340	<30
Vinyl Chloride	<54	<30	<1,410	<30	<31	<4,900	<3,340	<30
Xylene, total	2,590	2,770	43,500	255	90	11,200	<4,670	<42
TOTAL VOCs + Naphthalene	104,282	115,811	1,801,300	7,987	3,296	837,760	192,210	695

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-22	SD-22	SD-23	SD-23	SD-23	SD-24	SD-24	SD-24
Depth	6-8	8-10	0-2	2-4	6-8	2-4	4-6	6-8
Solids (%)	82.0	84.6	69.1	80.0	85.3	79.0	84.0	88.3
Acenaphthene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Acenaphthylene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Antracene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Benzo(a)anthracene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Benzo(b)fluoranthene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Benzo(k)fluoranthene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Benzo(g,h,i)perylene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Benzo(a)pyrene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Chrysene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Dibenzo(a,h)anthracene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Fluoranthene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Fluorene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Indeno (1,2,3-cd)pyrene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
2-Methylnaphthalene	<0.40	**0.43**	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Naphthalene	<0.40	**0.53**	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Phenanthrene	<0.40	**0.56**	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
Pyrene	<0.40	<0.39	<0.48	<0.41	<0.39	<1.2	<0.39	<0.37
TOTAL PAHs	0	1.52	0	0	0	0	0	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-22	SD-22	SD-23	SD-23	SD-23	SD-24	SD-24	SD-24
Depth	6-8	8-10	0-2	2-4	6-8	2-4	4-6	6-8
Benzene	<30	<30	<36	<31	<29	<32	<30	<32
Bromobenzene	<30	<30	<36	<31	<29	<32	<30	<32
Bromochloromethane	<30	<30	<36	<31	<29	<32	<30	<32
Bromodichloromethane	<30	<30	<36	<31	<29	<32	<30	<32
Bromoform	<30	<30	<36	<31	<29	<32	<30	<32
Bromomethane	<122	<118	<145	<125	<117	<127	<119	<125
n-Butylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
sec-Butylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
tert-Butylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
Carbon Tetrachloride	<30	<30	<36	<31	<29	<32	<30	<32
Chlorobenzene	<30	<30	<36	<31	<29	<32	<30	<32
Chlorodibromethane	<30	<30	<36	<31	<29	<32	<30	<32
Chloroethane	<43	<41	<51	<44	<41	<44	<42	<43
Chloroform	<30	<30	<36	<31	<29	<32	<30	<32
Chloromethane	<61	<59	<72	<62	<59	<63	<60	<62
2-Chlorotolunene	<30	<30	<36	<31	<29	<32	<30	<32
4-Chlorotolunene	<30	<30	<36	<31	<29	<32	<30	<32
1,2-Dibromo-3-Chloropropane	<61	<59	<72	<62	<59	<63	<60	<62
1,2-Dibromethane (EDB)	<30	<30	<36	<31	<29	<32	<30	<32
Dibromomethane	<30	<30	<36	<31	<29	<32	<30	<32
1,2-Dichlorobenzene	<30	<30	<36	<31	<29	<32	<30	<32
1,3-Dichlorobenzene	<30	<30	<36	<31	<29	<32	<30	<32
1,4-Dichlorobenzene	<30	<30	<36	<31	<29	<32	<30	<32
Dichlorodifluoromethane	<30	<30	<36	<31	<29	<32	<30	<32
1,1-Dichloroethane	<30	<30	<36	<31	<29	<32	<30	<32
1,2-Dichloroethane	<30	<30	<36	<31	<29	<32	<30	<32
1,1-Dichloroethene	<30	<30	<36	<31	<29	<32	<30	<32
cis-1,2-Dichloroethene	<30	<30	<36	<31	<29	<32	<30	<32
trans-1,2-Dichloroethene	<30	<30	<36	<31	<29	<32	<30	<32
1,2-Dichloropropane	<30	<30	<36	<31	<29	<32	<30	<32
1,3-Dichloropropane	<30	<30	<36	<31	<29	<32	<30	<32
2,2-Dichloropropane	<30	<30	<36	<31	<29	<32	<30	<32
1,1-Dichloropropene	<30	<30	<36	<31	<29	<32	<30	<32
cis-1,3-Dichloropropene	<30	<30	<36	<31	<29	<32	<30	<32
trans-1,3-Dichloropropene	<30	<30	<36	<31	<29	<32	<30	<32
Di-isopropyl ether	<30	<30	<36	<31	<29	<32	<30	<32
Ethylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
Hexachlorobutadiene	<43	<41	<51	<44	<41	<44	<42	<43
Isopropylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
p-Isopropyltoluene	<30	<30	120	<31	<29	<32	<30	<32
Methylene Chloride	402	100 L	<72	<62	74 L	120 L	110 L	113 L
Methyl-t-butyl-ether	<30	<30	<36	<31	<29	<32	<30	<32
Naphthalene	683	284	62	78	<29	<32	<30	97
n-Propylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
Styrene	<30	<30	<36	<31	<29	<32	<30	<32
1,1,1,2-Tetrachloroethane	<30	<30	<36	<31	<29	<32	<30	<32
1,1,2,2-Tetrachloroethane	<30	<30	<36	<31	<29	<32	<30	<32
Tetrachloroethane	<30	<30	<36	<31	<29	<32	<30	<32
Toluene	<30	<30	362	<31	<29	<32	<30	<32
1,2,3-Trichlorobenzene	<30	<30	<36	<31	<29	<32	<30	<32
1,2,4-Trichlorobenzene	<30	<30	<36	<31	<29	<32	<30	<32
1,1,1-Trichloroethane	<30	<30	<36	<31	<29	<32	<30	<32
1,1,2-Trichloroethane	<30	<30	<36	<31	<29	<32	<30	<32
Trichloroethene	<30	<30	<36	<31	<29	<32	<30	<32
Trichlorofluoromethane	<30	<30	<36	<31	<29	<32	<30	<32
1,2,3-Trichloropropane	<30	<30	<36	<31	<29	<32	<30	<32
1,2,4-Trimethylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
1,3,5-Trimethylbenzene	<30	<30	<36	<31	<29	<32	<30	<32
Vinyl Chloride	<30	<30	<36	<31	<29	<32	<30	<32
Xylene, total	<43	<41	<51	<44	<41	<44	<42	<43
TOTAL VOCs + Naphthalene	1,085	284	544	78	0	0	0	97

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-25	SD-25	SD-25	SD-25	SD-25	SD-26	SD-26	SD-26	SD-26
Depth	0-2	2-4	4-5	5-6	6-8	0-2	2-4	4-6	6-8
Solids (%)	73.0	79.8	80.1	84.4	77.4	51.4	77.8	84.7	82.6
Acenaphthene	32	226	824	1.2	0.47	160	110	401	<0.40
Acenaphthylene	<2.2	14	60	<0.39	<0.43	<15	6.7	28	<0.40
Antracene	13	83	250	0.51	<0.43	53	31	165	<0.40
Benzo(a)anthracene	6.4	35	125	<0.39	<0.43	<15	17	60	<0.40
Benzo(b)fluoranthene	2.6	15	51	<0.39	<0.43	<15	6.4	25	<0.40
Benzo(k)fluoranthene	3.4	18	64	<0.39	<0.43	<15	8.0	27	<0.40
Benzo(g,h,I)perylene	2.3	13	46	<0.39	<0.43	<15	5.4	20	<0.40
Benzo(a)pyrene	5.5	29	110	<0.39	<0.43	<15	13	45	<0.40
Chrysene	5.9	31	120	<0.39	<0.43	<15	14	53	<0.40
Dibenzo(a,h)anthracene	<2.2	3.5	<20	<0.39	<0.43	<15	<2.1	6.1	<0.40
Fluoranthene	13	85	262	0.58	<0.43	43	33	142	<0.40
Fluorene	16	125	400	0.73	<0.43	78	60	236	<0.40
Indeno (1,2,3-cd)pyrene	<2.2	11	39	<0.39	<0.43	<15	4.6	18	<0.40
2-Methylnaphthalene	49	338	1,370	1.2	<0.43	292	193	720	<0.40
Naphthalene	74	439	1,870	0.90	<0.43	525	257	850	<0.40
Phenanthrene	34	263	999	1.8	0.98	160	120	449	<0.40
Pyrene	19	6.4	362	0.86	0.50	56	42	12	<0.40
TOTAL PAHs	205	1267.4	5302	6.07	1.48	1154	709.6	2427	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-25	SD-25	SD-25	SD-25	SD-25	SD-26	SD-26	SD-26	SD-26
Depth	0-2	2-4	4-5	5-6	6-8	0-2	2-4	4-6	6-8
Benzene	<3,420	<3,130	<6,240	100	50	<4,860	<32,100	<29,500	36
Bromobenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Bromochloromethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Bromodichloromethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Bromoform	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Bromomethane	<13,700	<12,500	<25,000	<118	<142	<19,500	<129,000	<118,000	<121
n-Butylbenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
sec-Butylbenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
tert-Butylbenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Carbon Tetrachloride	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Chlorobenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Chlorodibromethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Chloroethane	<4,790	<4,390	<8,740	<41	<49	<6,810	<45,000	<41,300	<42
Chloroform	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Chloromethane	<6,850	<6,270	<12,500	<59	<71	<9,730	<64,300	<59,000	<61
2-Chlorotolunene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
4-Chlorotolunene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,2-Dibromo-3-Chloropropane	<6,850	<6,270	<12,500	<59	<71	<9,730	<64,300	<59,000	<61
1,2-Dibromethane (EDB)	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Dibromomethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,2-Dichlorobenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,3-Dichlorobenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,4-Dichlorobenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Dichlorodifluoromethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,1-Dichloroethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,2-Dichloroethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,1-Dichloroethene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
cis-1,2-Dichloroethene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
trans-1,2-Dichloroethene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,2-Dichloropropane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,3-Dichloropropane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
2,2-Dichloropropane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,1-Dichloropropene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
cis-1,3-Dichloropropene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
trans-1,3-Dichloropropene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Di-isopropyl ether	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Ethylbenzene	4,520	17,500	23,700	344	120	8,950	<32,100	61,400	34
Hexachlorobutadiene	<4,790	<4,390	<8,740	<41	<49	<6,810	<45,000	<41,300	<42
Isopropylbenzene	<3,420	<3,130	<6,240	38	<36	<4,860	<32,100	<29,500	<30
p-Isopropyltoluene	<3,420	<3,130	<6,240	38	<36	<4,860	<32,100	<29,500	<30
Methylene Chloride	7,950 L	7,890 L	<12,500	118 L	90 L	25,300 L	308,000 L	153,000 L	94 L
Methyl-t-butyl-ether	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Naphthalene	112,000	313,000	612,000	5,810	2,200	214,000	540,000	1,300,000	291
n-Propylbenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Styrene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,1,1,2-Tetrachloroethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,1,2,2-Tetrachloroethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Tetrachloroethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Toluene	<3,420	<3,130	<6,240	120	44	<4,860	<32,100	<29,500	36
1,2,3-Trichlorobenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,2,4-Trichlorobenzene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,1,1-Trichloroethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,1,2-Trichloroethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Trichloroethene	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Trichlorofluoromethane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,2,3-Trichloropropane	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
1,2,4-Trimethylbenzene	4,110	12,300	21,200	213	80	8,170	<32,100	44,900	<30
1,3,5-Trimethylbenzene	<3,420	<3,130	8,360	43	<36	<4,860	<32,100	<29,500	<30
Vinyl Chloride	<3,420	<3,130	<6,240	<30	<36	<4,860	<32,100	<29,500	<30
Xylene, total	<4,790	18,800	22,500	379	129	10,500	<45,000	70,800	<42
TOTAL VOCs + Naphthalene	120,630	361,600	687,760	7,085	2,623	241,620	540,000	1,477,100	397

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-27	SD-27	SD-27	SD-27	SD-28	SD-28	SD-28	SD-28
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Solids (%)	37.9	80.4	78.3	83.0	30.4	70.6	77.6	80.9
Acenaphthene	<2.2	<0.41	<0.42	<0.40	<1.1	**4.1**	<0.43	<0.41
Acenaphthylene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Antracene	<2.2	<0.41	<0.42	<0.40	<1.1	**1.1**	<0.43	<0.41
Benzo(a)anthracene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Benzo(b)fluoranthene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Benzo(k)fluoranthene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Benzo(g,h,I)perylene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Benzo(a)pyrene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Chrysene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Dibenzo(a,h)anthracene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
Fluoranthene	**2.6**	<0.41	<0.42	<0.40	<1.1	**0.78**	<0.43	<0.41
Fluorene	<2.2	<0.41	<0.42	<0.40	<1.1	**2.1**	<0.43	<0.41
Indeno (1,2,3-cd)pyrene	<2.2	<0.41	<0.42	<0.40	<1.1	<0.47	<0.43	<0.41
2-Methylnaphthalene	<2.2	<0.41	<0.42	<0.40	<1.1	**8.4**	<0.43	<0.41
Naphthalene	<2.2	<0.41	<0.42	<0.40	**2.3**	**18**	<0.43	<0.41
Phenanthrene	<2.2	<0.41	<0.42	<0.40	<1.1	**4.4**	<0.43	<0.41
Pyrene	**3.4**	<0.41	<0.42	<0.40	<1.1	**0.95**	<0.43	<0.41
TOTAL PAHs	6	0	0	0	2.3	34.63	0	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-27	SD-27	SD-27	SD-27	SD-28	SD-28	SD-28	SD-28
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Benzene	<66	<35	<36	<34	<82	<354	<32	<31
Bromobenzene	<66	<35	<36	<34	<82	<354	<32	<31
Bromochloromethane	<66	<35	<36	<34	<82	<354	<32	<31
Bromodichloromethane	<66	<35	<36	<34	<82	<354	<32	<31
Bromoform	<66	<35	<36	<34	<82	<354	<32	<31
Bromomethane	<264	<137	<140	<133	<329	<1,420	<129	<124
n-Butylbenzene	<66	<35	<36	<34	<82	<354	<32	<31
sec-Butylbenzene	<66	<35	<36	<34	<82	<354	<32	<31
tert-Butylbenzene	<66	<35	<36	<34	<82	<354	<32	<31
Carbon Tetrachloride	<66	<35	<36	<34	<82	<354	<32	<31
Chlorobenzene	<66	<35	<36	<34	<82	<354	<32	<31
Chlorodibromethane	<66	<35	<36	<34	<82	<354	<32	<31
Chloroethane	<92	<47	<49	<46	<120	<496	<45	<43
Chloroform	<66	<35	<36	<34	<82	<354	<32	<31
Chloromethane	<130	<68	<70	<66	<160	<708	<64	<62
2-Chlorotolunene	<66	<35	<36	<34	<82	<354	<32	<31
4-Chlorotolunene	<66	<35	<36	<34	<82	<354	<32	<31
1,2-Dibromo-3-Chloropropane	<130	<68	<70	<66	<160	<708	<64	<62
1,2-Dibromethane (EDB)	<66	<35	<36	<34	<82	<354	<32	<31
Dibromomethane	<66	<35	<36	<34	<82	<354	<32	<31
1,2-Dichlorobenzene	<66	<35	<36	<34	<82	<354	<32	<31
1,3-Dichlorobenzene	<66	<35	<36	<34	<82	<354	<32	<31
1,4-Dichlorobenzene	<66	<35	<36	<34	<82	<354	<32	<31
Dichlorodifluoromethane	<66	<35	<36	<34	<82	<354	<32	<31
1,1-Dichloroethane	<66	<35	<36	<34	<82	<354	<32	<31
1,2-Dichloroethane	<66	<35	<36	<34	<82	<354	<32	<31
1,1-Dichloroethene	<66	<35	<36	<34	<82	<354	<32	<31
cis-1,2-Dichloroethene	<66	<35	<36	<34	<82	<354	<32	<31
trans-1,2-Dichloroethene	<66	<35	<36	<34	<82	<354	<32	<31
1,2-Dichloropropane	<66	<35	<36	<34	<82	<354	<32	<31
1,3-Dichloropropane	<66	<35	<36	<34	<82	<354	<32	<31
2,2-Dichloropropane	<66	<35	<36	<34	<82	<354	<32	<31
1,1-Dichloropropene	<66	<35	<36	<34	<82	<354	<32	<31
cis-1,3-Dichloropropene	<66	<35	<36	<34	<82	<354	<32	<31
trans-1,3-Dichloropropene	<66	<35	<36	<34	<82	<354	<32	<31
Di-isopropyl ether	<66	<35	<36	<34	<82	<354	<32	<31
Ethylbenzene	<66	<35	<36	<34	<82	<354	<32	<31
Hexachlorobutadiene	<92	<47	<49	<46	<120	<496	<45	<43
Isopropylbenzene	<66	<35	<36	<34	<82	<354	<32	<31
p-Isopropyltoluene	**2,480**	<35	<36	<34	<82	<354	<32	<31
Methylene Chloride	<130	**120 L**	<70	**217 L**	**190 L**	**992 L**	<64	<62
Methyl-t-butyl-ether	<66	<35	<36	<34	<82	<354	<32	<31
Naphthalene	**110**	**61**	<36	<34	**559**	**4,390**	**1,420**	<31
n-Propylbenzene	<66	<35	<36	<34	<82	<354	<32	<31
Styrene	<66	<35	<36	<34	<82	<354	<32	<31
1,1,1,2-Tetrachloroethane	<66	<35	<36	<34	<82	<354	<32	<31
1,1,2,2-Tetrachloroethane	<66	<35	<36	<34	<82	<354	<32	<31
Tetrachloroethane	<66	<35	<36	<34	<82	<354	<32	<31
Toluene	**739**	<35	<36	<34	<82	<354	<32	<31
1,2,3-Trichlorobenzene	<66	<35	<36	<34	<82	<354	<32	<31
1,2,4-Trichlorobenzene	<66	<35	<36	<34	<82	<354	<32	<31
1,1,1-Trichloroethane	<66	<35	<36	<34	<82	<354	<32	<31
1,1,2-Trichloroethane	<66	<35	<36	<34	<82	<354	<32	<31
Trichloroethene	<66	<35	<36	<34	<82	<354	<32	<31
Trichlorofluoromethane	<66	<35	<36	<34	<82	<354	<32	<31
1,2,3-Trichloropropane	<66	<35	<36	<34	<82	<354	<32	<31
1,2,4-Trimethylbenzene	<66	<35	<36	<34	**99**	<354	**120**	<31
1,3,5-Trimethylbenzene	<66	<35	<36	<34	<82	<354	<32	<31
Vinyl Chloride	<66	<35	<36	<34	<82	<354	<32	<31
Xylene, total	<92	<47	<49	<46	<120	<496	**54**	<43
TOTAL VOCs + Naphthalene	3,329	61	0	0	658	4,390	1,594	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-29	SD-29	SD-29	SD-29	SD-30	SD-30	SD-30	SD-30
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Solids (%)	42.2	39.0	65.3	82.7	28.7	65.6	82.3	80.4
Acenaphthene	<3.8	<4.1	<0.52	<0.40	<10	**0.91**	<0.40	<0.41
Acenaphthylene	<3.8	<4.1	<0.52	<0.40	<10	<0.50	<0.40	<0.41
Antracene	<3.8	<4.1	<0.52	<0.40	<10	**0.79**	<0.40	<0.41
Benzo(a)anthracene	<3.8	<4.1	<0.52	<0.40	<10	**1.8**	<0.40	<0.41
Benzo(b)fluoranthene	<3.8	<4.1	<0.52	<0.40	<10	**0.95**	<0.40	<0.41
Benzo(k)fluoranthene	<3.8	<4.1	<0.52	<0.40	<10	**0.98**	<0.40	<0.41
Benzo(g,h,i)perylene	<3.8	<4.1	<0.52	<0.40	<10	**0.88**	<0.40	<0.41
Benzo(a)pyrene	<3.8	<4.1	<0.52	<0.40	<10	**1.5**	<0.40	<0.41
Chrysene	<3.8	<4.1	<0.52	<0.40	<10	**1.8**	<0.40	<0.41
Dibenzo(a,h)anthracene	<3.8	<4.1	<0.52	<0.40	<10	<0.50	<0.40	<0.41
Fluoranthene	<3.8	<4.1	<0.52	<0.40	13	**2.9**	<0.40	<0.41
Fluorene	<3.8	<4.1	<0.52	<0.40	<10	**0.56**	<0.40	<0.41
Indeno (1,2,3-cd)pyrene	<3.8	<4.1	<0.52	<0.40	<10	**0.72**	<0.40	<0.41
2-Methylnaphthalene	<3.8	<4.1	<0.52	<0.40	<10	**1.0**	<0.40	<0.41
Naphthalene	<3.8	<4.1	<0.52	<0.40	<10	**1.2**	<0.40	<0.41
Phenanthrene	<3.8	<4.1	<0.52	<0.40	14	**2.4**	<0.40	<0.41
Pyrene	<3.8	<4.1	<0.52	<0.40	<10	**5.0**	<0.40	<0.41
TOTAL PAHs	0	0	0	0	27	13.78	0	0

All units report in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-29	SD-29	SD-29	SD-29	SD-30	SD-30	SD-30	SD-30
Depth	0-2	2-4	4-6	6-8	0-2	2-4	4-6	6-8
Benzene	<59	<64	<39	<30	<87	<38	<30	<31
Bromobenzene	<59	<64	<39	<30	<87	<38	<30	<31
Bromochloromethane	<59	<64	<39	<30	<87	<38	<30	<31
Bromodichloromethane	<59	<64	<39	<30	<87	<38	<30	<31
Bromoform	<59	<64	<39	<30	<87	<38	<30	<31
Bromomethane	<237	<256	<158	<121	<348	<152	<122	<124
n-Butylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
sec-Butylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
tert-Butylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
Carbon Tetrachloride	<59	<64	<39	<30	<87	<38	<30	<31
Chlorobenzene	<59	<64	<39	<30	<87	<38	<30	<31
Chlorodibromethane	<59	<64	<39	<30	<87	<38	<30	<31
Chloroethane	<83	<90	<55	<42	<120	<53	<43	<44
Chloroform	<59	<64	<39	<30	<87	<38	<30	<31
Chloromethane	<120	<130	<79	<60	<170	<76	<61	<62
2-Chlorotolunene	<59	<64	<39	<30	<87	<38	<30	<31
4-Chlorotolunene	<59	<64	<39	<30	<87	<38	<30	<31
1,2-Dibromo-3-Chloropropane	<120	<130	<79	<60	<170	<76	<61	<62
1,2-Dibromethane (EDB)	<59	<64	<39	<30	<87	<38	<30	<31
Dibromomethane	<59	<64	<39	<30	<87	<38	<30	<31
1,2-Dichlorobenzene	<59	<64	<39	<30	<87	<38	<30	<31
1,3-Dichlorobenzene	<59	<64	<39	<30	<87	<38	<30	<31
1,4-Dichlorobenzene	<59	<64	<39	<30	<87	<38	<30	<31
Dichlorodifluoromethane	<59	<64	<39	<30	<87	<38	<30	<31
1,1-Dichloroethane	<59	<64	<39	<30	<87	<38	<30	<31
1,2-Dichloroethane	<59	<64	<39	<30	<87	<38	<30	<31
1,1-Dichloroethene	<59	<64	<39	<30	<87	<38	<30	<31
cis-1,2-Dichloroethene	<59	<64	<39	<30	<87	<38	<30	<31
trans-1,2-Dichloroethene	<59	<64	<39	<30	<87	<38	<30	<31
1,2-Dichloropropane	<59	<64	<39	<30	<87	<38	<30	<31
1,3-Dichloropropane	<59	<64	<39	<30	<87	<38	<30	<31
2,2-Dichloropropane	<59	<64	<39	<30	<87	<38	<30	<31
1,1-Dichloropropene	<59	<64	<39	<30	<87	<38	<30	<31
cis-1,3-Dichloropropene	<59	<64	<39	<30	<87	<38	<30	<31
trans-1,3-Dichloropropene	<59	<64	<39	<30	<87	<38	<30	<31
Di-isopropyl ether	<59	<64	<39	<30	<87	<38	<30	<31
Ethylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
Hexachlorobutadiene	<83	<90	<55	<42	<170	<53	<43	<44
Isopropylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
p-Isopropyltoluene	<59	<64	**76**	<30	**160**	**99**	<30	<31
Methylene Chloride	**210 L**	**256 L**	**140 L**	**100 L**	**170 L**	<76	**110 L**	**137 L**
Methyl-t-butyl-ether	<59	<64	<39	<30	<87	<38	<30	<31
Naphthalene	<59	<64	<39	<30	**240**	**58**	<30	<31
n-Propylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
Styrene	<59	<64	<39	<30	<87	<38	<30	<31
1,1,1,2-Tetrachloroethane	<59	<64	<39	<30	<87	<38	<30	<31
1,1,2,2-Tetrachloroethane	<59	<64	<39	<30	<87	<38	<30	<31
Tetrachloroethane	<59	<64	<39	<30	<87	<38	<30	<31
Toluene	<59	<64	**44**	<30	**100**	**120**	<30	<31
1,2,3-Trichlorobenzene	<59	<64	<39	<30	<87	<38	<30	<31
1,2,4-Trichlorobenzene	<59	<64	<39	<30	<87	<38	<30	<31
1,1,1-Trichloroethane	<59	<64	<39	<30	<87	<38	<30	<31
1,1,2-Trichloroethane	<59	<64	<39	<30	<87	<38	<30	<31
Trichloroethene	<59	<64	<39	<30	<87	<38	<30	<31
Trichlorofluoromethane	<59	<64	<39	<30	<87	<38	<30	<31
1,2,3-Trichloropropane	<59	<64	<39	<30	<87	<38	<30	<31
1,2,4-Trimethylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
1,3,5-Trimethylbenzene	<59	<64	<39	<30	<87	<38	<30	<31
Vinyl Chloride	<59	<64	<39	<30	<87	<38	<30	<31
Xylene, total	<83	<90	<55	<42	<120	<53	<43	<44
TOTAL VOCs + Naphthalene	0	0	120	0	500	277	0	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-31	SD-31	SD-31	SD-31	SD-32	SD-32	SD-32	SD-32
Depth	2-4	4-6	8-10	12-14	2-4	4-6	6-8	10-12
Solids (%)	77.3	81.2	77.0	80.7	75.2	83.0	79.5	80.5
Acenaphthene	26	<0.41	<0.43	<0.41	7.3	<0.40	<0.42	<0.41
Acenaphthylene	<2.1	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42-	<0.41
Antracene	8.4	<0.41	<0.43	<0.41	2.3	<0.40	<0.42	<0.41
Benzo(a)anthracene	3.9	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
Benzo(b)fluoranthene	<2.1	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
Benzo(k)fluoranthene	<2.1	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
Benzo(g,h,I)perylene	<2.1	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
Benzo(a)pyrene	3.6	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
Chrysene	3.9	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
Dibenzo(a,h)anthracene	<2.1	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
Fluoranthene	9.6	<0.41	<0.43	<0.41	2.8	<0.40	<0.42	<0.41
Fluorene	13	<0.41	<0.43	<0.41	3.5	<0.40	<0.42	<0.41
Indeno (1,2,3-cd)pyrene	<2.1	<0.41	<0.43	<0.41	<2.1	<0.40	<0.42	<0.41
2-Methylnaphthalene	43	0.59	<0.43	<0.41	10	<0.40	<0.42	<0.41
Naphthalene	80	1.4	<0.43	<0.41	16	<0.40	<0.42	<0.41
Phenanthrene	30	<0.41	<0.43	<0.41	8.9	0.46	<0.42	<0.41
Pyrene	16	<0.41	<0.43	<0.41	4.4	<0.40	<0.42	<0.41
TOTAL PAHs	191.6	1.99	0	0	45.6	0.46	0	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-31	SD-31	SD-31	SD-31	SD-32	SD-32	SD-32	SD-32
Depth	2-4	4-6	8-10	12-14	2-4	4-6	6-8	10-12
Benzene	<3,230	<31	<32	<31	<3,320	<30	40	<31
Bromobenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Bromochloromethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Bromodichloromethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Bromoform	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Bromomethane	<12,900	<123	<130	<124	<13,300	<120	<126	<124
n-Butylbenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
sec-Butylbenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
tert-Butylbenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Carbon Tetrachloride	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Chlorobenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Chlorodibromethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Chloroethane	<4,530	<43	<45	<43	<4,650	<42	<44	<43
Chloroform	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Chloromethane	<6,470	<62	<65	<62	<6,650	<60	<63	<62
2-Chlorotolunene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
4-Chlorotolunene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,2-Dibromo-3-Chloropropane	<6,470	<62	<65	<62	<6,650	<60	<63	<62
1,2-Dibromethane (EDB)	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Dibromomethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,2-Dichlorobenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,3-Dichlorobenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,4-Dichlorobenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Dichlorodifluoromethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,1-Dichloroethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,2-Dichloroethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,1-Dichloroethene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
cis-1,2-Dichloroethene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
trans-1,2-Dichloroethene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,2-Dichloropropane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,3-Dichloropropane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
2,2-Dichloropropane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,1-Dichloropropene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
cis-1,3-Dichloropropene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
trans-1,3-Dichloropropene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Di-isopropyl ether	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Ethylbenzene	25,900	68	<32	<31	30,600	53	38	<31
Hexachlorobutadiene	<4,530	<43	<45	<43	<4,650	<42	<44	<43
Isopropylbenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
p-Isopropyltoluene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Methylene Chloride	18,100 L	123 L	130 L	136 L	19,900 L	289 L	277 L	149 L
Methyl-t-butyl-ether	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Naphthalene	401,000	505	<32	33	665,000	1,450	314	57
n-Propylbenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Styrene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,1,1,2-Tetrachloroethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,1,2,2-Tetrachloroethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Tetrachloroethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Toluene	<3,230	<31	<32	<31	5,320	<30	36	<31
1,2,3-Trichlorobenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,2,4-Trichlorobenzene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,1,1-Trichloroethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,1,2-Trichloroethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Trichloroethene	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Trichlorofluoromethane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,2,3-Trichloropropane	<3,230	<31	<32	<31	<3,320	<30	<31	<31
1,2,4-Trimethylbenzene	12,500	<31	<32	<31	16,000	<30	<31	<31
1,3,5-Trimethylbenzene	<3,230	<31	<32	<31	6,120	<30	<31	<31
Vinyl Chloride	<3,230	<31	<32	<31	<3,320	<30	<31	<31
Xylene, total	22,000	54	<45	<43	22,600	53	<44	<43
TOTAL VOCs + Naphthalene	461,400	627	0	33	745,640	1,556	428	57

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-33	SD-33	SD-33	SD-33	SD-33	SD-34	SD-34	SD-34
Depth	0-2	2-4	4-6	6-8	8-10	2-4	4-6	6-8
Solids (%)	77.3	75.3	82.6	83.2	80.7	80.3	81.0	80.0
Acenaphthene	36	31	133	6.1	<0.41	2.4	0.69	0.66
Acenaphthylene	1.8	2.0	9.8	<0.76	<0.41	<0.41	<0.41	<0.41
Antracene	10	8.0	39	2.0	<0.41	0.76	<0.41	<0.41
Benzo(a)anthracene	7.1	5.4	23	1.1	<0.41	<0.41	<0.41	<0.41
Benzo(b)fluoranthene	2.7	2.1	8.7	<0.76	<0.41	<0.41	<0.41	<0.41
Benzo(k)fluoranthene	3.8	2.9	12	<0.76	<0.41	<0.41	<0.41	<0.41
Benzo(g,h,I)perylene	3.1	2.4	9.9	<0.76	<0.41	<0.41	<0.41	<0.41
Benzo(a)pyrene	6.6	5.0	22	0.94	<0.41	<0.41	<0.41	<0.41
Chrysene	6.7	5.0	22	1.0	<0.41	<0.41	<0.41	<0.41
Dibenzo(a,h)anthracene	0.57	0.46	<3.9	<0.76	<0.41	<0.41	<0.41	<0.41
Fluoranthene	18	13	54	2.9	<0.41	0.91	0.42	<0.41
Fluorene	13	9.6	58	2.9	<0.41	1.2	<0.41	<0.41
Indeno (1,2,3-cd)pyrene	2.8	2.3	9.1	<0.76	<0.41	<0.41	<0.41	<0.41
2-Methylnaphthalene	45	44	206	7.3	<0.41	3.7	0.70	0.91
Naphthalene	52	70	339	9.9	<0.41	6.8	0.62	1.1
Phenanthrene	50	39	169	8.4	<0.41	3.1	1.4	0.85
Pyrene	26	19	74	4.1	<0.41	1.2	0.58	<0.41
TOTAL PAHs	206.8	196.9	909.1	35.5	0	16.91	3.72	2.86

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-33	SD-33	SD-33	SD-33	SD-33	SD-34	SD-34	SD-34
Depth	0-2	2-4	4-6	6-8	8-10	2-4	4-6	6-8
Benzene	<323	40	<30	<30	<31	87	<31	<625
Bromobenzene	<323	<33	<30	<30	<31	<31	<31	<625
Bromochloromethane	<323	<33	<30	<30	<31	<31	<31	<625
Bromodichloromethane	<323	<33	<30	<30	<31	<31	<31	<625
Bromoform	<323	<33	<30	<30	<31	<31	<31	<625
Bromomethane	<1,290	<133	<121	<120	<124	<125	<123	<2,500
n-Butylbenzene	<323	<33	<30	<30	<31	<31	<31	<625
sec-Butylbenzene	<323	<33	<30	<30	<31	<31	<31	<625
tert-Butylbenzene	<323	<33	<30	<30	<31	<31	<31	<625
Carbon Tetrachloride	<323	<33	<30	<30	<31	<31	<31	<625
Chlorobenzene	<323	<33	<30	<30	<31	<31	<31	<625
Chlorodibromethane	<323	<33	<30	<30	<31	<31	<31	<625
Chloroethane	<453	<46	<42	<42	<43	<44	<43	<875
Chloroform	<323	<33	<30	<30	<31	<31	<31	<625
Chloromethane	<647	<66	<61	<60	<62	<62	<62	<1,250
2-Chlorotolunene	<323	<33	<30	<30	<31	<31	<31	<625
4-Chlorotolunene	<323	<33	<30	<30	<31	<31	<31	<625
1,2-Dibromo-3-Chloropropane	<647	<66	<61	<61	<62	<62	<62	<1,250
1,2-Dibromethane (EDB)	<323	<33	<30	<30	<31	<31	<31	<625
Dibromomethane	<323	<33	<30	<30	<31	<31	<31	<625
1,2-Dichlorobenzene	<323	<33	<30	<30	<31	<31	<31	<625
1,3-Dichlorobenzene	<323	<33	<30	<30	<31	<31	<31	<625
1,4-Dichlorobenzene	<323	<33	<30	<30	<31	<31	<31	<625
Dichlorodifluoromethane	<323	<33	<30	<30	<31	<31	<31	<625
1,1-Dichloroethane	<323	<33	<30	<30	<31	<31	<31	<625
1,2-Dichloroethane	<323	<33	<30	<30	<31	<31	<31	<625
1,1-Dichloroethene	<323	<33	<30	<30	<31	<31	<31	<625
cis-1,2-Dichloroethene	<323	<33	<30	<30	<31	<31	<31	<625
trans-1,2-Dichloroethene	<323	<33	<30	<30	<31	<31	<31	<625
1,2-Dichloropropane	<323	<33	<30	<30	<31	<31	<31	<625
1,3-Dichloropropane	<323	<33	<30	<30	<31	<31	<31	<625
2,2-Dichloropropane	<323	<33	<30	<30	<31	<31	<31	<625
1,1-Dichloropropene	<323	<33	<30	<30	<31	<31	<31	<625
cis-1,3-Dichloropropene	<323	<33	<30	<30	<31	<31	<31	<625
trans-1,3-Dichloropropene	<323	<33	<30	<30	<31	<31	<31	<625
Di-isopropyl ether	<323	<33	<30	<30	<31	<31	<31	<625
Ethylbenzene	1,810	677	157	697	<31	1,020	84	<625
Hexachlorobutadiene	<453	<46	<42	<42	<43	<44	<43	<875
Isopropylbenzene	440	53	<30	79	<31	85	<31	<625
p-Isopropyltoluene	1,220	58	<30	110	<31	62	<31	<625
Methylene Chloride	<647	<66	<61	<60	<62	110 L	<62	1,500 L
Methyl-t-butyl-ether	<323	<33	<30	<30	<31	<31	<31	<625
Naphthalene	181,000	19,900	3,270,000	27,600	110	19,900	1,140	11,800
n-Propylbenzene	<323	<33	<30	<30	<31	<31	<31	<625
Styrene	<323	<33	<30	<30	<31	<31	<31	<625
1,1,1,2-Tetrachloroethane	<323	<33	<30	<30	<31	<31	<31	<625
1,1,2,2-Tetrachloroethane	<323	<33	<30	<30	<31	<31	<31	<625
Tetrachloroethane	<323	<33	<30	<30	<31	<31	<31	<625
Toluene	<323	35	<30	72	<31	224	<31	<625
1,2,3-Trichlorobenzene	<323	<33	<30	<30	<31	<31	<31	<625
1,2,4-Trichlorobenzene	<323	<33	<30	<30	<31	<31	<31	<625
1,1,1-Trichloroethane	<323	<33	<30	<30	<31	<31	<31	<625
1,1,2-Trichloroethane	<323	<33	<30	<30	<31	<31	<31	<625
Trichloroethene	<323	<33	<30	<30	<31	<31	<31	<625
Trichlorofluoromethane	<323	<33	<30	<30	<31	<31	<31	<625
1,2,3-Trichloropropane	<323	<33	<30	<30	<31	<31	<31	<625
1,2,4-Trimethylbenzene	3,100	305	98	517	<31	486	<31	<625
1,3,5-Trimethylbenzene	1,030	110	39	180	<31	149	<31	<625
Vinyl Chloride	<323	<33	<30	<30	<31	<31	<31	<625
Xylene, total	1,550	584	133	625	<43	996	48	<875
TOTAL VOCs + Naphthalene	190,150	21,762	3,270,427	29,880	110	23,009	1,272	11,800

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-35	SD-35	SD-35	SD-35	SD-36	SD-36	SD-36	SD-36
Depth	2-4	4-6	6-8	8-10	2-4	4-6	6-8	8-10
Solids (%)	81.2	82.0	82.0	89.9	85.2	86.5	68.7	80.8
Acenaphthene	0.97	4.4	<0.40	<0.37	72	370	247	<0.41
Acenaphthylene	<0.41	0.4	<0.40	<0.37	3.9	28	22	<0.41
Antracene	<0.41	1.6	<0.40	<0.37	21	173	82	<0.41
Benzo(a)anthracene	<0.41	1.0	<0.40	<0.37	9.9	71	39	<0.41
Benzo(b)fluoranthene	<0.41	<0.40	<0.40	<0.37	4.0	27	16	<0.41
Benzo(k)fluoranthene	<0.41	0.52	<0.40	<0.37	5.4	25	19	<0.41
Benzo(g,h,l)perylene	<0.41	0.44	<0.40	<0.37	3.4	18	13	<0.41
Benzo(a)pyrene	<0.41	1.0	<0.40	<0.37	8.2	43	31	<0.41
Chrysene	<0.41	0.98	<0.40	<0.37	9.2	66	36	<0.41
Dibenzo(a,h)anthracene	<0.41	<0.40	<0.40	<0.37	1.1	6.4	<4.7	<0.41
Fluoranthene	<0.41	2.6	<0.40	<0.37	21	150	84	<0.41
Fluorene	<0.41	2.2	<0.40	<0.37	33	243	160	<0.41
Indeno (1,2,3-cd)pyrene	<0.41	<0.40	<0.40	<0.37	3.4	17	11	<0.41
2-Methylnaphthalene	1.4	5.0	<0.40	<0.37	129	786	466	<0.41
Naphthalene	3.6	6.5	<0.40	<0.37	164	1,030	582	<0.41
Phenanthrene	1.1	6.5	0.90	<0.37	81	405	291	<0.41
Pyrene	0.43	3.5	0.41	<0.37	29	208	100	<0.41
TOTAL PAHs	6.53	26.3	1.31	0	460.4	2839	1694	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-35	SD-35	SD-35	SD-35	SD-36	SD-36	SD-36	SD-36
Depth	2-4	4-6	6-8	8-10	2-4	4-6	6-8	8-10
Benzene	31	<305	<30	<31	1,290	<28,900	786	100
Bromobenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
Bromochloromethane	<31	<305	<30	<31	<329	<28,900	<364	<31
Bromodichloromethane	<31	<305	<30	<31	<329	<28,900	<364	<31
Bromoform	<31	<305	<30	<31	<329	<28,900	<364	<31
Bromomethane	<123	<1,200	<122	<122	<1,290	<116,000	<1,460	<124
n-Butylbenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
sec-Butylbenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
tert-Butylbenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
Carbon Tetrachloride	<31	<305	<30	<31	<329	<28,900	<364	<31
Chlorobenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
Chlorodibromethane	<31	<305	<30	<31	<329	<28,900	<364	<31
Chloroethane	<43	<427	<43	<42	<446	<40,500	<509	<43
Chloroform	<31	<305	<30	<31	<329	<28,900	<364	<31
Chloromethane	<62	<610	<61	<61	<646	<57,800	<728	<62
2-Chlorotolunene	<31	<305	<30	<31	<329	<28,900	<364	<31
4-Chlorotolunene	<31	<305	<30	<31	<329	<28,900	<364	<31
1,2-Dibromo-3-Chloropropane	<62	<610	<61	<61	<646	<57,800	<728	<62
1,2-Dibromethane (EDB)	<31	<305	<30	<31	<329	<28,900	<364	<31
Dibromomethane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,2-Dichlorobenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
1,3-Dichlorobenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
1,4-Dichlorobenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
Dichlorodifluoromethane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,1-Dichloroethane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,2-Dichloroethane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,1-Dichloroethene	<31	<305	<30	<31	<329	<28,900	<364	<31
cis-1,2-Dichloroethene	<31	<305	<30	<31	<329	<28,900	<364	<31
trans-1,2-Dichloroethene	<31	<305	<30	<31	<329	<28,900	<364	<31
1,2-Dichloropropane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,3-Dichloropropane	<31	<305	<30	<31	<329	<28,900	<364	<31
2,2-Dichloropropane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,1-Dichloropropene	<31	<305	<30	<31	<329	<28,900	<364	<31
cis-1,3-Dichloropropene	<31	<305	<30	<31	<329	<28,900	<364	<31
trans-1,3-Dichloropropene	<31	<305	<30	<31	<329	<28,900	<364	<31
Di-isopropyl ether	<31	<305	<30	<31	<329	<28,900	<364	<31
Ethylbenzene	419	378	<30	<31	17,600	90,200	7,130	161
Hexachlorobutadiene	<43	<427	<43	<42	<446	<40,500	<509	<43
Isopropylbenzene	32	<305	<30	<31	2,110	<28,900	859	<31
p-Isopropyltoluene	<31	<305	<30	<31	1,640	<28,900	611	<31
Methylene Chloride	67 L	3,170	207 L	133 L	1,530 L	173,000 L	2,040 L	110 L
Methyl-t-butyl-ether	<31	<305	<30	<31	<329	<28,900	<364	<31
Naphthalene	8,870	24,400	951	145	305,000	1,730,000	125,000	1,360
n-Propylbenzene	<31	<305	<30	<31	798	<28,900	<364	<31
Styrene	<31	<305	<30	<31	<329	<28,900	<364	<31
1,1,1,2-Tetrachloroethane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,1,2,2-Tetrachloroethane	<31	<305	<30	<31	<329	<28,900	<364	<31
Tetrachloroethane	<31	<305	<30	<31	<329	<28,900	<364	<31
Toluene	224	<305	<30	<31	2,350	32,400	3,060	69
1,2,3-Trichlorobenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
1,2,4-Trichlorobenzene	<31	<305	<30	<31	<329	<28,900	<364	<31
1,1,1-Trichloroethane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,1,2-Trichloroethane	<31	<305	<30	<31	<329	<28,900	<364	<31
Trichloroethene	<31	<305	<30	<31	<329	<28,900	<364	<31
Trichlorofluoromethane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,2,3-Trichloropropane	<31	<305	<30	<31	<329	<28,900	<364	<31
1,2,4-Trimethylbenzene	172	439	<30	<31	12,900	60,100	4,950	50
1,3,5-Trimethylbenzene	60	<305	<30	<31	3,050	<28,900	1,340	<31
Vinyl Chloride	<31	<305	<30	<31	<329	<28,900	<364	<31
Xylene, total	369	<427	<43	<42	20,000	104,000	8,010	186
TOTAL VOCs + Naphthalene	10,177	28,387	951	145	366,738	2,016,700	151,746	1,926

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-37	SD-37	SD-37	SD-38	SD-38	SD-38	SD-38
Depth	0-2	4-6	6-8	0-2	2-4	4-6	6-8
Solids (%)	37.3	80.5	80.8	19.7	74.8	80.6	79.8
Acenaphthene	<21	149	<0.41	<4.8	<0.44	<0.86	<0.41
Acenaphthylene	<21	15	<0.41	<4.8	<0.44	<0.86	<0.41
Antracene	<21	66	<0.41	<4.8	<0.44	<0.86	<0.41
Benzo(a)anthracene	<21	22	<0.41	<4.8	<0.44	<0.86	<0.41
Benzo(b)fluoranthene	<21	8.2	<0.41	<4.8	<0.44	<0.86	<0.41
Benzo(k)fluoranthene	<21	12	<0.41	<4.8	<0.44	<0.86	<0.41
Benzo(g,h,I)perylene	<21	7.3	<0.41	<4.8	<0.44	<0.86	<0.41
Benzo(a)pyrene	<21	17	<0.41	<4.8	<0.44	<0.86	<0.41
Chrysene	<21	21	<0.41	<4.8	<0.44	<0.86	<0.41
Dibenzo(a,h)anthracene	<21	2.4	<0.41	<4.8	<0.44	<0.86	<0.41
Fluoranthene	<21	45	<0.41	<4.8	<0.44	<0.86	<0.41
Fluorene	<21	93	<0.41	<4.8	<0.44	<0.86	<0.41
Indeno (1,2,3-cd)pyrene	<21	6.6	<0.41	<4.8	<0.44	<0.86	<0.41
2-Methylnaphthalene	<21	273	<0.41	<4.8	<0.44	<0.86	<0.41
Naphthalene	<21	323	<0.41	6.1	<0.44	<0.86	<0.41
Phenanthrene	<21	174	<0.41	<4.8	<0.44	<0.86	<0.41
Pyrene	<21	75	<0.41	<4.8	<0.44	<0.86	<0.41
TOTAL PAHs	0	989.6	0	6.1	0	0	0

All units reported in mg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-37	SD-37	SD-37	SD-38	SD-38	SD-38	SD-38
Depth	0-2	4-6	6-8	0-2	2-4	4-6	6-8
Benzene	<67	<31,100	**89**	<130	<33	<35	<35
Bromobenzene	<67	<31,100	<31	<130	<33	<35	<35
Bromochloromethane	<67	<31,100	<31	<130	<33	<35	<35
Bromodichloromethane	<67	<31,100	<31	<130	<33	<35	<35
Bromoform	<67	<31,100	<31	<130	<33	<35	<35
Bromomethane	<268	<124,000	<124	<508	<134	<136	<138
n-Butylbenzene	<67	<31,100	<31	<130	<33	<35	<35
sec-Butylbenzene	<67	<31,100	<31	<130	<33	<35	<35
tert-Butylbenzene	<67	<31,100	<31	<130	<33	<35	<35
Carbon Tetrachloride	<67	<31,100	<31	<130	<33	<35	<35
Chlorobenzene	<67	<31,100	<31	<130	<33	<35	<35
Chlorodibromethane	<67	<31,100	<31	<130	<33	<35	<35
Chloroethane	<94	<43,500	<43	<180	<47	<47	<48
Chloroform	<67	<31,100	<31	<130	<33	<35	<35
Chloromethane	<130	<62,100	<62	<250	<67	<68	<69
2-Chlorotolunene	<67	<31,100	<31	<130	<33	<35	<35
4-Chlorotolunene	<67	<31,100	<31	<130	<33	<35	<35
1,2-Dibromo-3-Chloropropane	<130	<62,100	<62	<250	<67	<68	<69
1,2-Dibromethane (EDB)	<67	<31,100	<31	<130	<33	<35	<35
Dibromomethane	<67	<31,100	<31	<130	<33	<35	<35
1,2-Dichlorobenzene	<67	<31,100	<31	<130	<33	<35	<35
1,3-Dichlorobenzene	<67	<31,100	<31	<130	<33	<35	<35
1,4-Dichlorobenzene	<67	<31,100	<31	<130	<33	<35	<35
Dichlorodifluoromethane	<67	<31,100	<31	<130	<33	<35	<35
1,1-Dichloroethane	<67	<31,100	<31	<130	<33	<35	<35
1,2-Dichloroethane	<67	<31,100	<31	<130	<33	<35	<35
1,1-Dichloroethene	<67	<31,100	<31	<130	<33	<35	<35
cis-1,2-Dichloroethene	<67	<31,100	<31	<130	<33	<35	<35
trans-1,2-Dichloroethene	<67	<31,100	<31	<130	<33	<35	<35
1,2-Dichloropropane	<67	<31,100	<31	<130	<33	<35	<35
1,3-Dichloropropane	<67	<31,100	<31	<130	<33	<35	<35
2,2-Dichloropropane	<67	<31,100	<31	<130	<33	<35	<35
1,1-Dichloropropene	<67	<31,100	<31	<130	<33	<35	<35
cis-1,3-Dichloropropene	<67	<31,100	<31	<130	<33	<35	<35
trans-1,3-Dichloropropene	<67	<31,100	<31	<130	<33	<35	<35
Di-isopropyl ether	<67	<31,100	<31	<130	<33	<35	<35
Ethylbenzene	<67	<31,100	**235**	<130	<33	<35	<35
Hexachlorobutadiene	<94	<43,500	<43	<180	<47	<47	<48
Isopropylbenzene	<67	<31,100	<31	<130	<33	<35	<35
p-Isopropyltoluene	**160**	<31,100	<31	**914**	**227**	<35	<35
Methylene Chloride	<160	**161,000 L**	**100 L**	<250	<67	<68	<69
Methyl-t-butyl-ether	<67	<31,100	<31	<130	<33	<35	<35
Naphthalene	**590**	**770,000**	**1,490**	<130	<33	<35	<35
n-Propylbenzene	<67	<31,100	<31	<130	<33	<35	<35
Styrene	<67	<31,100	<31	<130	<33	<35	<35
1,1,1,2-Tetrachloroethane	<67	<31,100	<31	<130	<33	<35	<35
1,1,2,2-Tetrachloroethane	<67	<31,100	<31	<130	<33	<35	<35
Tetrachloroethane	<67	<31,100	<31	<130	<33	<35	<35
Toluene	**180**	<31,100	**48**	**2,230**	**267**	<35	<35
1,2,3-Trichlorobenzene	<67	<31,100	<31	<130	<33	<35	<35
1,2,4-Trichlorobenzene	<67	<31,100	<31	<130	<33	<35	<35
1,1,1-Trichloroethane	<67	<31,100	<31	<130	<33	<35	<35
1,1,2-Trichloroethane	<67	<31,100	<31	<130	<33	<35	<35
Trichloroethene	<67	<31,100	<31	<130	<33	<35	<35
Trichlorofluoromethane	<67	<31,100	<31	<130	<33	<35	<35
1,2,3-Trichloropropane	<67	<31,100	<31	<130	<33	<35	<35
1,2,4-Trimethylbenzene	**322**	<31,100	**54**	<130	<33	<35	<35
1,3,5-Trimethylbenzene	<67	<31,100	<31	<130	<33	<35	<35
Vinyl Chloride	<67	<31,100	<31	<130	<33	<35	<35
Xylene, total	<94	<43,500	**235**	<180	<47	<47	<48
TOTAL VOCs + Naphthalene	1,252	770,000	2,151	3,144	494	0	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-39	SD-39	SD-39	SD-39	SD-40	SD-40	SD-40
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Solids (%)	32.8	82.6	79.5	82.3	76.5	80.6	82.7
Acenaphthene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Acenaphthylene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Antracene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Benzo(a)anthracene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Benzo(b)fluoranthene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Benzo(k)fluoranthene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Benzo(g,h,I)perylene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Benzo(a)pyrene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Chrysene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Dibenzo(a,h)anthracene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Fluoranthene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Fluorene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Indeno (1,2,3-cd)pyrene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
2-Methylnaphthalene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Naphthalene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Phenanthrene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
Pyrene	<12	<0.80	<2.0	<0.40	<0.43	<0.41	<0.40
TOTAL PAHs	0	0	0	0	0	0	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-39	SD-39	SD-39	SD-39	SD-40	SD-40	SD-40
Depth	0-2	2-4	4-6	6-8	2-4	4-6	6-8
Benzene	<76	<30	<31	<30	<33	<31	<34
Bromobenzene	<76	<30	<31	<30	<33	<31	<34
Bromochloromethane	<76	<30	<31	<30	<33	<31	<34
Bromodichloromethane	<76	<30	<31	<30	<33	<31	<34
Bromoform	<76	<30	<31	<30	<33	<31	<34
Bromomethane	<305	<121	<126	<122	<131	<124	<133
n-Butylbenzene	<76	<30	<31	<30	<33	<31	<34
sec-Butylbenzene	<76	<30	<31	<30	<33	<31	<34
tert-Butylbenzene	<76	<30	<31	<30	<33	<31	<34
Carbon Tetrachloride	<76	<30	<31	<30	<33	<31	<34
Chlorobenzene	<76	<30	<31	<30	<33	<31	<34
Chlorodibromethane	<76	<30	<31	<30	<33	<31	<34
Chloroethane	<110	<42	<44	<43	<46	<43	<46
Chloroform	<76	<30	<31	<30	<33	<31	<34
Chloromethane	<150	<61	<63	<61	<65	<62	<67
2-Chlorotolunene	<76	<30	<31	<30	<33	<31	<34
4-Chlorotolunene	<76	<30	<31	<30	<33	<31	<34
1,2-Dibromo-3-Chloropropane	<150	<61	<63	<61	<65	<62	<67
1,2-Dibromethane (EDB)	<76	<30	<31	<30	<33	<31	<34
Dibromomethane	<76	<30	<31	<30	<33	<31	<34
1,2-Dichlorobenzene	<76	<30	<31	<30	<33	<31	<34
1,3-Dichlorobenzene	<76	<30	<31	<30	<33	<31	<34
1,4-Dichlorobenzene	<76	<30	<31	<30	<33	<31	<34
Dichlorodifluoromethane	<76	<30	<31	<30	<33	<31	<34
1,1-Dichloroethane	<76	<30	<31	<30	<33	<31	<34
1,2-Dichloroethane	<76	<30	<31	<30	<33	<31	<34
1,1-Dichloroethene	<76	<30	<31	<30	<33	<31	<34
cis-1,2-Dichloroethene	<76	<30	<31	<30	<33	<31	<34
trans-1,2-Dichloroethene	<76	<30	<31	<30	<33	<31	<34
1,2-Dichloropropane	<76	<30	<31	<30	<33	<31	<34
1,3-Dichloropropane	<76	<30	<31	<30	<33	<31	<34
2,2-Dichloropropane	<76	<30	<31	<30	<33	<31	<34
1,1-Dichloropropene	<76	<30	<31	<30	<33	<31	<34
cis-1,3-Dichloropropene	<76	<30	<31	<30	<33	<31	<34
trans-1,3-Dichloropropene	<76	<30	<31	<30	<33	<31	<34
Di-isopropyl ether	<76	<30	<31	<30	<33	<31	<34
Ethylbenzene	<76	<30	<31	<30	<33	<31	<34
Hexachlorobutadiene	<110	<42	<44	<43	<46	<43	<46
Isopropylbenzene	<76	<30	<31	<30	<33	<31	<34
p-Isopropyltoluene	**140**	<30	<31	<30	<33	<31	<34
Methylene Chloride	<150	**80 L**	**65 L**	<61	**93 L**	<62	<67
Methyl-t-butyl-ether	<76	<30	<31	<30	<33	<31	<34
Naphthalene	<76	<30	<31	<30	**34**	**60**	<34
n-Propylbenzene	<76	<30	<31	<30	<33	<31	<34
Styrene	<76	<30	<31	<30	<33	<31	<34
1,1,1,2-Tetrachloroethane	<76	<30	<31	<30	<33	<31	<34
1,1,2,2-Tetrachloroethane	<76	<30	<31	<30	<33	<31	<34
Tetrachloroethane	<76	<30	<31	<30	<33	<31	<34
Toluene	**610**	<30	<31	<30	**37**	<31	<34
1,2,3-Trichlorobenzene	<76	<30	<31	<30	<33	<31	<34
1,2,4-Trichlorobenzene	<76	<30	<31	<30	<33	<31	<34
1,1,1-Trichloroethane	<76	<30	<31	<30	<33	<31	<34
1,1,2-Trichloroethane	<76	<30	<31	<30	<33	<31	<34
Trichloroethene	<76	<30	<31	<30	<33	<31	<34
Trichlorofluoromethane	<76	<30	<31	<30	<33	<31	<34
1,2,3-Trichloropropane	<76	<30	<31	<30	<33	<31	<34
1,2,4-Trimethylbenzene	<76	<30	<31	<30	<33	<31	<34
1,3,5-Trimethylbenzene	<76	<30	<31	<30	<33	<31	<34
Vinyl Chloride	<76	<30	<31	<30	<33	<31	<34
Xylene, total	<110	<42	<44	<43	<46	<43	<46
TOTAL VOCs + Naphthalene	750	0	0	0	71	60	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-41	SD-41	SD-41	SD-42	SD-42	SD-42	SD-42
Depth	6-7	7-8	8-10	0-2	2-4	4-6	6-8
Solids (%)	74.4	83.5	87.3	32.1	38.6	77.0	79.6
Acenaphthene	94	<0.40	<0.38	<20	1.0	<0.43	<0.41
Acenaphthylene	13	<0.40	<0.38	<20	0.93	<0.43	<0.41
Antracene	46	<0.40	<0.38	<20	<0.85	<0.43	<0.41
Benzo(a)anthracene	24	<0.40	<0.38	25	0.91	<0.43	<0.41
Benzo(b)fluoranthene	9.0	<0.40	<0.38	<20	<0.85	<0.43	<0.41
Benzo(k)fluoranthene	12	<0.40	<0.38	<20	<0.85	<0.43	<0.41
Benzo(g,h,I)perylene	8.9	<0.40	<0.38	<20	<0.85	<0.43	<0.41
Benzo(a)pyrene	19	<0.40	<0.38	26	0.88	<0.43	<0.41
Chrysene	22	<0.40	<0.38	25	<0.85	<0.43	<0.41
Dibenzo(a,h)anthracene	<4.2	<0.40	<0.38	<20	<0.85	<0.43	<0.41
Fluoranthene	55	<0.40	<0.38	37	1.9	<0.43	<0.41
Fluorene	48	<0.40	<0.38	<20	<0.85	<0.43	<0.41
Indeno (1,2,3-cd)pyrene	8.1	<0.40	<0.38	<20	<0.85	<0.43	<0.41
2-Methylnaphthalene	110	<0.40	<0.38	<20	1.7	<0.43	<0.41
Naphthalene	110	<0.40	<0.38	27	4.4	<0.43	<0.41
Phenanthrene	91	1.0	<0.38	31	2.5	<0.43	<0.41
Pyrene	62	0.42	<0.38	50	2.8	<0.43	<0.41
TOTAL PAHs	484.1	1.42	0	145	13.3	0	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-41	SD-41	SD-41	SD-42	SD-42	SD-42	SD-42
Depth	6-7	7-8	8-10	0-2	2-4	4-6	6-8
Benzene	<6,720	<30	<29	<78	<65	<32	<31
Bromobenzene	<6,720	<30	<29	<78	<65	<32	<31
Bromochloromethane	<6,720	<30	<29	<78	<65	<32	<31
Bromodichloromethane	<6,720	<30	<29	<78	<65	<32	<31
Bromoform	<6,720	<30	<29	<78	<65	<32	<31
Bromomethane	<29,900	<120	<115	<312	<259	<130	<126
n-Butylbenzene	<6,720	<30	<29	<78	<65	<32	<31
sec-Butylbenzene	<6,720	<30	<29	<78	<65	<32	<31
tert-Butylbenzene	<6,720	<30	<29	<78	<65	<32	<31
Carbon Tetrachloride	<6,720	<30	<29	<78	<65	<32	<31
Chlorobenzene	<6,720	<30	<29	<78	<65	<32	<31
Chlorodibromethane	<6,720	<30	<29	<78	<65	<32	<31
Chloroethane	<9,410	<42	<40	<110	<91	<45	<44
Chloroform	<6,720	<30	<29	<78	<65	<32	<31
Chloromethane	<13,400	<60	<57	<160	<130	<65	<63
2-Chlorotolunene	<6,720	<30	<29	<78	<65	<32	<31
4-Chlorotolunene	<6,720	<30	<29	<78	<65	<32	<31
1,2-Dibromo-3-Chloropropane	<13,400	<60	<57	<160	<130	<65	<63
1,2-Dibromethane (EDB)	<6,720	<30	<29	<78	<65	<32	<31
Dibromomethane	<6,720	<30	<29	<78	<65	<32	<31
1,2-Dichlorobenzene	<6,720	<30	<29	<78	<65	<32	<31
1,3-Dichlorobenzene	<6,720	<30	<29	<78	<65	<32	<31
1,4-Dichlorobenzene	<6,720	<30	<29	<78	<65	<32	<31
Dichlorodifluoromethane	<6,720	<30	<29	<78	<65	<32	<31
1,1-Dichloroethane	<6,720	<30	<29	<78	<65	<32	<31
1,2-Dichloroethane	<6,720	<30	<29	<78	<65	<32	<31
1,1-Dichloroethene	<6,720	<30	<29	<78	<65	<32	<31
cis-1,2-Dichloroethene	<6,720	<30	<29	<78	<65	<32	<31
trans-1,2-Dichloroethene	<6,720	<30	<29	<78	<65	<32	<31
1,2-Dichloropropane	<6,720	<30	<29	<78	<65	<32	<31
1,3-Dichloropropane	<6,720	<30	<29	<78	<65	<32	<31
2,2-Dichloropropane	<6,720	<30	<29	<78	<65	<32	<31
1,1-Dichloropropene	<6,720	<30	<29	<78	<65	<32	<31
cis-1,3-Dichloropropene	<6,720	<30	<29	<78	<65	<32	<31
trans-1,3-Dichloropropene	<6,720	<30	<29	<78	<65	<32	<31
Di-isopropyl ether	<6,720	<30	<29	<78	<65	<32	<31
Ethylbenzene	<6,720	<30	<29	<78	<65	<32	<31
Hexachlorobutadiene	<9,410	<42	<40	<110	<91	<45	<44
Isopropylbenzene	<6,720	<30	<29	<78	<65	<32	<31
p-Isopropyltoluene	<6,720	<30	<29	**779**	**170**	<32	<31
Methylene Chloride	<13,400	**90 L**	**85 L**	<160	**130 L**	<65	<63
Methyl-t-butyl-ether	<6,720	<30	<29	<78	<65	<32	<31
Naphthalene	**282,000**	**467**	<29	**374**	**250**	<32	<31
n-Propylbenzene	<6,720	<30	<29	<78	<65	<32	<31
Styrene	<6,720	<30	<29	<78	<65	<32	<31
1,1,1,2-Tetrachloroethane	<6,720	<30	<29	<78	<65	<32	<31
1,1,2,2-Tetrachloroethane	<6,720	<30	<29	<78	<65	<32	<31
Tetrachloroethane	<6,720	<30	<29	<78	<65	<32	<31
Toluene	<6,720	<30	<29	**170**	**363**	<32	<31
1,2,3-Trichlorobenzene	<6,720	<30	<29	<78	<65	<32	<31
1,2,4-Trichlorobenzene	<6,720	<30	<29	<78	<65	<32	<31
1,1,1-Trichloroethane	<6,720	<30	<29	<78	<65	<32	<31
1,1,2-Trichloroethane	<6,720	<30	<29	<78	<65	<32	<31
Trichloroethene	<6,720	<30	<29	<78	<65	<32	<31
Trichlorofluoromethane	<6,720	<30	<29	<78	<65	<32	<31
1,2,3-Trichloropropane	<6,720	<30	<29	<78	<65	<32	<31
1,2,4-Trimethylbenzene	**16,100**	<30	<29	**81**	<65	<32	<31
1,3,5-Trimethylbenzene	<6,720	<30	<29	<78	<65	<32	<31
Vinyl Chloride	<6,720	<30	<29	<78	<65	<32	<31
Xylene, total	<9,410	<42	<40	<110	<91	<45	<44
TOTAL VOCs + Naphthalene	298,100	467	0	1,404	783	0	0

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-43	SD-43	SD-43	SD-43	SD-43	SD-44	SD-44	SD-44
Depth	0-2	2-4	4-6	6-8	8-10	0-2	2-4	4-6
Solids (%)	27.8	79.2	78.3	81.0	80.5	61.8	78.0	83.7
Acenaphthene	86	8.6	5.1	<0.41	<0.41	324	295	0.39
Acenaphthylene	<29	<0.42	<0.42	<0.41	<0.41	21	22	<0.39
Antracene	43	2.9	1.7	<0.41	<0.41	130	110	<0.39
Benzo(a)anthracene	43	1.4	0.80	<0.41	<0.41	55	55	<0.39
Benzo(b)fluoranthene	<29	0.56	0.51	<0.41	<0.41	23	24	<0.39
Benzo(k)fluoranthene	<29	0.78	0.56	<0.41	<0.41	31	29	<0.39
Benzo(g,h,I)perylene	<29	0.63	0.47	<0.41	<0.41	24	24	<0.39
Benzo(a)pyrene	40	1.3	<0.42	<0.41	<0.41	52	53	<0.39
Chrysene	40	1.3	0.97	<0.41	<0.41	55	53	<0.39
Dibenzo(a,h)anthracene	<29	<0.42	<0.42	<0.41	<0.41	<21	<12	<0.39
Fluoranthene	90	3.4	2.39	<0.41	<0.41	140	130	<0.39
Fluorene	40	4.5	2.57	<0.41	<0.41	162	154	<0.39
Indeno (1,2,3-cd)pyrene	<29	0.49	<0.42	<0.41	<0.41	18	19	<0.39
2-Methylnaphthalene	47	14	6.5	<0.41	<0.41	485	615	0.44
Naphthalene	36	18	7.8	<0.41	<0.41	1,200	1,130	0.39
Phenanthrene	150	9.7	6.8	<0.41	<0.41	405	436	0.70
Pyrene	130	5.3	3.7	<0.41	<0.41	210	179	<0.39
TOTAL PAHs	493	55.39	29.76	0	0	2620	2663	1.53

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-43	SD-43	SD-43	SD-43	SD-43	SD-44	SD-44	SD-44
Depth	0-2	2-4	4-6	6-8	8-10	0-2	2-4	4-6
Benzene	<90	<6,310	38	<31	<31	5,340	<6,410	93
Bromobenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Bromochloromethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Bromodichloromethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Bromoform	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Bromomethane	<360	<25,300	<128	<123	<124	<16,200	<25,600	<119
n-Butylbenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
sec-Butylbenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
tert-Butylbenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Carbon Tetrachloride	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Chlorobenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Chlorodibromethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Chloroethane	<130	<8,840	<45	<43	<43	<5,660	<8,970	<42
Chloroform	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Chloromethane	<180	<12,600	<64	<62	<62	<8,090	<12,800	<60
2-Chlorotolunene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
4-Chlorotolunene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,2-Dibromo-3-Chloropropane	<180	<12,600	<64	<62	<62	<8,090	<12,800	<60
1,2-Dibromethane (EDB)	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Dibromomethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,2-Dichlorobenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,3-Dichlorobenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,4-Dichlorobenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Dichlorodifluoromethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,1-Dichloroethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,2-Dichloroethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,1-Dichloroethene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
cis-1,2-Dichloroethene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
trans-1,2-Dichloroethene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,2-Dichloropropane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,3-Dichloropropane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
2,2-Dichloropropane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,1-Dichloropropene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
cis-1,3-Dichloropropene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
trans-1,3-Dichloropropene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Di-isopropyl ether	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Ethylbenzene	<90	29,000	2,680	52	<31	25,900	30,800	98
Hexachlorobutadiene	<130	<8,480	<45	<43	<43	<5,660	<8,970	<42
Isopropylbenzene	<90	<6,310	332	<31	<31	<4,050	<6,410	<30
p-Isopropyltoluene	612	<6,310	409	<31	<31	<4,050	<6,410	<30
Methylene Chloride	<180	<12,600	<64	<62	<62	<8,090	<12,800	110 L
Methyl-t-butyl-ether	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Naphthalene	4,320	694,000	65,100	494	<31	356,000	449,000	896
n-Propylbenzene	<90	<6,310	110	<31	<31	<4,050	<6,410	<30
Styrene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,1,1,2-Tetrachloroethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,1,2,2-Tetrachloroethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Tetrachloroethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Toluene	<90	<6,310	56	<31	<31	7,440	6,790	<30
1,2,3-Trichlorobenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,2,4-Trichlorobenzene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,1,1-Trichloroethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,1,2-Trichloroethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Trichloroethene	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Trichlorofluoromethane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,2,3-Trichloropropane	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
1,2,4-Trimethylbenzene	755	20,200	2,040	<31	<31	10,000	11,500	<30
1,3,5-Trimethylbenzene	270	<6,310	575	<31	<31	<4,050	<6,410	<30
Vinyl Chloride	<90	<6,310	<32	<31	<31	<4,050	<6,410	<30
Xylene, total	160	27,800	2,550	<43	<43	21,000	15,400	72
TOTAL VOCs + Naphthalene	6,117	771,000	73,890	546	0	425,680	513,490	1,159

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-44	SD-45	SD-45	SD-45	SD-45	SD-45	SD-46	SD-46	SD-46
Depth	6-8	0-2	2-3	3-4	4-6	6-8	0-2	2-4	4-6
Solids (%)	84.0	78.4	82.3	81.0	82.4	76.7	43.3	79.4	81.9
Acenaphthene	<0.39	74	70	<0.41	0.56	<0.43	1,020	38	<0.40
Acenaphthylene	<0.39	7.5	7.3	<0.41	<0.40	<0.43	74	4.3	<0.40
Antracene	<0.39	34	33	<0.41	<0.40	<0.43	300	16	<0.40
Benzo(a)anthracene	<0.39	13	13	<0.41	<0.40	<0.43	140	6.8	<0.40
Benzo(b)fluoranthene	<0.39	4.7	5.2	<0.41	<0.40	<0.43	46	2.5	<0.40
Benzo(k)fluoranthene	<0.39	6.1	6.6	<0.41	<0.40	<0.43	60	3.3	<0.40
Benzo(g,h,I)perylene	<0.39	4.5	5.0	<0.41	<0.40	<0.43	37	2.1	<0.40
Benzo(a)pyrene	<0.39	10	10	<0.41	<0.40	<0.43	92	4.9	<0.40
Chrysene	<0.39	12	12	<0.41	<0.40	<0.43	120	6.2	<0.40
Dibenzo(a,h)anthracene	<0.39	<4.0	1.2	<0.41	<0.40	<0.43	<14	<0.42	<0.40
Fluoranthene	<0.39	31	29	<0.41	<0.40	<0.43	277	14	<0.40
Fluorene	<0.39	32	28	<0.41	<0.40	<0.43	323	16	<0.40
Indeno (1,2,3-cd)pyrene	<0.39	4.1	4.9	<0.41	<0.40	<0.43	39	2.3	<0.40
2-Methylnaphthalene	<0.39	191	158	<0.41	0.73	<0.43	2,120	78	<0.40
Naphthalene	<0.39	268	194	<0.41	0.75	<0.43	2,540	92	<0.40
Phenanthrene	<0.39	91	86	0.58	0.84	<0.43	1,200	44	0.76
Pyrene	<0.39	41	40	<0.41	<0.40	<0.43	439	6.4	<0.40
TOTAL PAHs	0	658.1	539.9	0.58	2.32	0	6938	252.7	0.76

All units reported in mg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-44	SD-45	SD-45	SD-45	SD-45	SD-45	SD-46	SD-46	SD-46
Depth	6-8	0-2	2-3	3-4	4-6	6-8	0-2	2-4	4-6
Benzene	48	<6,380	1,180	346	267	110	<57,700	<6,300	195
Bromobenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Bromochloromethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Bromodichloromethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Bromoform	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Bromomethane	<119	<25,500	<122	<123	<121	<130	<231,000	<25,200	<122
n-Butylbenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
sec-Butylbenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
tert-Butylbenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Carbon Tetrachloride	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Chlorobenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Chlorodibromethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Chloroethane	<42	<8,930	<43	<43	<42	<46	<80,800	<8,280	<43
Chloroform	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Chloromethane	<60	<12,800	<61	<62	<61	<65	<115,000	<12,600	<61
2-Chlorotolunene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
4-Chlorotolunene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,2-Dibromo-3-Chloropropane	<60	<12,800	<61	<62	<61	<65	<115,000	<12,600	<61
1,2-Dibromethane (EDB)	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Dibromomethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,2-Dichlorobenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,3-Dichlorobenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,4-Dichlorobenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Dichlorodifluoromethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,1-Dichloroethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,2-Dichloroethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,1-Dichloroethene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
cis-1,2-Dichloroethene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
trans-1,2-Dichloroethene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,2-Dichloropropane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,3-Dichloropropane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
2,2-Dichloropropane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,1-Dichloropropene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
cis-1,3-Dichloropropene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
trans-1,3-Dichloropropene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Di-isopropyl ether	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Ethylbenzene	100	31,900	5,350	222	218	42	<57,700	16,400	110
Hexachlorobutadiene	<42	<8,930	<43	<43	<42	<46	<80,800	<8,820	<43
Isopropylbenzene	<30	<6,380	547	<31	<30	<33	<57,700	<6,300	<31
p-Isopropyltoluene	<30	<6,380	437	<31	<30	<33	<57,700	<6,300	<31
Methylene Chloride	71 L	<12,800	<61	64 L	<61	<33	462,000 L	15,100 L	65 L
Methyl-t-butyl-ether	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Naphthalene	1,430	497,000	120,000	2,100	1,940	782	993,000	227,000	1,050
n-Propylbenzene	<30	<6,380	207	<31	<30	<33	<57,700	<6,300	<31
Styrene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,1,1,2-Tetrachloroethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,1,2,2-Tetrachloroethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Tetrachloroethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Toluene	40	14,000	2,310	173	58	<33	<57,700	7,430	93
1,2,3-Trichlorobenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,2,4-Trichlorobenzene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,1,1-Trichloroethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,1,2-Trichloroethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Trichloroethene	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Trichlorofluoromethane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,2,3-Trichloropropane	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
1,2,4-Trimethylbenzene	44	17,900	2,920	64	61	<33	<57,700	11,300	40
1,3,5-Trimethylbenzene	<30	<6,380	948	<31	<30	<33	<57,700	<6,300	<31
Vinyl Chloride	<30	<6,380	<30	<31	<30	<33	<57,700	<6,300	<31
Xylene, total	79	29,300	5,350	222	170	<46	<80,800	20,200	134
TOTAL VOCs + Naphthalene	1,741	590,100	139,249	3,127	2,714	934	993,000	282,330	1,622

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-46	SD-46	SD-47	SD-47	SD-48	SD-48	SD-48	SD-48
Depth	6-8	8-10	0-2	6-8	0-2	2-4	4-6	8-10
Solids (%)	81.6	83.7	57.1	82.5	26.1	21.0	81.3	80.6
Acenaphthene	1.3	<0.39	140	<0.40	<6.3	<16	11	<0.41
Acenaphthylene	<0.40	<0.39	11	<0.40	<6.3	<16	<2.0	<0.41
Antracene	0.6	<0.39	42	<0.40	<6.3	<16	5.3	<0.41
Benzo(a)anthracene	<0.40	<0.39	19	<0.40	<6.3	<16	2.2	<0.41
Benzo(b)fluoranthene	<0.40	<0.39	6.7	<0.40	<6.3	<16	<2.0	<0.41
Benzo(k)fluoranthene	<0.40	<0.39	8.9	<0.40	<6.3	<16	<2.0	<0.41
Benzo(g,h,I)perylene	<0.40	<0.39	5.3	<0.40	<6.3	<16	<2.0	<0.41
Benzo(a)pyrene	<0.40	<0.39	13	<0.40	<6.3	<16	<2.0	<0.41
Chrysene	<0.40	<0.39	17	<0.40	<6.3	<16	<2.0	<0.41
Dibenzo(a,h)anthracene	<0.40	<0.39	<2.8	<0.40	<6.3	<16	<2.0	<0.41
Fluoranthene	0.58	<0.39	39	<0.40	<6.3	<16	4.9	<0.41
Fluorene	0.54	<0.39	40	<0.40	<6.3	<16	7.1	<0.41
Indeno (1,2,3-cd)pyrene	<0.40	<0.39	5.6	<0.40	<6.3	<16	<2.0	<0.41
2-Methylnaphthalene	2.0	<0.39	315	<0.40	<6.3	20	18	<0.41
Naphthalene	1.5	<0.39	403	0.95	8.4	40	20	<0.41
Phenanthrene	1.8	<0.39	170	<0.40	<6.3	<16	15	<0.41
Pyrene	0.72	<0.39	47	<0.40	<6.3	<16	7.0	<0.41
TOTAL PAHs	7.14	0	1019.6	0.95	8.4	60	72	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-46	SD-46	SD-47	SD-47	SD-48	SD-48	SD-48	SD-48
Depth	6-8	8-10	0-2	6-8	0-2	2-4	4-6	8-10
Benzene	245	167	<21,000	170	<110	160	38	<31
Bromobenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
Bromochloromethane	<31	<30	<21,000	<30	<110	<120	<34	<31
Bromodichloromethane	<31	<30	<21,000	<30	<110	<120	<34	<31
Bromoform	<31	<30	<21,000	<30	<110	<120	<34	<31
Bromomethane	<123	<119	<87,600	<121	<420	<476	<135	<124
n-Butylbenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
sec-Butylbenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
tert-Butylbenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
Carbon Tetrachloride	<31	<30	<21,000	<30	<110	<120	<34	<31
Chlorobenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
Chlorodibromethane	<31	<30	<21,000	<30	<110	<120	<34	<31
Chloroethane	<43	<42	<31,500	<42	<140	<170	<47	<43
Chloroform	<31	<30	<21,000	<30	<110	<120	<34	<31
Chloromethane	<61	<60	<43,800	<61	<210	<240	<68	<62
2-Chlorotolunene	<31	<30	<21,000	<30	<110	<120	<34	<31
4-Chlorotolunene	<31	<30	<21,000	<30	<110	<120	<34	<31
1,2-Dibromo-3-Chloropropane	<61	<60	<43,800	<61	<210	<240	<68	<62
1,2-Dibromethane (EDB)	<31	<30	<21,000	<30	<110	<120	<34	<31
Dibromomethane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,2-Dichlorobenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
1,3-Dichlorobenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
1,4-Dichlorobenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
Dichlorodifluoromethane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,1-Dichloroethane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,2-Dichloroethane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,1-Dichloroethene	<31	<30	<21,000	<30	<110	<120	<34	<31
cis-1,2-Dichloroethene	<31	<30	<21,000	<30	<110	<120	<34	<31
trans-1,2-Dichloroethene	<31	<30	<21,000	<30	<110	<120	<34	<31
1,2-Dichloropropane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,3-Dichloropropane	<31	<30	<21,000	<30	<110	<120	<34	<31
2,2-Dichloropropane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,1-Dichloropropene	<31	<30	<21,000	<30	<110	<120	<34	<31
cis-1,3-Dichloropropene	<31	<30	<21,000	<30	<110	<120	<34	<31
trans-1,3-Dichloropropene	<31	<30	<21,000	<30	<110	<120	<34	<31
Di-isopropyl ether	<31	<30	<21,000	<30	<110	<120	<34	<31
Ethylbenzene	539	31	31,500	327	<110	440	221	62
Hexachlorobutadiene	<43	<42	<31,500	<42	<140	<170	<47	<43
Isopropylbenzene	59	<30	<21,000	<30	<110	<120	<34	<31
p-Isopropyltoluene	49	<30	<21,000	<30	110	11,900	36	<31
Methylene Chloride	69 L	92 L	49,000 L	64 L	<210	<120	110 L	86 L
Methyl-t-butyl-ether	<31	<30	<21,000	<30	<110	<120	<34	<31
Naphthalene	7,480	167	<21,000	2,910	460	7,620	5,290	385
n-Propylbenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
Styrene	<31	<30	<21,000	<30	<110	<120	<34	<31
1,1,1,2-Tetrachloroethane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,1,2,2-Tetrachloroethane	<31	<30	<21,000	<30	<110	<120	<34	<31
Tetrachloroethane	<31	<30	<21,000	<30	<110	<120		<31
Toluene	245	65	<21,000	194	498	340	<34	<31
1,2,3-Trichlorobenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
1,2,4-Trichlorobenzene	<31	<30	<21,000	<30	<110	<120	<34	<31
1,1,1-Trichloroethane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,1,2-Trichloroethane	<31	<30	<21,000	<30	<110	<120	<34	<31
Trichloroethene	<31	<30	<21,000	<30	<110	<120	<34	<31
Trichlorofluoromethane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,2,3-Trichloropropane	<31	<30	<21,000	<30	<110	<120	<34	<31
1,2,4-Trimethylbenzene	355	<30	<21,000	121	170	667	197	<31
1,3,5-Trimethylbenzene	100	<30	<21,000	46	<110	280	46	<31
Vinyl Chloride	<31	<30	<21,000	<30	<110	<120	<34	<31
Xylene, total	576	<42	35,000	352	<140	857	295	67
TOTAL VOCs + Naphthalene	9,648	430	66,500	4,120	1,238	22,264	6,123	514

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-49	SD-49	SD-49	SD-49	SD-50	SD-50	SD-50
Depth	0-2	2-4	4-6	8-10	0-2	4-6	6-8
Solids (%)	29.2	20.4	81.9	81.7	17.9	82.3	84.6
Acenaphthene	<1.1	539	1.5	<0.40	<5.2	5.7	12
Acenaphthylene	<1.1	74	<0.40	<0.40	<5.2	0.56	<1.9
Antracene	<1.1	240	0.62	<0.40	<5.2	2.6	5.2
Benzo(a)anthracene	<1.1	120	<0.40	<0.40	<5.2	1.2	2.6
Benzo(b)fluoranthene	<1.1	54	<0.40	<0.40	<5.2	0.49	<1.9
Benzo(k)fluoranthene	<1.1	74	<0.40	<0.40	<5.2	0.66	<1.9
Benzo(g,h,I)perylene	<1.1	54	<0.40	<0.40	<5.2	<0.40	<1.9
Benzo(a)pyrene	<1.1	110	<0.40	<0.40	<5.2	0.97	2.0
Chrysene	<1.1	110	<0.40	<0.40	<5.2	1.1	2.4
Dibenzo(a,h)anthracene	<1.1	<17	<0.40	<0.40	<5.2	<0.40	<1.9
Fluoranthene	<1.1	270	0.73	<0.40	<5.2	3.0	6.1
Fluorene	<1.1	260	0.85	<0.40	<5.2	3.9	4.7
Indeno (1,2,3-cd)pyrene	<1.1	49	<0.40	<0.40	<5.2	<0.40	<1.9
2-Methylnaphthalene	<1.1	1,080	2.3	<0.40	<5.2	9.0	20
Naphthalene	1.1	1,370	2.4	<0.40	<5.2	8.7	18
Phenanthrene	<1.1	<17	2.2	<0.40	<5.2	7.7	17
Pyrene	<1.1	320	0.93	<0.40	<5.2	3.4	7.6
TOTAL PAHs	1.1	3349	9.41	0	0	35.7	73.4

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-49	SD-49	SD-49	SD-49	SD-50	SD-50	SD-50
Depth	0-2	2-4	4-6	8-10	0-2	4-6	6-8
Benzene	<86	<12,300	44	<31	<140	<6,080	95
Bromobenzene	<86	<12,300	<31	<31	<140	<6,080	<30
Bromochloromethane	<86	<12,300	<31	<31	<140	<6,080	<30
Bromodichloromethane	<86	<12,300	<31	<31	<140	<6,080	<30
Bromoform	<86	<12,300	<31	<31	<140	<6,080	<30
Bromomethane	<342	<49,000	<122	<122	<559	<24,300	<118
n-Butylbenzene	<86	<12,300	<31	<31	<140	<6,080	<30
sec-Butylbenzene	<86	<12,300	<31	<31	<140	<6,080	<30
tert-Butylbenzene	<86	<12,300	<31	<31	<140	<6,080	<30
Carbon Tetrachloride	<86	<12,300	<31	<31	<140	<6,080	<30
Chlorobenzene	<86	<12,300	<31	<31	<140	<6,080	<30
Chlorodibromethane	<86	<12,300	<31	<31	<140	<6,080	<30
Chloroethane	<120	<17,200	<43	<43	<200	<8,510	<41
Chloroform	<86	<12,300	<31	<31	<140	<6,080	<30
Chloromethane	<170	<24,500	<61	<61	<280	<12,200	<59
2-Chlorotolunene	<86	<12,300	<31	<31	<140	<6,080	<30
4-Chlorotolunene	<86	<12,300	<31	<31	<140	<6,080	<30
1,2-Dibromo-3-Chloropropane	<170	<24,500	<61	<61	<280	<12,200	<59
1,2-Dibromethane (EDB)	<86	<12,300	<31	<31	<140	<6,080	<30
Dibromomethane	<86	<12,300	<31	<31	<140	<6,080	<30
1,2-Dichlorobenzene	<86	<12,300	<31	<31	<140	<6,080	<30
1,3-Dichlorobenzene	<86	<12,300	<31	<31	<140	<6,080	<30
1,4-Dichlorobenzene	<86	<12,300	<31	<31	<140	<6,080	<30
Dichlorodifluoromethane	<86	<12,300	<31	<31	<140	<6,080	<30
1,1-Dichloroethane	<86	<12,300	<31	<31	<140	<6,080	<30
1,2-Dichloroethane	<86	<12,300	<31	<31	<140	<6,080	<30
1,1-Dichloroethene	<86	<12,300	<31	<31	<140	<6,080	<30
cis-1,2-Dichloroethene	<86	<12,300	<31	<31	<140	<6,080	<30
trans-1,2-Dichloroethene	<86	<12,300	<31	<31	<140	<6,080	<30
1,2-Dichloropropane	<86	<12,300	<31	<31	<140	<6,080	<30
1,3-Dichloropropane	<86	<12,300	<31	<31	<140	<6,080	<30
2,2-Dichloropropane	<86	<12,300	<31	<31	<140	<6,080	<30
1,1-Dichloropropene	<86	<12,300	<31	<31	<140	<6,080	<30
cis-1,3-Dichloropropene	<86	<12,300	<31	<31	<140	<6,080	<30
trans-1,3-Dichloropropene	<86	<12,300	<31	<31	<140	<6,080	<30
Di-isopropyl ether	<86	<12,300	<31	<31	<140	<6,080	<30
Ethylbenzene	<86	14,700	305	<31	<140	<6,080	1,650
Hexachlorobutadiene	<120	<17,200	<43	<43	<200	<8,510	<41
Isopropylbenzene	<86	<12,300	<31	<31	<140	<6,080	355
p-Isopropyltoluene	514	<12,300	<31	<31	310	<6,080	520
Methylene Chloride	<170	48,000 L	<61	66 L	500 L	12,200 L	<59
Methyl-t-butyl-ether	<86	<12,300	<31	<31	<140	<6,080	<30
Naphthalene	<86	314,000	3,660	110	726	113,000	40,200
n-Propylbenzene	<86	<12,300	<31	<31	<140	<6,080	142
Styrene	<86	<12,300	<31	<31	<140	<6,080	<30
1,1,1,2-Tetrachloroethane	<86	<12,300	<31	<31	<140	<6,080	<30
1,1,2,2-Tetrachloroethane	<86	<12,300	<31	<31	<140	<6,080	<30
Tetrachloroethane	<86	<12,300	<31	<31	<140	<6,080	<30
Toluene	445	<12,300	<31	<31	<140	<6,080	67
1,2,3-Trichlorobenzene	<86	<12,300	<31	<31	<140	<6,080	<30
1,2,4-Trichlorobenzene	<86	<12,300	<31	<31	<140	<6,080	<30
1,1,1-Trichloroethane	<86	<12,300	<31	<31	<140	<6,080	<30
1,1,2-Trichloroethane	<86	<12,300	<31	<31	<140	<6,080	<30
Trichloroethene	<86	<12,300	<31	<31	<140	<6,080	<30
Trichlorofluoromethane	<86	<12,300	<31	<31	<140	<6,080	<30
1,2,3-Trichloropropane	<86	<12,300	<31	<31	<140	<6,080	<30
1,2,4-Trimethylbenzene	<86	14,700	159	<31	180	<6,080	2,130
1,3,5-Trimethylbenzene	<86	<12,300	35	<31	<140	<6,080	579
Vinyl Chloride	<86	<12,300	<31	<31	<140	<6,080	<30
Xylene, total	<120	<17,200	366	<43	<200	<8,510	2,130
TOTAL VOCs + Naphthalene	959	343,400	4,569	110	1,216	113,000	47,868

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-51	SD-51	SD-51	SD-51	SD-52	SD-52	SD-52	SD-52
Depth	0-2	2-4	4-6	8-10	2-4	4-6	6-8	8-10
Solids (%)	45.9	43.1	50.6	81.7	24.4	78.2	81.7	81.6
Acenaphthene	<3.5	<0.77	<0.65	<0.40	160	5.9	<0.40	<0.40
Acenaphthylene	<3.5	<0.77	<0.65	<0.40	12	0.47	<0.40	<0.40
Antracene	<3.5	2.1	<0.65	<0.40	70	2.7	<0.40	<0.40
Benzo(a)anthracene	<3.5	<0.77	<0.65	<0.40	45	1.1	<0.40	<0.40
Benzo(b)fluoranthene	<3.5	<0.77	<0.65	<0.40	18	<0.42	<0.40	<0.40
Benzo(k)fluoranthene	<3.5	<0.77	<0.65	<0.40	23	0.56	<0.40	<0.40
Benzo(g,h,I)perylene	<3.5	<0.77	<0.65	<0.40	19	<0.42	<0.40	<0.40
Benzo(a)pyrene	<3.5	<0.77	<0.65	<0.40	39	0.97	<0.40	<0.40
Chrysene	<3.5	<0.77	<0.65	<0.40	45	1.1	<0.40	<0.40
Dibenzo(a,h)anthracene	<3.5	<0.77	<0.65	<0.40	4.5	<0.42	<0.40	<0.40
Fluoranthene	4.8	0.97	<0.65	<0.40	110	2.7	<0.40	<0.40
Fluorene	<3.5	<0.77	<0.65	<0.40	82	2.6	<0.40	<0.40
Indeno (1,2,3-cd)pyrene	<3.5	<0.77	<0.65	<0.40	18	<0.42	<0.40	<0.40
2-Methylnaphthalene	<3.5	<0.77	<0.65	<0.40	310	18	<0.40	<0.40
Naphthalene	5.7	1.0	2.4	<0.40	779	26	<0.40	<0.40
Phenanthrene	6.3	1.4	<0.65	<0.40	240	7.4	<0.40	<0.40
Pyrene	<3.5	0.86	<0.65	<0.40	160	3.7	<0.40	<0.40
TOTAL PAHs	16.8	4.23	2.4	0	1699	60.4	0	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-51	SD-51	SD-51	SD-51	SD-52	SD-52	SD-52	SD-52
Depth	0-2	2-4	4-6	8-10	2-4	4-6	6-8	8-10
Benzene	<61	<58	<49	<31	<10,200	614	80	44
Bromobenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
Bromochloromethane	<61	<58	<49	<31	<10,200	<320	<31	<31
Bromodichloromethane	<61	<58	<49	<31	<10,200	<320	<31	<31
Bromoform	<61	<58	<49	<31	<10,200	<320	<31	<31
Bromomethane	<240	<232	<198	<122	<41,000	<1,280	<122	<123
n-Butylbenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
sec-Butylbenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
tert-Butylbenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
Carbon Tetrachloride	<61	<58	<49	<31	<10,200	<320	<31	<31
Chlorobenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
Chlorodibromethane	<61	<58	<49	<31	<10,200	<320	<31	<31
Chloroethane	<83	<81	<69	<43	<14,300	<448	<43	<43
Chloroform	<61	<58	<49	<31	<10,200	<320	<31	<31
Chloromethane	<120	<120	<99	<61	<20,500	<639	<61	<61
2-Chlorotolunene	<61	<58	<49	<31	<10,200	<320	<31	<31
4-Chlorotolunene	<61	<58	<49	<31	<10,200	<320	<31	<31
1,2-Dibromo-3-Chloropropane	<120	<120	<99	<61	<20,500	<639	<61	<61
1,2-Dibromethane (EDB)	<61	<58	<49	<31	<10,200	<320	<31	<31
Dibromomethane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,2-Dichlorobenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
1,3-Dichlorobenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
1,4-Dichlorobenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
Dichlorodifluoromethane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,1-Dichloroethane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,2-Dichloroethane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,1-Dichloroethene	<61	<58	<49	<31	<10,200	<320	<31	<31
cis-1,2-Dichloroethene	<61	<58	<49	<31	<10,200	<320	<31	<31
trans-1,2-Dichloroethene	<61	<58	<49	<31	<10,200	<320	<31	<31
1,2-Dichloropropane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,3-Dichloropropane	<61	<58	<49	<31	<10,200	<320	<31	<31
2,2-Dichloropropane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,1-Dichloropropene	<61	<58	<49	<31	<10,200	<320	<31	<31
cis-1,3-Dichloropropene	<61	<58	<49	<31	<10,200	<320	<31	<31
trans-1,3-Dichloropropene	<61	<58	<49	<31	<10,200	<320	<31	<31
Di-Isopropyl ether	<61	<58	<49	<31	<10,200	<320	<31	<31
Ethylbenzene	<61	<58	110	<31	33,200	4,600	91	47
Hexachlorobutadiene	<83	<81	<69	<43	<14,300	<448	<43	<43
Isopropylbenzene	70	<58	91	<31	<10,200	384	<31	<31
p-Isopropyltoluene	893	180	356	<31	<10,200	435	<31	<31
Methylene Chloride	150 L	150 L	150 L	91 L	21,300 L	767 L	84 L	110 L
Methyl-t-butyl-ether	<61	<58	<49	<31	<10,200	<320	<31	<31
Naphthalene	632	<58	949	294	316,000	78,000	722	221
n-Propylbenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
Styrene	<61	<58	<49	<31	<10,200	<320	<31	<31
1,1,1,2-Tetrachloroethane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,1,2,2-Tetrachloroethane	<61	<58	<49	<31	<10,200	<320	<31	<31
Tetrachloroethane	<61	<58	<49	<31	<10,200	<320	<31	<31
Toluene	240	210	356	<31	<10,200	<320	<31	<31
1,2,3-Trichlorobenzene	<61	<58	<49	<31	<10,200	<320	<31	<31
1,2,4-Trichlorobenzene	<61	<58	<49	<31	14,800	512	<31	<31
1,1,1-Trichloroethane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,1,2-Trichloroethane	<61	<58	<49	<31	<10,200	<320	<31	<31
Trichloroethene	<61	<58	<49	<31	<10,200	<320	<31	<31
Trichlorofluoromethane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,2,3-Trichloropropane	<61	<58	<49	<31	<10,200	<320	<31	<31
1,2,4-Trimethylbenzene	110	<58	130	<31	<10,200	2,170	<31	<31
1,3,5-Trimethylbenzene	81	<58	67	<31	<10,200	537	<31	<31
Vinyl Chloride	<61	<58	<49	<31	<10,200	<320	<31	<31
Xylene, total	140	<81	316	<43	28,700	3,710	56	<43
TOTAL VOCs + Naphthalene	2,166	390	2,375	294	392,700	90,962	949	312

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-53	SD-53	SD-53	SD-53	SD-54	SD-54	SD-54	SD-54
Depth	2-4	4-6	6-8	8-10	2-4	4-6	6-8	10-12
Solids (%)	80.9	80.4	81.2	82.0	21.6	81.6	71.3	74.8
Acenaphthene	7.5	21	<0.41	1.5	450	58	2.1	5.5
Acenaphthylene	0.53	1.1	<0.41	<0.40	<130	7.4	1.1	2.9
Antracene	2.8	5.1	<0.41	0.71	210	26	1.4	3.6
Benzo(a)anthracene	1.5	3.1	<0.41	<0.40	<130	11	0.60	1.6
Benzo(b)fluoranthene	0.57	1.2	<0.41	<0.40	<130	4.8	<0.46	0.53
Benzo(k)fluoranthene	0.79	1.7	<0.41	<0.40	<130	6.1	<0.46	0.72
Benzo(g,h,I)perylene	0.64	1.4	<0.41	<0.40	<130	4.7	<0.46	0.47
Benzo(a)pyrene	1.4	2.9	<0.41	<0.40	<130	8.6	<0.46	1.2
Chrysene	1.4	3.0	<0.41	<0.40	<130	10	0.52	1.5
Dibenzo(a,h)anthracene	<0.41	<0.41	<0.41	<0.40	<130	1.1	<0.46	<0.44
Fluoranthene	3.3	6.2	<0.41	0.91	210	25	1.3	3.2
Fluorene	4.1	5.5	<0.41	0.84	190	9.2	1.5	3.6
Indeno (1,2,3-cd)pyrene	0.59	1.2	<0.41	<0.40	<130	4.5	<0.46	<0.44
2-Methylnaphthalene	20	29	<0.41	1.5	926	147	4.1	13
Naphthalene	30	35	<0.41	1.2	741	172	2.9	13
Phenanthrene	8.5	27	0.57	2.6	648	72	4.5	9.6
Pyrene	4.8	9.1	<0.41	1.3	260	34	1.8	4.5
TOTAL PAHs	71.29	113	0.57	8.35	2975	463.7	16.1	46.9

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-53	SD-53	SD-53	SD-53	SD-54	SD-54	SD-54	SD-54
Depth	2-4	4-6	6-8	8-10	2-4	4-6	6-8	10-12
Benzene	<1,480	236	96	<305	<23,100	564	91	<33
Bromobenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Bromochloromethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Bromodichloromethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Bromoform	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Bromomethane	<6,180	<124	<123	<1,220	<92,600	<123	<140	<134
n-Butylbenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
sec-Butylbenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
tert-Butylbenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Carbon Tetrachloride	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Chlorobenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Chlorodibromethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Chloroethane	<2,220	<44	<43	<427	<32,400	<43	<49	<47
Chloroform	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Chloromethane	<3,090	<62	<62	<610	<46,300	<61	<70	<67
2-Chlorotolunene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
4-Chlorotolunene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,2-Dibromo-3-Chloropropane	<3,090	<62	<62	<610	<46,300	<61	<70	<67
1,2-Dibromethane (EDB)	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Dibromomethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,2-Dichlorobenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,3-Dichlorobenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,4-Dichlorobenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Dichlorodifluoromethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,1-Dichloroethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,2-Dichloroethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,1-Dichloroethene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
cis-1,2-Dichloroethene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
trans-1,2-Dichloroethene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,2-Dichloropropane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,3-Dichloropropane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
2,2-Dichloropropane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,1-Dichloropropene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
cis-1,3-Dichloropropene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
trans-1,3-Dichloropropene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Di-Isopropyl ether	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Ethylbenzene	4,820	871	135	537	<23,100	2,570	238	187
Hexachlorobutadiene	<2,220	<44	<43	<427	<32,400	<43	<49	<47
Isopropylbenzene	<1,480	68	<31	<305	<23,100	466	<35	<33
p-Isopropyltoluene	<1,480	77	<31	<305	<23,100	1,120	45	35
Methylene Chloride	3,710 L	82 L	69 L	805 L	<46,300	<61	<35	<33
Methyl-t-butyl-ether	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Naphthalene	81,600	14,900	1,230	7,800	306,000	44,100	6,170	7,350
n-Propylbenzene	<1,480	<31	<31	<305	<23,100	87	<35	<33
Styrene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,1,1,2-Tetrachloroethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,1,2,2-Tetrachloroethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Tetrachloroethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Toluene	<1,480	62	<31	<305	<23,100	355	110	<33
1,2,3-Trichlorobenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,2,4-Trichlorobenzene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,1,1-Trichloroethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,1,2-Trichloroethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Trichloroethene	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Trichlorofluoromethane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,2,3-Trichloropropane	<1,480	<31	<31	<305	<23,100	<31	<35	<33
1,2,4-Trimethylbenzene	2,220	410	38	<305	<23,100	1,590	154	214
1,3,5-Trimethylbenzene	<1,480	100	<31	<305	<23,100	502	56	70
Vinyl Chloride	<1,480	<31	<31	<305	<23,100	<31	<35	<33
Xylene, total	3,830	697	100	<427	<32,400	2,450	224	201
TOTAL VOCs + Naphthalene	92,470	17,421	1,599	8,337	306,000	53,804	7,088	8,057

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-55	SD-55	SD-55	SD-55	SD-55	SD-56	SD-56	SD-56
Depth	0-2	2-4	4-6	6-8	8-10	0-2	4-6	6-8
Solids (%)	24.0	80.2	82.9	83.4	83.7	29.9	80.2	83.1
Acenaphthene	833	34	<0.40	2.0	<0.39	230	<20	<0.40
Acenaphthylene	75	3.6	<0.40	<0.40	<0.39	<31	<20	<0.40
Antracene	360	15	<0.40	1.1	<0.39	110	22	<0.40
Benzo(a)anthracene	150	6.2	<0.40	0.46	<0.39	37	<20	<0.40
Benzo(b)fluoranthene	50	2.1	<0.40	<0.40	<0.39	<31	<20	<0.40
Benzo(k)fluoranthene	71	2.9	<0.40	<0.40	<0.39	<31	<20	<0.40
Benzo(g,h,I)perylene	<42	<2.0	<0.40	<0.40	<0.39	<31	<20	<0.40
Benzo(a)pyrene	100	4.6	<0.40	<0.40	<0.39	<31	<20	<0.40
Chrysene	130	5.6	<0.40	0.41	<0.39	33	<20	<0.40
Dibenzo(a,h)anthracene	<42	<2.0	<0.40	<0.40	<0.39	<31	<20	<0.40
Fluoranthene	330	14	<0.40	1.1	<0.39	110	21	<0.40
Fluorene	500	15	<0.40	0.97	<0.39	94	30	<0.40
Indeno (1,2,3-cd)pyrene	<42	<2.0	<0.40	<0.40	<0.39	<31	<20	<0.40
2-Methylnaphthalene	2,380	92	0.43	3.2	<0.39	669	8.5	<0.40
Naphthalene	2,710	100	<0.40	3.0	<0.39	769	150	<0.40
Phenanthrene	917	39	0.48	3.4	0.42	330	71	<0.40
Pyrene	410	17	<0.40	1.3	<0.39	120	86	<0.40
TOTAL PAHs	7247	277	0.91	12.97	0.42	2092	366.5	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-55	SD-55	SD-55	SD-55	SD-55	SD-56	SD-56	SD-56
Depth	0-2	2-4	4-6	6-8	8-10	0-2	4-6	6-8
Benzene	<50,000	<15,000	145	132	<143	<16,700	1,620	110
Bromobenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Bromochloromethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Bromodichloromethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Bromoform	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Bromomethane	<208,000	<62,300	<121	<120	<597	<66,900	<125	<120
n-Butylbenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
sec-Butylbenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
tert-Butylbenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Carbon Tetrachloride	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Chlorobenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Chlorodibromethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Chloroethane	<75,000	<22,400	<42	<42	<215	<23,400	<44	<42
Chloroform	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Chloromethane	<104,000	<31,200	<60	<60	<299	<33,400	<62	<60
2-Chlorotolunene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
4-Chlorotolunene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,2-Dibromo-3-Chloropropane	<104,000	<31,200	<60	<60	<299	<33,400	<62	<60
1,2-Dibromethane (EDB)	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Dibromomethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,2-Dichlorobenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,3-Dichlorobenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,4-Dichlorobenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Dichlorodifluoromethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,1-Dichloroethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,2-Dichloroethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,1-Dichloroethene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
cis-1,2-Dichloroethene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
trans-1,2-Dichloroethene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,2-Dichloropropane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,3-Dichloropropane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
2,2-Dichloropropane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,1-Dichloropropene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
cis-1,3-Dichloropropene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
trans-1,3-Dichloropropene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Di-isopropyl ether	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Ethylbenzene	<50,000	<15,000	145	635	<143	31,100	5,610	70
Hexachlorobutadiene	<75,000	<22,400	<42	<42	<299	<16,700	<44	<42
Isopropylbenzene	<50,000	<15,000	<30	76	<143	<16,700	611	<30
p-Isopropyltoluene	<50,000	<15,000	<30	62	<143	<16,700	411	<30
Methylene Chloride	<50,000	59,900 L	93 L	64 L	645 L	36,800 L	70 L	78 L
Methyl-t-butyl-ether	<50,000	<15,000	<30	<30	<143	<143	<31	<30
Naphthalene	833,000	337,000	2,770	9,110	2,150	278,000	77,300	710
n-Propylbenzene	<50,000	<15,000	<30	<30	<143	<16,700	187	<30
Styrene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,1,1,2-Tetrachloroethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,1,2,2-Tetrachloroethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Tetrachloroethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Toluene	<50,000	<15,000	98	216	<143	<16,700	1,620	<30
1,2,3-Trichlorobenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,2,4-Trichlorobenzene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,1,1-Trichloroethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,1,2-Trichloroethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Trichloroethene	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Trichlorofluoromethane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,2,3-Trichloropropane	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
1,2,4-Trimethylbenzene	<50,000	<15,000	97	420	<143	<16,700	3,240	41
1,3,5-Trimethylbenzene	<50,000	<15,000	<30	97	<143	<16,700	985	<30
Vinyl Chloride	<50,000	<15,000	<30	<30	<143	<16,700	<31	<30
Xylene, total	<75,000	<22,400	169	647	<215	31,100	5,990	58
TOTAL VOCs + Naphthalene	833,000	337,000	3,424	11,395	2,150	340,200	97,574	989

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-57	SD-57	SD-57	SD-58	SD-58
Depth	4-6	6-7	7-8	4-6	6-8
Solids (%)	67.5	82.0	84.0	80.3	83.0
Acenaphthene	80	0.79	<0.39	4.9	<0.40
Acenaphthylene	5.2	<0.40	<0.39	<2.0	<0.40
Antracene	43	<0.40	<0.39	<2.0	<0.40
Benzo(a)anthracene	18	<0.40	<0.39	<2.0	<0.40
Benzo(b)fluoranthene	6.5	<0.40	<0.39	<2.0	<0.40
Benzo(k)fluoranthene	8.3	<0.40	<0.39	<2.0	<0.40
Benzo(g,h,I)perylene	7.4	<0.40	<0.39	<2.0	<0.40
Benzo(a)pyrene	16	<0.40	<0.39	<2.0	<0.40
Chrysene	16	<0.40	<0.39	<2.0	<0.40
Dibenzo(a,h)anthracene	1.6	<0.40	<0.39	<2.0	<0.40
Fluoranthene	43	<0.40	<0.39	<2.0	<0.40
Fluorene	44	<0.40	<0.39	2.4	<0.40
Indeno (1,2,3-cd)pyrene	6.8	<0.40	<0.39	<2.0	<0.40
2-Methylnaphthalene	110	0.99	<0.39	7.0	<0.40
Naphthalene	84	1.2	<0.39	7.3	<0.40
Phenanthrene	110	0.96	<0.39	6.5	<0.40
Pyrene	61	0.40	<0.39	3.0	<0.40
TOTAL PAHs	458.8	3.55	0	26.2	0

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-57	SD-57	SD-57	SD-58	SD-58
Depth	4-6	6-7	7-8	4-6	6-8
Benzene	<7,410	159	80	<3,110	<30
Bromobenzene	<7,410	<30	<30	<3,110	<30
Bromochloromethane	<7,410	<30	<30	<3,110	<30
Bromodichloromethane	<7,410	<30	<30	<3,110	<30
Bromoform	<7,410	<122	<119	<3,110	<30
Bromomethane	<29,600	<30	<30	<12,500	<120
n-Butylbenzene	<7,410	<30	<30	<3,110	<30
sec-Butylbenzene	<7,410	<30	<30	<3,110	<30
tert-Butylbenzene	<7,410	<30	<30	<3,110	<30
Carbon Tetrachloride	<7,410	<30	<30	<3,110	<30
Chlorobenzene	<7,410	<30	<30	<3,110	<30
Chlorodibromethane	<7,410	<43	<42	<3,110	<30
Chloroethane	<10,400	<30	<30	<4,360	<42
Chloroform	<7,410	<61	<60	<3,110	<30
Chloromethane	<14,800	<30	<30	<6,230	<60
2-Chlorotolunene	<7,410	<30	<30	<3,110	<30
4-Chlorotolunene	<7,410	<61	<60	<3,110	<30
1,2-Dibromo-3-Chloropropane	<14,800	<30	<30	<6,230	<60
1,2-Dibromethane (EDB)	<7,410	<30	<30	<3,110	<30
Dibromomethane	<7,410	<30	<30	<3,110	<30
1,2-Dichlorobenzene	<7,410	<30	<30	<3,110	<30
1,3-Dichlorobenzene	<7,410	<30	<30	<3,110	<30
1,4-Dichlorobenzene	<7,410	<30	<30	<3,110	<30
Dichlorodifluoromethane	<7,410	<30	<30	<3,110	<30
1,1-Dichloroethane	<7,410	<30	<30	<3,110	<30
1,2-Dichloroethane	<7,410	<30	<30	<3,110	<30
1,1-Dichloroethene	<7,410	<30	<30	<3,110	<30
cis-1,2-Dichloroethene	<7,410	<30	<30	<3,110	<30
trans-1,2-Dichloroethene	<7,410	<30	<30	<3,110	<30
1,2-Dichloropropane	<7,410	<30	<30	<3,110	<30
1,3-Dichloropropane	<7,410	<30	<30	<3,110	<30
2,2-Dichloropropane	<7,410	<30	<30	<3,110	<30
1,1-Dichloropropene	<7,410	<30	<30	<3,110	<30
cis-1,3-Dichloropropene	<7,410	<30	<30	<3,110	<30
trans-1,3-Dichloropropene	<7,410	<30	<30	<3,110	<30
Di-isopropyl ether	<7,410	<30	<30	<3,110	<30
Ethylbenzene	9,480	220	69	9,710	<30
Hexachlorobutadiene	<10,400	<43	<42	<4,360	<42
Isopropylbenzene	<7,410	<30	<30	<3,110	<30
p-Isopropyltoluene	<7,410	<30	<30	<3,110	<30
Methylene Chloride	41,500 L	71 L	110 L	16,200 L	265 L
Methyl-t-butyl-ether	<7,410	<30	<30	<3,110	<30
Naphthalene	356,000	3,780	<30	249,000	157
n-Propylbenzene	<7,410	<30	<30	<3,110	<30
Styrene	<7,410	<30	<30	<3,110	<30
1,1,1,2-Tetrachloroethane	<7,410	<30	<30	<3,110	<30
1,1,2,2-Tetrachloroethane	<7,410	<30	<30	<3,110	<30
Tetrachloroethane	<7,410	<30	<30	<3,110	<30
Toluene	<7,410	<30	<30	<3,110	<30
1,2,3-Trichlorobenzene	<7,410	<30	<30	<3,110	<30
1,2,4-Trichlorobenzene	<7,410	<30	<30	<3,110	<30
1,1,1-Trichloroethane	<7,410	<30	<30	<3,110	<30
1,1,2-Trichloroethane	<7,410	<30	<30	<3,110	<30
Trichloroethene	<7,410	<30	<30	<3,110	<30
Trichlorofluoromethane	<7,410	<30	<30	<3,110	<30
1,2,3-Trichloropropane	<7,410	<30	<30	<3,110	<30
1,2,4-Trimethylbenzene	10,200	98	<30	8,970	<30
1,3,5-Trimethylbenzene	<7,410	<30	<30	<3,110	<30
Vinyl Chloride	<7,410	<30	<30	<3,110	<30
Xylene, total	<10,400	66	<42	7,470	<42
TOTAL VOCs + Naphthalene	375,680	4,323	149	275,150	157

All units report in µg/kg

TABLE 4
TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (SVOCs-8270)	SD-59	SD-59	SD-59	SD-59	MeOH
Depth	0-2	2-4	4-6	6-8	Blank
Solids (%)	28.7	30.1	81.9	81.7	
Acenaphthene	49	230	0.67	<0.40	-
Acenaphthylene	<21	<33	<0.40	<0.40	
Antracene	<21	86	<0.40	<0.40	
Benzo(a)anthracene	<21	37	<0.40	<0.40	
Benzo(b)fluoranthene	<21	<33	<0.40	<0.40	
Benzo(k)fluoranthene	<21	<33	<0.40	<0.40	
Benzo(g,h,I)perylene	<21	<33	<0.40	<0.40	
Benzo(a)pyrene	<21	<33	<0.40	<0.40	
Chrysene	<21	37	<0.40	<0.40	
Dibenzo(a,h)anthracene	<21	<33	<0.40	<0.40	
Fluoranthene	26	90	<0.40	<0.40	
Fluorene	<21	120	<0.40	<0.40	
Indeno (1,2,3-cd)pyrene	<21	<33	<0.40	<0.40	
2-Methylnaphthalene	91	465	<0.40	<0.40	
Naphthalene	160	731	<0.40	<0.40	
Phenanthrene	38	270	0.77	<0.40	
Pyrene	38	110	<0.40	<0.40	
TOTAL PAHs	353	1786	0.77	0	

All units reported in mg/kg

TABLE 4

TEST AMERICA - SEDIMENT SAMPLE RESULTS

Parameter (VOCs-8260)	SD-59	SD-59	SD-59	SD-59	MeOH
Depth	0-2	2-4	4-6	6-8	Blank
Benzene	<871	<16,600	51	<31	<25
Bromobenzene	<871	<16,600	<31	<31	<25
Bromochloromethane	<871	<16,600	<31	<31	<25
Bromodichloromethane	<871	<16,600	<31	<31	<25
Bromoform	<871	<16,600	<31	<31	<25
Bromomethane	<3,480	<66,400	<122	<122	<100
n-Butylbenzene	<871	<16,600	<31	<31	<25
sec-Butylbenzene	<871	<16,600	<31	<31	<25
tert-Butylbenzene	<871	<16,600	<31	<31	<25
Carbon Tetrachloride	<871	<16,600	<31	<31	<25
Chlorobenzene	<871	<16,600	<31	<31	<25
Chlorodibromethane	<871	<16,600	<31	<31	<25
Chloroethane	<1,220	<23,300	<43	<43	<35
Chloroform	<871	<16,600	<31	<31	<25
Chloromethane	<1,740	<33,200	<61	<61	<50
2-Chlorotolunene	<871	<16,600	<31	<31	<25
4-Chlorotolunene	<871	<16,600	<31	<31	<25
1,2-Dibromo-3-Chloropropane	<1,740	<33,200	<61	<61	<50
1,2-Dibromethane (EDB)	<871	<16,600	<31	<31	<25
Dibromomethane	<871	<16,600	<31	<31	<25
1,2-Dichlorobenzene	<871	<16,600	<31	<31	<25
1,3-Dichlorobenzene	<871	<16,600	<31	<31	<25
1,4-Dichlorobenzene	<871	<16,600	<31	<31	<25
Dichlorodifluoromethane	<871	<16,600	<31	<31	<25
1,1-Dichloroethane	<871	<16,600	<31	<31	<25
1,2-Dichloroethane	<871	<16,600	<31	<31	<25
1,1-Dichloroethene	<871	<16,600	<31	<31	<25
cis-1,2-Dichloroethene	<871	<16,600	<31	<31	<25
trans-1,2-Dichloroethene	<871	<16,600	<31	<31	<25
1,2-Dichloropropane	<871	<16,600	<31	<31	<25
1,3-Dichloropropane	<871	<16,600	<31	<31	<25
2,2-Dichloropropane	<871	<16,600	<31	<31	<25
1,1-Dichloropropene	<871	<16,600	<31	<31	<25
cis-1,3-Dichloropropene	<871	<16,600	<31	<31	<25
trans-1,3-Dichloropropene	<871	<16,600	<31	<31	<25
Di-isopropyl ether	<871	<16,600	<31	<31	<25
Ethylbenzene	<871	18,900	208	<31	<25
Hexachlorobutadiene	<1,220	<23,300	<43	<43	<35
Isopropylbenzene	<871	<16,600	<31	<31	<25
p-Isopropyltoluene	13,900	<16,600	<31	<31	<25
Methylene Chloride	1,920 L	59,800 L	81 L	69 L	58 L
Methyl-t-butyl-ether	<871	<16,600	<31	<31	<25
Naphthalene	7,320	465,000	3,540	269	<25
n-Propylbenzene	<871	<16,600	<31	<31	<25
Styrene	<871	<16,600	<31	<31	<25
1,1,1,2-Tetrachloroethane	<871	<16,600	<31	<31	<25
1,1,2,2-Tetrachloroethane	<871	<16,600	<31	<31	<25
Tetrachloroethane	<871	<16,600	<31	<31	<25
Toluene	2,200	<16,600	<31	<31	<25
1,2,3-Trichlorobenzene	<871	<16,600	<31	<31	<25
1,2,4-Trichlorobenzene	<871	<16,600	<31	<31	<25
1,1,1-Trichloroethane	<871	<16,600	<31	<31	<25
1,1,2-Trichloroethane	<871	<16,600	<31	<31	<25
Trichloroethene	<871	<16,600	<31	<31	<25
Trichlorofluoromethane	<871	<16,600	<31	<31	<25
1,2,3-Trichloropropane	<871	<16,600	<31	<31	<25
1,2,4-Trimethylbenzene	1,430	<16,600	122	<31	<25
1,3,5-Trimethylbenzene	<871	<16,600	43	<31	<25
Vinyl Chloride	<871	<16,600	<31	<31	<25
Xylene, total	<1,220	<23,200	195	<43	<25
TOTAL VOCs + Naphthalene	24,850	483,900	4,159	269	0

All units report in µg/kg

Appendix C

Historic Site Documents

1	1989	2	Environmental Assessment: Wastewater Treatment Plant Site	Northern Environmental Technologies
2	1991	2	Specifications For Bayfront Area Sanitary Sewer Improvements - Ashland, WI	Bonestroo, Rosene, Anderlik & Associates
3	Jan-94	1	Site Health & Safety Plan	SEH
4	Mar-94	1	Waterfront Plan	Discovery Group, Ltd & Jane Silberstein
5	Aug-94	4	Remedial Investigation Interim Report	SEH
6	Feb-95	2	Existing Conditions Report	SEH
7	Mar-95	2	Final Report	Dames & Moore
8	Jun-95	2	Draft- Site Investigation Report & Remedial Action Plan	Dames & Moore
9	Aug-95	4	Site Investigation & Remedial Action Plan Final Report	Dames & Moore
10	Aug-95	2	Design Report, Bidding Documents, Plans & Specifications for Interim Remedial Action	Dames & Moore
11	Jan-96	2	Sediment Investigation Proposal for Environmental Services	SEH
12	Feb-96	1	Sediment Investigation Revised Proposal for Environmental Services	SEH
13	Feb-96	2	Draft Remediation Actions Options Feasibility Study	SEH
14	Feb-96	2	Sediment Investigation Work Plan	SEH
15	May-96	1	SEH Draft Remediation Action Options Feasibility Study.... Review Comments	Dames & Moore
16	Jul-96	2	Sediment Investigation Report	SEH
17	Aug-96	1	*Supplemental Groundwater Investigation- Final* Report	Dames & Moore
18	Feb-97	2	Copper Falls Aquifer Groundwater Investigation	Dames & Moore
19	Mar-97	1	Comprehensive Feasibility Study and Risk Assessment Proposal for Environmental Servcies	SEH
20	May-97	2	Comprehensive Environmental Investigation Report	SEH
21	Aug-97	1	Comprehensive Feasibility Study,Risk Assessment, Treatability Studies & Additional Investigation	SEH
22	Oct-97	2	Aquifer Performance Test & Groundwater Monitoring Results	Dames & Moore
23	Dec-97	6	Additional Investigation Work Plan	SEH
24	Mar-98	1	Supplemental Investigation Report	SEH
25	Mar-98	1	Exploration Trench Activities and Finding	Dames & Moore

26	Apr-98	2	Remedial Action Plan: Lower Copper Falls Formation Aquifer	Dames & Moore
27	Apr-98	2	Ecological Risk Assessment: Problem Formulation	SEH
28	Jun-98	2	Baseline Human Health Risk Assessment	SEH
29	Jun-02	1	Phase II Environmental Site Assessment	MSA
30	Oct-98	2	Ecological Risk Assessment	SEH
31	Dec-98	1	Remediation Action Options Feasibility Study	SEH
32	Mar-99	2	Ecological Risk Assessment: Ashland Lakefront Property (Final Draft)	Dames & Moore
33	Mar-99	1	Remedial Action Options Feasibility Study - Final Report	Dames & Moore
34	Mar-99	3	Supplemental Facility Site Investigation & Remedial Action Options Evaluation Report	Dames & Moore
35	Oct-99	2	1999 Supplemental Site Investigation	Dames & Moore
36	Mar-00	2	Bid Documents: Coal Tar Recovery System	Dames & Moore
37	Jul-00	1	Request for No further Action Determination	STS
38	Jul-00	1	Off-Site Discharge Exemption Request Application	STS
39	Nov-00	2	Proposal for Consulting Services	SEH
40	Nov-00	1	Revised Proposal for Consulting Services	SEH
41	Jan-01	1	Response to USEPA Comments Regarding Enviro Reports Prepared by META Enviro. Inc.	META
42	Feb-01	4	Seep Investigation Work Plan	SEH
43	Feb-01	3	Interim Response Coal Tar Recovery System-Volume 1 Construction Documentation Report	URS
44	Feb-01	3	Interim Response Coal Tar Recovery System-Volume 2 Operation, Maintenance, and Monitoring Plan	URS
45	Feb-01	3	Interim Response Coal Tar Recovery System-Final-Progress Report (Report #001)	URS
46	Feb-01	2	Proposal for Consulting Services: Supplemental Solid Phase Sediment Chemical Analysis & Bioassay Testing	SEH
47	Mar-01	1	Proposal for Consulting Services Sediment Sampling Observation & Documentation	SEH
48	May-01	1	Proposal for Consulting Services Pipe Source and Sampling	SEH
49	Jun-01	2	Sediment Sample Results Volume I of III	URS
50	Jun-01	2	Sediment Sample Results Volume II of III	URS
51	Jun-01	2	Sediment Sample Results Volume III of III	URS
52	Jun-01	1	3rd Addendum to Report: Comparative Analysis of NAPL Residues	GTI

53	Jun-01	1	Revised Proposal regarding environmental forensic analyses	Battelle
54	Jul-01	6	Pipe Source Investigation & Sampling Work Plan	SEH
55	Jul-01	1	Interim Response Coal Tar Recovery System-Final-Progress Report (Report #002)	URS
56	Oct-01	1	Interim Response Coal Tar Recovery System-Final-Progress Report (Report #003)	URS
57	Oct-01	4	Investigation, Interim Remedial Action Options, and Design Report	SEH
58	Dec-01	1	Air Monitoring Results from Pipe Investigation Conducted during week 09/17/01	URS
59	Dec-01	1	Interim Response Coal Tar Recovery System-Final-Progress Report (Report #004)	URS
60	Oct-02	2	Phase I Environmental Site Assessment (also see Phase II WDNR Report #29)	MSA
61	Jan-02	1	4th Addendum to Report: Comparative Analysis of NAPL Residues	GTI
62	Jan-02	2	Environmental Forensic Investigation of Subsurface Pipes Containing Tar Residues	Battelle
63	Jan-02	1	Final Phase II ESA Work Plan	MSA
64	Feb-02	1	Clay Tile Investigation	URS
65	Feb-02	2	Ecological Risk Assessment Supplement	SEH
66	Feb-02	1	Interim Response Coal Tar Recovery System-Final-Progress Report (Report #005)	URS
67	Apr-02	1	Seep Area Interim Action Work Plan	URS
68	Aug-02	1	5th Addendum to Report: Comparative Analysis of NAPL Residues	GTI
69	Aug-02	1	Seep Interim Action Documentation	URS
70	Sep-02	1	Progress Report #7 - 6/02 GW Results	URS
71	Jun-02	1 CD	Progress Report #6 - 6/02 GW Results	URS
72	Dec-02	1 Hard & 1CD	QAPP - Quality Assurance Project Plan	URS
73	Jan-03	1 Hard & 1CD	Progress Report #8 - 8/02 GW Results	URS

Appendix D

STL Chicago SOPs

STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURE

SOP No.	Revision No.	Date	Page
USP-5035	03	04/14/03	1 of 10

TITLE: **Laboratory Handling, Transfer and Preservation of VOA Soil Samples Received in EnCore™ Samplers for SW-846 Method 5035 Low Concentration and 5030B**

Updated by:	Signature:	Date:
JoAnn M. Petruszak GC/MS Supervisor	JoAnn M. Petruszak	4-11-03

Approved by:	Signature:	Date:
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ISSUED TO: Gloria Chojnacki - SEH
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Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) has been written using SW-846 Methods 5035 and describes the procedures for handling, transferring and preserving solid waste, soil and sediment samples for subsequent determination of volatile organic compounds when received by the laboratory in EnCore™ Disposable Samplers. The EnCore™ Sampler is a single use device which cannot be cleaned and/or reused. Samples are transferred to vials and are then suitable for analysis using preparation Methods 5035 for Low Concentration volatile compounds or 5030B for High Concentration volatile compounds. This procedure also addresses issues relating to VOC samples preserved in the field using Method 5035, however, does not discuss sample collection.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

Refer to the analytical SOPs.

1.1.2 Reporting Limits

Refer to the Analytical SOPs.

1.2 Summary of Method

This procedure is used when soils are sampled in the field with EnCore™ samplers and then transferred to the laboratory for preservation. The specific preparation procedures for sample vials depends on the expected concentration range of the sample, with separate procedures for "low" concentration soil samples (Section 7.1) and "high" concentration soil samples (Section 7.2). Low concentration soils are transferred to vials containing sodium bisulfate and water which forms an acid for preserving the VOC from biodegradation prior to sample preparation method 5035. High concentration VOC soils are transferred to vials containing methanol prior to sample preparation 5030B.

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM).

2.0 INTERFERENCES

Solvents, reagents, solvents, glassware and room conditions may yield volatile organic compounds. All these materials must be demonstrated to be free from interferences under the conditions of the preparation by analyzing method blanks.

3.0 SAFETY

- Employees will adhere to the practices and policies in the STL Corporate Safety Manual (CSM) and will read the MSDSs for the materials used in this method before handling or using the material.
- Samples should be handled with care due to the uncertainty of the properties and contents involved.
- Take careful note of those sections marked "CAUTION", "NOTE", "WARNING".
- All extractions and handling of solvents and reagents should be performed under well-ventilated conditions or under a fume hood. Methanol and sodium bisulfate may be health hazards if swallowed, inhaled or if it comes in contact with skin.

WARNING: When the sample is added to the vial containing sodium bisulfate and organic free water, a reaction can result with pressure build-up if the sample is immediately capped. This may result in the popping of the septum cap and splashing of corrosive liquid (acid) and, under severe pressure, may burst the sample vial. If effervescence is noted, the sample vial shall not be sealed until the reaction is complete or ends. All samples demonstrating effervescence shall be labeled "effervescent" so that any further handling by others can be done with caution. Acid solution can cause burns, therefore, protective gloves, lab coat and eye protection shall be worn during this transfer.

NOTE: Upon transferring samples from the EnCore™ Samplers to VOA vials, samples that effervesce upon contact with the acid preservative to the degree of, for example, foaming or inability to seal the vial, the client will be immediately contacted that a new sample is required. If the amount of gas that is generated is small (i.e., several mLs), the loss is considered minimal if the vial is immediately sealed.

4.0 EQUIPMENT AND SUPPLIES

- 40-ml, screw-cap, PTFE lined, septum-sealed glass vials
- Magnetic stir bars
- EnCore™ Extrusion Tool
- Top-loading balance capable of accurately reading to 0.01 g.
- Balance weights
- 5 g En Core™ samplers (from field in sealed containers)
- Pliers for removing En Core™ Sampler locking arms.
- Repipet suitable for dispensing methanol
- Repipet suitable for dispensing lab pure water
- 1 gram scoop; and VOC vial rack

5.0 REAGENTS AND STANDARDS

A label on any reagent bottle must contain the concentration of the reagent, name of the reagent, date prepared, expiration date and the analyst who prepared the reagent.

5.1 Reagents

- Methanol, CH_3OH - purge and trap quality of equivalent
- Organic Free Laboratory Water (OFW)
- Sodium Bisulfate, $NaHSO_4$ - ACS grade or equivalent

5.2 Quality Control (QC) Solutions

Refer to analytical SOPs.

6.0 CALIBRATION

Not Applicable.

7.0 PROCEDURE

7.1 Low Concentration Procedure

The following steps apply to the preparation vials and EnCore™ sample transfers to vials that will be analyzed for low concentration volatile compounds by the closed-system purge and trap equipment described in Method 5035.

7.1.1 Low Concentration Sample Vial Preparation

Ready-to-use sample vials for the low-level method may be purchased from a vendor which contain the sodium bisulfate preservative, water, magnetic stirrer and tare weighted. If not, steps described in 7.1.1 are to be followed to prepare the vials.

7.1.1.1 Add a clean magnetic stir bar to each clean 40 mL vial. Add 5 mLs of a 20% sodium bisulfate solution (200g sodium bisulfate/Liter OFW). Enough sodium bisulfate should be present to ensure a sample pH of ≤ 2.

7.1.1.2 The water and preservative form an acid solution that will eliminate the majority of the biological activity in the sample, preventing biodegradation of the volatile target analytes. Seal the vial with the screw-cap septum seal.

7.1.1.3 Since calcareous soils may react vigorously with sodium bisulfate, which could result in a loss of volatile compounds, an effervescence test should be performed prior to sample preparation. Add ~5 grams of sample to an empty 40-mL vial. Add ~5

mLs of 20% sodium bisulfate solution to the vial. Observe for bubbles. If the sample effervesces, then prepare the sample in OFW and freeze instead of preparing in sodium bisulfate.

(WARNING: Capping the vial while effervescing may cause pressure on the vial resulting in popping of the septum or vial bursting. Acid solutions can cause burns, therefore, protective gloves, lab coat and eye protection shall be worn during this transfer.)

7.1.1.4 Weigh the prepared vial to the nearest 0.01 g, record the tare weight on the label and record the vial number and tare weight in the VOC Sample logbook (Attachment A). The vial is then ready for transferring the soil sample from the EnCore™ sampler into the vial as described in section 7.1.2.

7.1.2 Sample Transfer from EnCore™ to Low Concentration Vial

7.1.2.1 Within 48 hours of sample collection, the sample in the EnCore™ sampler must be transferred to the sample vial containing preservative or OFW depending on the effervescence test. Line up the EnCore™ sample bags with vials and record the respective sample # on the vial and in the logbook. Perform the effervescence test and record the results in the logbook.

7.1.2.2 Remove the EnCore™ sampler from its sealed bag and break off the locking arms on the cap using pliers. Do not remove the cap at this time.
(CAUTION: Broken edges will be sharp).

7.1.2.3 Attach the EnCore™ Sampler to the EnCore™ Extrusion Tool as follows: Depress the locking lever on the Extrusion Tool and place the sampler, plunger end first, into the open end of Extrusion Tool (aligning slots on sampler body with pins in Extrusion Tool). Turn the coring body clockwise until it locks into place. Then release the locking lever.

7.1.2.4 Place the soil core plug into the matching vial: Remove the cap from the vial and then remove the cap from the EnCore™ Sampler, which was previously inserted in the Extrusion Tool. Slowly place the sample core directly over the vial (avoid sample or vial spillage), then release the soil core by pushing down on the plunger knob of the EnCore™ Extrusion Tool. Cap the vial if sample effervescence is not apparent. In the logbook, record the time the sample was transferred into the vial. After the sample is safely transferred, remove and properly dispose of the EnCore™ Sampler.

If samples are received already preserved from the field and they show evidence of effervescence (i.e., bulging septa, fizzing, hissing when auto-sampler punctures septa, etc..), the analyst shall notify the PM at once. Additionally, the analyst needs to proceed

with the analysis using either Method 5030B purge & trap using an appropriate aliquot from the VOA jar or solids jar if available or in cases where the client provides both sodium bisulfate preserved sample and OFW prepared samples use the OFW and document the reason.

7.1.2.5 Weigh the sample vial to the nearest 0.01 g and record weight on the label and in the logbook. The sample is then transferred to the GC/MS VOC refrigerator if preserved in sodium bisulfate or transferred to the GC/MS VOC freezer if prepared in water.

NOTE: Because volatile organics will partition into the headspace of the vial from the aqueous solution and will be lost when the vial is opened, surrogates, matrix spikes and internal standards should be added through the septa after the vial has been capped. These standards will be introduced by the GC/MS VOC analyst or automatically by the sample introduction system, just prior to analysis.

7.2 High Concentration Procedure

The following steps apply to the preparation vials and En Core™ sample transfer to these vials to be analyzed for High concentration volatile compounds described in Method 5030B.

7.2.1 High Concentration Sample Vial Preparation

Sample vials ready for use for the high concentration method may be purchased from a vendor which contain the methanol preservative and tare weighted. If not, steps described in 7.2.1 are to be followed to prepare the vials.

7.2.1.1 Add 5 mLs of methanol to each vial. **NOTE: Any combination of sample weight and methanol volume may be used as long as it is demonstrates that method performance objectives can be achieved.**

7.2.1.2 Seal the vial with the screw-cap septum seal and affix a label to the vials.

7.2.1.3 Weigh the prepared vial to the nearest 0.01 g, record the tare weight and write it on the label and record the vial number and tare weight in the logbook. The vial is then ready for transferring the soil sample from the EnCore™ sampler into the vial as described in Section 7.2.2.

7.2.2 Sample Transfer from En Core™ Sampler to High Concentration Vial

7.2.2.1 Within 48 hours of sample collection, the sample in the EnCore™ sampler must be transferred to the sample vial containing preservative. Line up the EnCore™ sample bags with vials and record on the vial and the logbook the respective sample #.

7.2.2.2 Remove the EnCore™ sampler from its sealed bag and break off the locking arms on the cap using pliers, but do not remove cap at this time.
(CAUTION: Broken edges will be sharp).

7.2.2.3 Attach the EnCore™ Sampler to the EnCore™ Extrusion Tool as follows: Depress the locking lever on the Extrusion Tool and place the sampler, plunger end first, into the open end of Extrusion Tool (aligning slots on sampler body with pins in Extrusion Tool). Turn the coring body clockwise until it locks into place. Then release the locking lever.

7.2.2.4 Place the soil core plug into the matching vial: Remove the cap from the vial and then remove the cap from the EnCore™ Sampler, which was previously inserted in the Extrusion Tool. Slowly place the sample core directly over the vial (avoid sample or vial spillage), then release the soil core by pushing down on the plunger knob of the En Core™ Extrusion Tool. Cap the vial but be careful not to spill. **(WARNING: Precautions must be taken when handling vials and samples. Methanol is flammable and should not be handled near a heat source or open flame. Protective gloves, lab coat and eye protection shall be worn during this transfer.)** In the logbook, record the time the sample was transferred into the vial. After the sample is safely transferred, remove and properly dispose of the EnCore™ Sampler.

7.2.2.5 Weigh the sample vial to the nearest 0.01-g and record the weight on the label and in the logbook. The sample is then transferred to the GC/MS VOC refrigerator for 24 hours. After the 24 hour contact time, draw off the methanol and put into a 1.5 mL amber vial labeled with the appropriate sample identification. Record the time the methanol is drawn off in the logbook. Surrogates, matrix spikes and internal standards should be added by the GC/MS VOC analyst at the time of analysis.

7.2.2.6 In cases where the client requires a quick turnaround time, the 24-hour contact time can be replaced by sonicating the samples for 20 minutes and then draw of the methanol. This procedure requires the client's approval.

7.3 Quality Control Checks

Refer to the analytical SOP.

7.4 Sample Preservation and Storage

The hold times for the extraction of volatile organic compounds from soils and sediments is 14 days from the date of sampling. The samples must be transferred from the EnCore™ Sampler to the preservatives or OFW and vial within 48 hours after collection. Preserved samples must be stored at 4 ± 2°C prior to analysis. Samples in OFW must be frozen at -10 ± 2°C. Frozen samples must be allowed to come to room temperature before analysis.

7.5 Calibration / Standardization

Not Applicable.

7.6 Preventive Maintenance

Balances should be cleaned and checked for levelness prior to each use. Class "S" weights must be weighed and documented each day the balance is used. Refer to the Balance Calibration Logbook for the weights and control limits.

Consult your section manager or supervisor if the weights are out of acceptable limits. Do not use the balance until the situation is back in control.

7.7 Documentation

All sample transfer information must be carefully documented in the VOC Sample Log. Any additional sample information may be recorded in the comment section. All problems and/or deviations from normal procedures must be documented, the section manager or supervisor should be notified and a Sample Discrepancy Report (SDR) may need to be initiated.

8.0 QUALITY CONTROL

8.1 QC Summary

Refer to the analytical SOP (UMV-8260).

8.2 Corrective Actions

All problems and/or deviations from the normal procedure must be documented in the VOC Sample Log. The section manager or supervisor should be notified and an SDR may need to be initiated.

9.0 DATA ANALYSIS AND CALCULATIONS

Not Applicable.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

- Waste from this procedure will enter the 'Flammable Vials' wastestream.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.

13.0 ATTACHMENTS

Attachment A: Example: EnCore™ VOC Sample Log

Historical File: Revision 00: 02/27/98
Revision 01: 06/16/99
Revision 02: 06/22/01
Revision 03: 04/11/03

Reasons for Change, Revision 03:

- Sections 7.1.1.3 & 7.1.2.1: Effervescence test.
- Section 7.2.2.6: Sonicating high-level samples for quick TATs.

U:\QC\SOP\SP\5035.DOC

Attachment A.

Example: VOC Sample Log

COMPANY CONFIDENTIAL AND PROPRIETARY

STL C[illegible]go
VOC Sample Preservation 5030/5035

Preserved in: (Che[illegible]e)
☐ Field*
☐ Laboratory

* Note: Field Preserved Samples Do Not Have an EB1

Page No.:_____
Balance No:_____
NaHSO4 Soln. ID:_____
Methanol Lot No.:_____
Repipetor Vol. Check (Yes = OK):_____
Methanol:_____ H2SO4:_____
Water:_____

Job #:_____
Client:_____
Continued from Page:_____

EB1 (P)	Job Number:	
	Filename:	
EB3 (F)	Job Number:	
	Filename:	
EB2 (MEOH)	Job Number:	
	Filename:	

Low Concentration VOC

5035PL Batch: _____

High Concentration VOC

Drawn Off Date:_____
Time:_____
5035PH Batch: _____
5035PG Batch: _____

	Sample #	Bottle Letter	Preserved: F - Frozen or P - Preservative	Date Preserved	Time Preserved	Tare Wt. Vial + Preserv. (g)	Final Wt. (g)	Severe Effervescence	Methanol (mLs)	Tare Wt. Vial + Preserv. (g)	Final Wt. (g)
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											

Field Prep - Weight Transcription Signature:_____ Date:_____
Preparation Analyst Signature: _____ Date:_____

CHI-22-16-050/F-01/03

STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURE

SOP No.	Revision No.	Date	Page
USP-3000	11	01/23/03	1 of 14

TITLE: SAMPLE PREPARATION
Metals Digestion by SW-846 3000 Series

Updated by:	Signature:	Date:
Lisa Roots Analyst, Metals Department	Lisa M. Roots	1/16/03

Approved by:	Signature:	Date:
Mani S. Iyer Section Manager, Metals Dept.	Mani S Iyer	1/16/03
David L. Kaczka Env. Health & Safety Coor.	David L. Kaczka/Lym	1/17/03
Terese A. Preston Quality Manager	Terese A Preston	1/17/03

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ISSUED TO : Gloria Chojnacki, S.E.H.
Re: Ashland/NSP Lakefront Site QAPP

Full Signature Approvals Are Kept on File
with STLs QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the guidelines for the preparation of wastewaters, extracts, wastes and soil samples for metals analysis by Trace Inductively Couples Argon Plasma (ICP) and Graphite Furnace AA (GFAA). This SOP was written using the following methods of SW-846, Third Edition:

Method	Description
3005A	Surface and ground waters for analysis by Trace ICP.
3010A	Waters and extracts for analysis by Trace ICP.
3020A	Waters and extracts for analysis by GFAA (excluding As and Se).
3020A Modified	Waters and extracts for analysis by GFAA (including As and Se w/ H_2O_2).
3050B	Soil and waste samples for analysis by Trace ICP or GFAA.
7060A	Waters for As by GFAA.
7740	Waters for Se by GFAA.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

Not Applicable. Refer to the analytical SOPs.

1.1.2 Reporting Limits

Not Applicable. Refer to the analytical SOPs.

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM).

1.2 Summary of Method

Water and soil samples are digested with nitric acid, hydrochloric acid and/or hydrogen peroxide to produce digestates that are in the correct acid media for analysis by the Trace ICP or GFAA.

2.0 INTERFERENCES

Matrix interferences are usually not present for the digestion process. Analytical matrix interferences may be apparent during the instrumental analysis of the digestates. The type of interferences for the instruments are discussed in the appropriate SOPs.

3.0 SAFETY

- Employees will adhere to the practices and policies in the STL Corporate Safety Manual (CSM) and will read the MSDSs for the materials used in this method before handling or using the material.
- The standards contain potentially harmful elements. Care should be taken to avoid contact with the stock solutions. In case of contact, rinse with cold water for 15 minutes.
- If contact occurs with a standard containing Hydrofluoric Acid, flush with water and apply Calcium Gluconate Gel (located in standards cabinet) immediately. Seek medical attention.
- Acid vapor can be dangerous. Work in a well ventilated area (i.e., fume hood.)

4.0 EQUIPMENT AND SUPPLIES

- Top loading balance
- Hot plate (w/ thermometer)
- Hot Block w/ digestion vessels (w/ thermometer)
- 250 mL beakers
- 100 mL graduated cylinders
- Whatman No. 541 filter paper
- Funnels
- 100 & 50 mL Class A volumetric flasks
- Fume hood(s)
- Eppendorf Pipettes
- Watch glasses (ribbed & non-ribbed)
- Filters and plunger apparatus

5.0 REAGENTS AND STANDARDS

5.1 Reagents

- Concentrated Nitric Acid (Instra Pure)
- Concentrated Hydrochloric Acid (Instra Pure)
- 30% Hydrogen Peroxide Solution
- Milli-Q Water (available internally)

Purchased from a chemical vendor.

- Life of Reagent: Specified by the Manufacturer, usually 1 year.
- Storage Requirements: Acid Cabinet

5.2 Standards

Trace ICP and GFAA Intermediate Standards are made from multi-element solutions purchased from vendors. Single element spikes may be used if needed. These solutions expire one year from the date of receipt.

5.2.1 Trace ICP Spike Solution

Add ~400 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add:

100 mLs each of HP1381-A-500, HP1381-B-500 and HP1381-C-500;
9 mLs of 1,000 ppm Se;
8 mLs of 1,000 ppm Pb;
6 mLs of 1,000 ppm As;
5 mLs of 1,000 ppm Tl; and
40 mLs of InstraPure nitric acid.

Swirl to mix. Dilute to volume with Milli-Q water.

- Life of Standard: Expiration date of the earliest expiring standard.
- Storage Requirements: None

5.2.2 GFAA Spike Solution

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add:

20 mLs of nitric acid;
5 mLs each of 1000 ppm Sb, Tl;
4 mLs of 1000 ppm As;
2 mLs each of 1000 ppm Pb, Cr;
1 mL of 1000 ppm Se; and
0.5 mLs of 1000 ppm Cd.

Swirl to mix. Dilute to volume with Milli-Q water.

- Life of Standard: Expiration date of the earliest expiring standard.
- Storage Requirements: None

5.2.3 GFAA Ag Spike Solution

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add:

20 mLs each of nitric acid and hydrogen peroxide; and
2 mLs of 1000 ppm Ag.

Swirl to mix. Dilute to volume with Milli-Q water.

- Life of Standard: As defined by the manufacturer.
- Storage Requirements: None

** **NOTE:** Soils use a 100 mL volume; and the Waters use a 50 mL volume.**

5.2.4 Method Blank (MB)

The MB consists of Milli-Q water that is processed through the digestion procedure. **(See Note above).**

5.2.5 Matrix Duplicate (MD)

The MD is an aliquot of the same field sample that is digested independently. **(See Note above).**

5.2.6 Laboratory Control Sample (LCS) Matrix Spike (MS) / MS Duplicate (MSD)

- The LCS consists of Milli-Q water.
- The MS/MSD consists of sample.

(See Note above)

The LCS and MS/MSD are spiked with a known amount of analyte and processed through the digestion procedure. The spiking procedure is as follows:

Method	Spike Volume [1]
Trace ICP	1 mL of Trace ICP Intermediate Spiking Solution (Rgt. 5.2.2)
GFAA	1 mL of GFAA Intermediate Spiking Solution (Rgt. 5.2.3)

[1] When using the Hot Blocks, ½ of the amount of standard indicated above is added to the reduced sample size of 50 mLs.

Refer to Appendix A for the individual element concentrations within the spiking solutions. Matrix spikes for TCLP extracts are added after filtration of the TCLP extract and before preservation. Refer to USP-1311.

6.0 CALIBRATION (NON-DAILY)

Not Applicable.

7.0 PROCEDURE

7.1 Quality Control Checks

Each digestion batch will contain a maximum of 20 samples with a 5% frequency (1 in 20) on MDs and MS/MSDs[1]. A MB and LCS[2] will also be prepared with each digestion batch.

[1] The sample selection for MS/MSD/MD are rotated among client samples so that various matrix problems may be noted and/or addressed.
[2] LCS Duplicate (LCD) are performed when requested by the client, contract or QAPP.

7.2 Sample Preservation and Storage

Matrix	Holding Time	Preservation
Waters	180 days	HNO_3, pH <2; Cool 4 $\pm$ 2°C
Soils	180 days	Cool 4 $\pm$ 2°C

7.2.1 Sample Handling Procedures (Other than Soils / Waters)

Matrix	Description
Wipes	The entire wipe is digested with results reported as ug/wipe.
Paint Chips	Care is taken to remove the paint from the substrate. The chips are then cut and ground into a fine powder. Sample size is 0.1 to 0.5 grams.
Solids *	Dried and ground with a mechanical crusher.

*Bricks, wood, etc..

7.3 Sample Preparation

- Since the pH is checked by the sample custodian at sample receipt, the digestion analysis will check the pH at random and/or if the analyst has a reason to suspect that the sample may not be preserved.
- The start and end temperature of the hot plate or hot block digestion is documented within LabNet.

NOTE: The LCS and MB must be filtered when analyzed with dissolved metals that are filtered in the laboratory (unpreserved samples).

7.4 Calibration / Standardization

Not Applicable.

7.5 Preventive Maintenance

- To minimize contamination during sample preparation, the fume hoods and counter areas must be kept clean and free of dust.
- The digestion hoods are cleaned on a regular basis (a minimum of once a month) and documented within the hood maintenance log.

7.6 Sample Digestion

NOTE: 50 mL sample size is used for the Hot Block digesters. All acid and spiking solution volumes are reduced accordingly by ½.

7.6.1 Method 3005A

Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel. Add 1 mLs of InstraPure nitric acid and 2.5 mLs of InstraPure hydrochloric acid. Cover the vessel with a ribbed watch glass and heat on a preheated hot block at 90-95°C until the volume has been reduced to 10-15 mLs.

Remove the vessels from the hot block and allow to cool. Fill to a 50 mL final volume in the digestion vessel with Milli-Q water and filter using the plunger apparatus. The sample is now ready for analysis. (See attached certificate for the digestion vessels.)

NOTE: When using the Hot Plates, all volumes remain the same in the 250 mL beaker. When filtering, wash down the sides of the beaker with Milli-Q water and filter into a 50 mL volumetric flask through Whatman 541 filter paper. Dilute the sample to a final 50 mL volume using Milli-Q water.

7.6.2 Method 3010A

Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel. Add 1.5 mLs of InstraPure nitric acid. Cover the vessel with a ribbed watch glass and place on a preheated hot block set at 90-95°C. Evaporate the sample down to a low volume – just enough to cover the bottom of the vessel. **The sample should not boil or any portion of the vessel bottom allowed to go dry.** Remove the vessel from the hot block and allow to cool. Add another 1.5 mL portion of InstraPure nitric acid. Cover the

vessel with a non-ribbed watch glass and return to the hot block to allow a gentle reflux to occur.

Continue to add InstraPure nitric acid as necessary, until the digestion is complete (no change in appearance with continued refluxing). Uncover and evaporate to a low volume, not allowing any part of the vessel to go dry. Remove the vessels from the hot block and allow to cool. Add 2.5 mLs of InstraPure hydrochloric acid and 2.5 mLs of Milli-Q water. Warm the vessel for another 15 minutes to dissolve any precipitate.

Remove from hot block and allow to cool. Fill to a 50 mL final volume in the digestion vessel with Milli-Q water and filter using plunger apparatus. The sample is now ready for analysis.

NOTE: When using the Hot Plate, the volume remains the same in a 250 mL beaker. When filtering wash down the sides of the beaker with Milli-Q water and filter the sample into a 50 mL volumetric flask through Whatman 541 filter paper. Dilute to the 50 mL final volume with Milli-Q water.

7.6.3 Method 3020A

Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel. Add 1.5 mLs of InstraPure nitric acid. Cover the vessel with a ribbed watch glass and place on a preheated hot block set at 90-95°C. Evaporate the sample down to a low volume – just enough to cover the bottom of the vessel. **The sample should not boil or any portion of the vessel bottom allowed to go dry.**

Remove the vessels from the hot block and allow to cool. Add another 1.5 mL portion of InstraPure nitric acid. Cover the vessel with a non-ribbed watch glass and return to the hot block to allow a gentle reflux to occur.

Continue to add InstraPure nitric acid as necessary, until the digestion is complete (no change in appearance with continued refluxing). Uncover and evaporate to a low volume, not allowing any part of the vessel to go dry. Remove the vessel from the hot block and allow to cool. Add 5 mLs of Milli-Q water and continue warming for 10-15 minutes to dissolve any precipitates.

Remove from the hot block and allow to cool. Fill to a final 50 mL volume in the digestion vessel with Milli-Q water and filter using plunger apparatus. The sample is now ready for analysis.

NOTE: When using the Hot Plate, all volumes remain the same in 250 mL beaker. When filtering wash down the sides of the beaker with Milli-Q water and filter the sample

into a 50 mL volumetric flask through Whatman 541 filter paper. Dilute to the 50 mL final volume with Milli-Q water.

7.6.4 Method 3020A Modified

This method is equivalent to Method 3020A, however, 1 mL of hydrogen peroxide is added to the sample with the initial 1.5 mLs of nitric acid.

7.6.5 Method 3050B

Weight out 1.00 – 2.00 grams of the well-mixed sample into a 250 mL beaker. The exact weight is recorded in the LabNet digestion spreadsheet. For samples with a high liquid content, more sample may be used as long as the digestion is complete.

NOTE: When using the hot blocks, soils are generally weighed to 1.00-1.20 grams due to the size of the digestion vessels. All other volumes are the same as for the hot plate/beaker digestions.

Add 10 mLs of InstraPure nitric acid and 5 mLs of Milli-Q water. Cover the beaker with a non-ribbed watch glass and place on a preheated hotplate set at 90-95°C for 15 minutes without boiling. Remove the beaker from the hot plate and allow to cool. Add 5 mLs of InstraPure nitric acid and reflux for 30 minutes. If brown fumes are generated, repeat this last step. Keep repeating until no brown fumes are generated indicating complete reaction with the nitric acid.

Allow the solution to evaporate to a low volume – just enough to cover the bottom of the beaker. **Do not allow the sample to boil.**

Remove the beaker from the hot plate and allow to cool. Add 2 mLs of Milli-Q water and 3 mLs of 30% hydrogen peroxide. Cover the beaker and heat until the reaction is complete. Remove the beaker from the hot plate and allow to cool.

Continue to add 30% hydrogen peroxide in 1 mL aliquots with warming until the effervescence is minimal or until the general sample appearance in unchanged. **Do not add more than a total of 10 mLs of hydrogen peroxide.**

Cover the sample with a ribbed watch glass and heat until the volume has been reduced to ~5mLs or heat at 90-95°C for 2-hours without boiling. Maintain a covering of solution on the bottom of the beaker at all times.

If the sample is being analyzed by the Trace ICP: Add 10 mLs of InstraPure hydrochloric acid. Place the beaker on the hot plate and heat for 15 minutes without boiling. Remove the beaker from the hot plate and allow to cool. Wash down the sides of

the beaker with Milli-Q water and filter into a 100 mL Class A volumetric flask through Whatman 541 filter paper. Dilute the sample to the 100 mL final volume with Milli-Q water. The sample is now ready for analysis.

If the sample is being analyzed by GFAA: Let the sample cool. Wash down the sides of the beaker with Milli-Q water and filter into a 100 mL Class A volumetric flask through Whatman 541 filter paper. Dilute the sample to the 100 mL final volume with Milli-Q water. The sample is now ready for analysis.

7.6.6 Methods 7060A / 7740

Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel. Add 1 mL of Hydrogen Peroxide and 0.5 mL of InstraPure nitric acid. Place the vessel on a preheated hot block set at 90-95°C. Evaporate the sample down to a volume slightly less than 25 mLs.

Remove the samples and allow to cool. Fill to a final 50 mL volume in the digestion vessel with Milli-Q water and filter using the plunger apparatus. The sample is now ready for analysis.

NOTE: When using the Hot Plate, all volume remains the same in a 250 mL beaker. When filtering, wash down the sides of the beaker with Milli-Q water. Filter the sample through Whatman 541 filter paper into a 50 mL Class A volumetric flask. Dilute to volume with Milli-Q water.

7.7 Documentation

7.7.1 LabNet Digestion Spreadsheets

Sample digestion and standard traceability are documented within the LabNet spreadsheets. The spreadsheets must be completed for each days work. The time of digestion and temperature of the hot plate/block must be recorded. Refer to Appendix B for an examples of the GFAA and Trace ICP digestion spreadsheets.

7.7.2 Traceability of Standards

Custom made and single element stock standard solutions which are traceable to NIST or EPA are purchased. Upon receipt, each standard is entered into the LabNet database and is issued a unique source ID#. The manufacturer, lot #, date received, expiration date, and the initials of the analyst are also entered.

8.0 QUALITY CONTROL

8.1 QC Summary

Each digestion batch will contain a maximum of 20 samples. A MB, LCS, MD and MS/MSD will be prepared with each digestion batch.

8.1.1 Method Blank (MB)

The MBs are examined to determine if there was any contamination introduced during the digestion process.

8.1.2 Laboratory Control Sample (LCS)

The LCSs are used to determine the completeness of the digestion process. The accuracy is measured by the percent recovery (%R) of each standard.

8.1.3 Matrix Duplicate (MD)

The MDs demonstrate analytical precision and is reported as Relative Percent Difference (RPD).

8.1.4 Matrix Spike / Matrix Duplicate (MS/MSD)

The MS/MSDs are used to demonstrate analytical accuracy and is reported as % recovery.

8.2 Corrective Action

Since this is a preparation procedure, out-of-control situations will not be identified until the filtrates are analyzed. Refer to the analytical SOPs for corrective actions.

9.0 DATA ANALYSIS AND CALCULATIONS

Not Applicable.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

- Waste from this procedure will enter the "Corrosive Wastewater" wastestream.

11.0 METHOD PERFORMANCE CRITERIA

Refer to sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0.

13.0 ATTACHMENTS

Appendix A. Metals Digestion Standard Spike Concentrations
Appendix B. Example: GFAA and Trace ICP LabNet Digestion Spreadsheets
Documentation of Digestion Vessel Calibration

Historical File:

Revision 00: 08/15/91	Revision 06: 10/07/97
Revision 01: 03/16/93	Revision 07: 10/16/97
Revision 02: 08/20/93	Revision 08: 03/31/99
Revision 03: 01/20/94	Revision 09: 05/05/00
Revision 04: 11/22/95	Revision 10: 07/06/01
Revision 05: 02/18/97	Revision 11: 01/09/03

Reasons for Change, Revision 11:

- Digestion temperature range added: 90-95°C.
- Removed references to the non-Trace ICPs.
- Section 7.3: Added the note for filtering the LCS/MB for dissolved metals that are filtered within the laboratory

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Appendix A.
Metals Digestion Standard Spike Concentration

Trace-ICP

Vendor	Stock Name	Elements	Conc. (mg/L)
Environmental Express	HP1381-A-500	Al, Ba	2,000
		Ca, Mg, K, Na	10,000
	HP1381-B-500	Se	10
		Pb	20
		As	40
		Tl, Be, Cd	50
		Cr	200
		Cu	250
		Co, Ni, Li, V, Bi, Mn, Zn	500
		B, Fe, Sr	1,000
	HP1381-C-500	Ag	50
		Sb, P	500
		Mo, Sn, Ti	1,000
		Si	5,000

GFAA

Vendor	Stock Name	Elements	Conc. (mg/L)
Inorganic Ventures	STL-CLP-60R	Sb,Tl	500
		As	400
		Cr, Cu, Pb	200
		Se	100
		Cd	50
	Single Element Standard	Ag	1,000

TCLP (MS)

Vendor	Stock Name	Elements	Conc. (mg/L)
Inorganic Ventures	STL-TCLP-1A	Hg	20
		Cu	25
		Zn, Ni	50
		Cd, Se, Ag	100
		Cr, As, Pb	500
	Single Element Standard	Ba	10,000

Appendix B.

Example: LabNet Digestion Spreadsheets
Documentation of Digestion Vessel Calibration

VOLUME CERTIFICATION
CATALOG NUMBER SC500, DISPOSABLE DIGESTION CUPS
LOT NUMBER: 1260

THIS CERTIFIES THAT THE ABOVE REFERENCED LOT OF SC500 DISPOSABLE DIGESTION CUPS HAS BEEN TESTED TO DETERMINE VOLUME. A REPRESENTATIVE SAMPLE OF THE LOT WAS CONDITIONED TO ROOM TEMPERATURE AND FILLED TO THE BOTTOM OF THE 50ML GRADUATION LINE ON THE CUP WITH DEIONIZED WATER. VOLUME WAS DETERMINED BY WEIGHT USING A SPECIFIC GRAVITY OF WATER OF 0.997. WEIGHINGS WERE DONE ON AN ANALYTICAL BALANCE, CERTIFIED WITH CLASS S WEIGHTS TRACEABLE TO NIST

WHEN THE CUPS WERE FILLED TO THE TOP OF THE 50ML LINE AT 25 DEGREES CELSIUS, THEY WERE FOUND TO CONTAIN A VOLUME OF 50ML ±0.2ML.

ENVIRONMENTAL EXPRESS
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MT. PLEASANT, SC 29464

Catalogue SC500
Lot# 1260 Analysis Report

A minimum of 36 cups are collected randomly from the manufacturing lot. Blank samples are digested according to EPA Method 200.2 and analyzed on a Hewlett Packard 4500 ICP/MS by an independent laboratory. Results are averaged and reported in the chart below. Field results may vary with environmental conditions, analytical techniques and handling procedures. Care should be taken in storage and handling to prevent background contamination.

LOT NUMBER 1260

Analyte	Blank mg/L	Analyte	Blank mg/L	Analyte	Blank mg/L
Antimony	<0.010	Aluminum	<0.050	Arsenic	<0.005
Boron	<0.050	Beryllium	<0.005	Barium	<0.005
Calcium	<0.100	Cadmium	<0.005	Cobalt	<0.005
Copper	<0.005	Chromium	<0.005	Iron	<0.050
Lead	<0.005	Molybdenum	<0.010	Magnesium	<0.050
Manganese	<0.050	Nickel	<0.005	Thallium	<0.010
Selenium	<0.005	Silver	<0.005	Vanadium	<0.010
Zinc	<0.010				

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*** BATCH WORKSHEET *** (V2)

Acid Digestion (ICAP) Report Date: 1/17/03 15:53

Method Code..: 3005	Batch Date...: 11/25/02	QC Code.....:	Equipment Code.:
Batch Code...: 70074	Batch Time...: 1705	Calc Code.....: PFACW	Import Code....:
Status.....: RVWD	User Name....: rlc	Location Code..: 57222	

BATCH: Item	Description	Description Information
1	Analyst:	rlc
2	Reviewer:	jlw
3	Prep Time Start:	1630
4	Hot Plate #	1154
5	Temperature oC Initial:	95
6	Temperature oC Final:	95
7	Repipettor Volume Check:	ok
8	HNO3 Preservative Lot #	n/a
9	HNO3 (Conc.) Lot #	x43045
10	H2O2 (Conc.) Lot #	n/a
11	HCL (Conc.) Lot #	x40064
12	Comment:	Trace
13	Comment:	
14	Comment:	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGTR Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	1	___MB_70074_		Complete	50	50	1.0000	1.000
	1	2	___LCS_MO2KSPK001_		Complete	50	50	1.0000	1.000
	1	3	213542_1___		Complete	50	50	1.0000	1.000
	1	4	213542_1__MD__3		Complete	50	50	1.0000	1.000
	1	5	213542_1__MS_MO2KSPK001_3		Complete	50	50	1.0000	1.000
	1	6	213542_1__MSD_MO2KSPK001_3		Complete	50	50	1.0000	1.000
	1	7	213572_1___		Complete	50	50	1.0000	1.000
	1	8	213572_2___		Complete	50	50	1.0000	1.000
	1	9	213572_3___		Complete	50	50	1.0000	1.000
	1	10	213572_4___		Complete	50	50	1.0000	1.000
	1	11	213572_5___		Complete	50	50	1.0000	1.000
	1	12	213572_6___		Complete	50	50	1.0000	1.000
	1	13	213572_7___		Complete	50	50	1.0000	1.000
	1	14	213574_1___		Complete	50	50	1.0000	1.000

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	CLARIB Text	CLARIF Text
	1	1	___MB_70074_		50				
	1	2	___LCS_MO2KSPK001_		50				

*** BATCH WORKSHEET *** (V2)

Acid Digestion (ICAP) Report Date: 1/17/03 15:54

thod Code..: 3010	Batch Date...: 01/16/03	QC Code.....:	Equipment Code.:
tch Code...: 73885	Batch Time...: 1817	Calc Code.....: PFACV	Import Code....:
Status.....: RVWD	User Name....: rlc	Location Code..: 57222	

BATCH:	Item	Description	Description Information
	1	Analyst:	rlc
	2	Reviewer:	jlw
	3	Prep Time Start:	1740
	4	Hot Plate #	1154
	5	Temperature oC Initial:	95
	6	Temperature oC Final:	95
	7	Repipettor Volume Check:	ok
	8	HNO3 Preservative Lot #	n/a
	9	HNO3 (Conc.) Lot #	x40023
	10	H2O2 (Conc.) Lot #	n/a
	11	HCL (Conc.) Lot #	x36046
	12	Comment:	Trace Pb
	13	Comment:	
	14	Comment:	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGICP Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	1	MB_73885		Complete	50	50	1.0000	1.000
	1	2	LCS_M02KSPK001		Complete	50	50	1.0000	1.000
	1	3	214704_1		Complete	50	50	1.0000	1.000
	1	4	214704_1_MD_3		Complete	50	50	1.0000	1.000
	1	5	214704_1_MS_M02KSPK001_3		Complete	50	50	1.0000	1.000
	1	6	214704_1_MSD_M02KSPK001_3		Complete	50	50	1.0000	1.000
	1	7	214704_2		Complete	50	50	1.0000	1.000
	1	8	214704_3		Complete	50	50	1.0000	1.000

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	CLARIB Text	CLARIF Text
	1	1	MB_73885		50				
	1	2	LCS_M02KSPK001		50				
	1	3	214704_1		50				
	1	4	214704_1_MD_3		50				
	1	5	214704_1_MS_M02KSPK001_3		50				
	1	6	214704_1_MSD_M02KSPK001_3		50				
	1	7	214704_2		50				

*** BATCH WORKSHEET *** (V2)

Acid Digestion (GFAA)

Report Date: 1/17/03 15:55

Method Code..: 3020	Batch Date...: 08/09/02	QC Code.....:	Equipment Code.:
Batch Code...: 59348	Batch Time...: 1006	Calc Code.....: PFACW	Import Code....:
Status.....: RVWD	User Name....: lmr	Location Code..: 57222	

BATCH: Item	Description	Description Information
1	Analyst:	LMR
2	Reviewer:	jlw
3	Prep Time Start:	09:05
4	Hot Plate #	1172
5	Temperature oC Initial:	90
6	Temperature oC Final:	95
7	Repipettor Volume Check:	OK
8	HNO3 Preservative Lot #	N/A
9	HNO3 (Conc.) Lot #	6623V51F00
10	H2O2 (Conc.) Lot #	X05A14
11	HCL (Conc.) Lot #	N/A
12	Comment:	CD,CR,PB
13	Comment:	CLP-LIKE
14	Comment:	**LCG**

SAMPLE: Grp	Pos	Sample ID	Dilution	DIGGFA Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
1	1	__MB_59348_		Complete	50	50	1.0000	1.000
1	2	__LCS_M02ESPK002_		Complete	50	50	1.0000	1.000
1	3	210929_1___		Complete	50	50	1.0000	1.000
1	4	210929_1__MD__3		Complete	50	50	1.0000	1.000
1	5	210929_1__MS_M02ESPK002_3		Complete	50	50	1.0000	1.000
1	6	210929_1_D___		Complete	50	50	1.0000	1.000
1	7	210929_1_D_MD__6		Complete	50	50	1.0000	1.000
1	8	210929_1_D_MS_M02ESPK002_6		Complete	50	50	1.0000	1.000
1	9	210929_2___		Complete	50	50	1.0000	1.000
1	10	210929_2_D___		Complete	50	50	1.0000	1.000
1	11	210929_3___		Complete	50	50	1.0000	1.000
1	12	210929_3_D___		Complete	50	50	1.0000	1.000
1	13	210929_5___		Complete	50	50	1.0000	1.000
1	14	210929_5_D___		Complete	50	50	1.0000	1.000
1	15	210929_6___		Complete	50	50	1.0000	1.000
1	16	210929_6_D___		Complete	50	50	1.0000	1.000
1	17	210929_7___		Complete	50	50	1.0000	1.000

Acid Digestion (GFAA) Report Date: 1/17/03 15:55

'hod Code..: 3020 Batch Date...: 08/09/02 QC Code.....: Equipment Code.:
.ch Code...: 59348 Batch Time...: 1006 Calc Code.....: PFACW Import Code....:
Status.....: RVWD User Name....: lmr Location Code..: 57222

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGGFA Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	18	210929_7_D___		Complete	50	50	1.0000	1.000
	1	19	210929_8____		Complete	50	50	1.0000	1.000
	1	20	210929_8_D___		Complete	50	50	1.0000	1.000
	1	21	210929_9____		Complete	50	50	1.0000	1.000
	1	22	210929_9_D___		Complete	50	50	1.0000	1.000
	1	23	210929_11____		Complete	50	50	1.0000	1.000
	1	24	210929_11_D___		Complete	50	50	1.0000	1.000

SAMPLE:	Grp	Pos	Sample ID	Dilution	COLORB Text	COLORF Text	CLARIB Text	CLARIF Text	ARTIFA Text
	1	1	___MB_59348_						
	1	2	___LCS_M02ESPK002_						
	1	3	210929_1____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	4	210929_1__MD__3		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	5	210929_1__MS_M02ESPK002_3		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	6	210929_1_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	7	210929_1_D_MD__6		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	8	210929_1_D_MS_M02ESPK002_6		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	9	210929_2____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	10	210929_2_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	11	210929_3____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	12	210929_3_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	13	210929_5____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	14	210929_5_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	15	210929_6____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	16	210929_6_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	17	210929_7____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	18	210929_7_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	19	210929_8____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	20	210929_8_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	21	210929_9____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	22	210929_9_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	23	210929_11____		COLORLESS	COLORLESS	CLEAR	CLEAR	
	1	24	210929_11_D___		COLORLESS	COLORLESS	CLEAR	CLEAR	

*** BATCH WORKSHEET *** (V2)

Acid Digestion: Solids (ICAP) Report Date: 1/17/03 15:55

Method Code..: 3050	Batch Date...: 01/15/03	QC Code.....:	Equipment Code.:
Batch Code...: 73782	Batch Time...: 1904	Calc Code.....: PFACS	Import Code....:
Status.....: RVWD	User Name....: rlc	Location Code..: 57222	

BATCH:	Item	Description	Description Information
	1	Analyst:	rlc
	2	Reviewer:	jlw
	3	Prep Time Start:	1900
	4	Hot Plate #	1172
	5	Temperature oC Initial:	95
	6	Temperature oC Final:	95
	7	Repipettor Volume Check:	oka
	8	HNO3 Preservative Lot #	n/a023
	9	HNO3 (Conc.) Lot #	x40023
	10	H2O2 (Conc.) Lot #	x36a10
	11	HCL (Conc.) Lot #	x36046
	12	Comment:	Trace RCRA
	13	Comment:	
	14	Comment:	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGSOL Text	WEIGHT g	MLF mL	PREPF N/A	DLFAC N/A
	1	1	__S_MB_73782_		Complete	1.000	100	100.0000	1.0000
	1	2	__S_LCS_MO2KSPK001_		Complete	1.000	100	100.0000	1.0000
	1	3	214681_1_S__		Complete	1.149	100	87.0322	0.8703
	1	4	214681_1_S_MD__3		Complete	1.117	100	89.5255	0.8953
	1	5	214681_1_S_MS_MO2KSPK001_3		Complete	1.091	100	91.6590	0.9166
	1	6	214681_1_S_MSD_MO2KSPK001_3		Complete	1.162	100	86.0585	0.8606
	1	7	214681_2_S__		Complete	1.027	100	97.3710	0.9737
	1	8	214681_3_S__		Complete	1.035	100	96.6184	0.9662
	1	9	214681_4_S__		Complete	1.110	100	90.0901	0.9009

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	TEXTUR Text	ARTIFA Text
	1	1	__S_MB_73782_		100				
	1	2	__S_LCS_MO2KSPK001_		100				
	1	3	214681_1_S__		100				
	1	4	214681_1_S_MD__3		100				
	1	5	214681_1_S_MS_MO2KSPK001_3		100				
	1	6	214681_1_S_MSD_MO2KSPK001_3		100				

STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURE

SOP No.	Revision No.	Date	Page
USP-3550	02	04/16/02	1 of 26

TITLE: **Sample Preparation Semivolatile and Nonvolatile Organic Compounds from a Soil/Sediment Matrix Using Sonication Extraction**

Updated by:	Signature:	Date
Daniel A. Knieriemen Unit Leader, Organic Extractions	D. A. K.	04/04/02

Approved by:	Signature:	Date:
Patti J. Gibson Section Manager, Organics Dept.	Patti Gibson	4/4/02
David L. Kaczka Env. Health & Safety Coor.	D. L. Kaczka	4/5/02
Terese A. Preston Quality Manager	Terese A. Preston	4/17/02

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ISSUED TO : Gloria Chojnacki, S.E.H.
Re: Ashland/NSP Lakefront Site
QAPP

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE AND APPLICATION

To outline the extraction procedure of semivolatile and nonvolatile compounds[1] from soil and sediment matrices using SW-846 Methods 3500B, 3550A and 3550B. The compounds of interest are as listing in the analytical Standard Operating Procedure (SOP).

[1]BNAs, Pesticides, Pesticides/PCBs, PCBs, Organophosphorus Pesticides, PAHs and DRO.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP) and authorized via laboratory signature approval; and amended to the data packages case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

Refer to the analytical SOP(s).

1.1.2 Reporting Limits

Refer to the analytical SOP(s).

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM, Revision 01).

1.2 Summary of Procedure

The following procedure is used for the sonication extraction of semivolatile and nonvolatile organics from soils and sediments for subsequent analysis. Approximately 30 grams of sample, or 10 grams depending on previous sample experience, is mixed with anhydrous sodium sulfate to form a free-flowing powder. This mixture is solvent extracted three times (using sonication) with DCM:acetone (1:1)(v:v). The combined extract is dried, concentrated, exchanged to another solvent if necessary, and adjusted to the appropriate final volume. The labeled extracts are stored in extraction batches at 4 $\pm$ 2°C prior to analysis. Optional cleanup procedures may be performed upon request. The mandatory acid cleanup for PCB samples is described within this SOP. GPC, Florisil, and sulfur removal cleanup procedures are described in other SOPs (refer to the USP-003 for the specific cleanup references).

Sludge samples (water and suspended solids) with very low solid content may be prepared following the wastewater extraction (USP-3510 or –3520). Organic sludges and wastes, both single phase, are generally prepared following the dilution technique (USP-3580) for wastes and oils.

2.0 INTERFERENCES

- Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or interferences to sample analysis. All these materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing method blanks.
- **Plastics, in particular**, must be avoided because phthalates are commonly used as plasticizers. These phthalates are easily extracted or leached from such materials during laboratory operations. Cross contamination of clean glassware routinely occurs when plastics are handled during extraction steps especially when solvent-wetted surfaces are handled. Avoiding contact with any plastic materials can best minimize interference from phthalates.
- Soap residue on glassware may cause degradation of certain analytes. This problem is especially pronounced with glassware that may be difficult to rinse. These items should be hand-rinsed very carefully to avoid this problem.
- Matrix interferences may be caused by contaminants that are co-extracted from the sample. These can appear as large, distinct peaks and/or elevated baselines. Occasionally matrix interferences may prevent the proper detection of surrogate and/or analytes, resulting in the reporting of low, or possibly high, surrogate and/or spike recoveries. The extent of matrix interferences will vary considerably from sample to sample, depending upon the nature of the site being sampled. Various cleanup procedures may be performed to remove heavy background or interferences, including GPC cleanup, Florisil cleanup, acid cleanup, and sulfur removal procedures.

3.0 SAFETY

- Employees will adhere to the practices and policies in the STL Corporate Safety Manual (CSM) and will read the MSDSs for the materials used in this method before handling or using the material.
- Take careful note of those sections marked "CAUTION" and "NOTE".
- Safety glasses and lab coats must be worn at all times during the extraction process. Nitrile or equivalent gloves are available and must be worn when handling acids, bases, or samples.
- All extractions and handling of solvents should be performed under well-ventilated conditions of a fume hood.
- DCM is considered a health hazard and possible carcinogen. It is harmful if swallowed or inhaled. The vapor is irritating, and thus should be used in a hood. It is readily absorbed through the skin and contact may be irritating.
- PCBs are a bio-accumulating carcinogen. Extreme care should be taken when working with these standards and samples.

- All glassware should be carefully inspected for any kind of crack or star prior to use. Dispose of imperfect glassware in an appropriate container. Some types of glassware are repairable.
- All samples should be handled with care due to the uncertainty of the properties and the contents involved.
- The sonicator is an electrical instrument with high voltage. If a sample is spilled into the components box, unplug it immediately and have it serviced prior to using.

4.0 EQUIPMENT AND SUPPLIES

4.1 Glassware

- 100 mL, 1000 mL, 2000 mL graduated cylinders
- 0.5 mL, 1.0 mL, 10 mL volumetric pipet, Class A
- 25 mL, 100 mL volumetric flask, Class A
- 500 uL, 1000 uL syringe
- 250 mL, 400 mL beakers
- 100 mm glass, powder funnels
- Buchner funnels
- 500 mL filtering, Erlenmeyer flasks
- 500 mL Kuderna-Danish flasks
- 10 mL receiver (concentrator tubes) with clips, standard and insulated
- 3 ball Snyder columns
- 250 mL Erlenmeyer flasks
- 5.0 mL, 10.0 mL pre-marked 16 X 125 test tubes with Teflon lined lids*
- Transfer pipets
- Shallow Pyrex drying tray
- Vials, 1.5 - 2.0 mL, screw-capped, Teflon-lined

* Volumetrically add the appropriate volume of Hexane to a 16 X 125 screw top test tube and mark the meniscus using a fine-tipped marker. Discard the Hexane into an appropriate waste vessel and let dry. Bring up sample to volume using this test tube.

4.2 Miscellaneous

- Ultrasonic Cell disrupter (Misonix Incorporated, Model XL2020 Sonicator, 550 Watts with pulsing capability, Dual Horn with No. 208, 3/4 in. solid extenders).
- Sonabox acoustical enclosure
- Balance (capable of weighing to 0.01 g)
- Teflon squeeze bottles
- Nitrogen evaporator
- Waterbath - heated, with concentric ring covers, capable of temperature control; and must be in a hood.
- Magnetic stir plate and stir bars
- Wide range pH paper 1 to 12

- #41 Whatman filter paper
- Mixing pan/aluminum foil
- Wooden spatulas and stainless steel spatula
- Vacuum pump
- Boiling chips; soxhlet extracted
- Muffle furnace
- Desiccator
- Centrifuge

5.0 REAGENTS AND STANDARDS

5.1 Reagents

5.1.1 Pesticide Grade Methylene Chloride (DCM)
Pesticide Grade Acetone
Pesticide Grade Hexane
Pesticide Grade Acetonitrile

5.1.2 Heat Purified Granular Sodium Sulfate

Purify by heating at 400°C for 4-hours in a shallow drying tray, cool in a desiccator, and store in a glass bottle.

- Life of Reagent: 1 year.
- Storage Requirements: Store in a glass container and keep dry (anhydrous).

5.1.3 Heat Purified Powdered Sodium Sulfate

Purify by heating at 400°C for 4-hours in a shallow drying tray, cool in a desiccator, and store in a glass bottle.

- Life of Reagent: 1 year.
- Storage Requirements: Store in a glass container and keep dry (anhydrous).

5.1.4 DCM:Acetone (1:1) (v:v)

Add 1000 mLs pesticide grade DCM into 1000 mLs pesticide grade acetone in a 2 Liter graduated cylinder. Pour into a 4-L solvent bottle and swirl to mix. Do not close the top on the bottle because the pressure will build and may cause it to explode.

- Hazardous Properties: Acetone is flammable. When not in use it should be stored in a flammable cabinet. Do not use near open flame or heat. DCM is an inhalation hazard. Use only in a well ventilated area. Harmful if swallowed.

- Life of Reagent: 1 year.
- Storage Requirements: Store in a glass container with a Teflon-lined cap. Store in a flammable cabinet.

5.1.5 Concentrated Sulfuric Acid

Purchased from a supplier

- Hazardous Properties: Sulfuric Acid (H_2SO_4) is extremely corrosive and toxic to tissues. Vapors are also harmful.
- Life of Reagent: 1 year
- Storage Requirements: Store in glass container. The label on the bottle must contain concentration and name of reagent.

5.2 Quality Control (QC) Solutions

QC solutions must be stored in amber or foil-wrapped, glass containers that have Teflon-lined caps. the label on the container must contain the following information: Name of the solution, standard #, concentration of the components, date prepared, preparation analyst, and expiration date. All QC solutions are stored either in the standards refrigerator in the GC/MS lab, GC Extractables lab, or in the standards refrigerator located in the organic extraction lab. QC solutions are stored at 4 ± 2 °C.

Listed below are the various QC solutions and concentrations appropriate for extraction of BNAs, Pesticides, Pesticides/PCBs, PCBs, Organophosphorus Pesticides, PAHs and DRO from soil/sediment matrices. Instructions detailing the preparation of these solutions are found in the corresponding analytical OPs.

5.2.1 Surrogate Spike Solutions

5.2.1.1 BNA Surrogate Spike Solution

The BNA Surrogate Spike Solution is purchased directly from a chemical vendor at the levels listed below. 500 uLs of BNA Surrogate Spike Solution is added to all samples and blanks.

Compound	Concentration
p-Terphenyl-d_4	100 ug/mL
Nitrobenzene-d_5	100 ug/mL
2-Fluorobiphenyl	100 ug/mL
1,2-Dichlorobenzene-d_4	100 ug/mL
Phenol-d_5	150 ug/mL
2-Fluorophenol	150 ug/mL

Compound	Concentration
2,4,6-Tribromophenol	150 ug/mL
2-Chlorophenol-d_4	150 ug/mL

- Life of Standard: 6 months from the preparation date (as documented from the vendor).
- Storage Requirements: As stated in Section 5.2

5.2.1.2 Pesticide/PCB Surrogate Spike Solution

The surrogate used in the extraction of pesticides/PCBs from soil/sediments is a solution of Decachlorobiphenyl (DCB) and 2,4,5,6-Tetrachloro-m-xylene (TCMX) in acetone at the concentrations listed below. 1000 uLs of Pesticide/PCB Surrogate Spike Solution is added to all samples and blanks.

Compound	Concentration
DCB	0.4 ug/mL
TCMX	0.4 ug/mL

- Life of Standard: Same as parent solution
- Storage Requirements: As stated in Section 5.2

5.2.1.3 Organophosphorus Pesticide Surrogate Spike Solution

The surrogate solution used in the extraction of organophosphorus pesticides from soil/sediments is a solution of Tributylphosphate and Triphenyl phosphate in acetone. The GC Extractables department prepares all standard solutions. The desired concentration of each compound is 20 ug/mL; however, there may be slight variability between separate solutions. 1000 uLs of Organophosphorus Pesticide Surrogate Spike Solution is added to all samples and blanks.

Compound	Concentration
Tributylphosphate	~ 20 ug/mL
Triphenyl Phosphate	~20 ug/mL

- Life of Standard: 2 months from the preparation date or as documented by the vendor, whichever comes first.
- Storage Requirements: As stated in Section 5.2.

5.2.1.4 PAH Surrogate Spike Solution

The surrogate used in the extraction of PAHs from soil/sediments is a solution of Decafluorobiphenyl and Benzo (e) pyrene in acetone at the concentrations listed below. The HPLC group prepares the working surrogate solution. 500 uLs of PAH Surrogate Spike Solution is added to all samples and blanks.

Compound	Concentration
Decafluorobiphenyl	100 ug/mL
Benzo (e) pyrene	5.0 ug/mL

- Life of Standard: Same as parent solution
- Storage Requirements: As stated in Section 5.2

5.2.1.5 DRO Surrogate Spike Solution

The surrogate used in the extraction of DRO from soil/sediments is a solution of 2-Fluorobiphenyl and o-Terphenyl in acetone at the concentrations listed below. The GC group prepares the working surrogate solution. 500 uLs of DRO Surrogate Spike Solution is added to all samples and blanks and spikes.

Compound	Concentration
2-Fluorobiphenyl	100 ug/mL
o-Terphenyl	100 ug/mL

- Life of Standard: Same as parent solution.
- Storage Requirements: As stated in Section 5.2.

5.2.2 Laboratory Control Sample (LCS) & Matrix Spike (MS) Solutions

5.2.2.1 BNA TCL Spike Solution

The BNA TCL Spike Solution is purchased directly from vendor at the levels listed below. 1000 uLs of BNA TCL Spike Solution is added to the LCS and MS/MS Duplicate (MSD).

Compound	Concentration
Acid Compounds	100 ug/mL
Base/Neutral Compounds	100 ug/mL

- Life of Standard: 6 months from the from the preparation date (as documented from the vendor).
- Storage Requirements: As stated in Section 5.2.

5.2.2.2 BNA Matrix Spike (SIM) Solution

The BNA TCL Spike Solution is purchased directly from vendor at the levels listed below. 1000 uLs of BNA TCL Spike Solution is added to LCS and MS/MSD samples.

Compound	Concentration
Acid Compounds	10 ug/mL
Base/Neutral Compounds	10 ug/mL

- Life of Standard: Same as parent solution.
- Storage Requirements: As stated in Section 5.2.

5.2.2.3 Pesticide (Full List) Spike Solution

The LCS/MS solution used in the extraction of pesticides or pesticides/PCB from soil/sediments is a solution of 20 pesticides in methanol at the following concentrations. 1000 uLs of Pesticide (Full List) Spike Solution is added to LCS and MS/MSD.

Compound	Concentration
All compounds	0.4 ug/mL

- Life of Standard: Same as parent solution.
- Storage Requirements: As stated in Section 5.2.

5.2.2.4 PCB Spike Solution

The LCS/MS solution used in the extraction of PCBs from soil/sediments is a solution of Arochlor 1016 and Arochlor 1260 in methanol at the following concentrations. 1000 uLs of PCB Spike Solution is added to the LCS and MS/MSD.

Compound	Concentration
AR1016	5.0 ug/mL
AR1260	5.0 ug/mL

- Life of Standard: Same as parent solution.
- Storage Requirements: As stated in Section 5.2.

5.2.2.5 Organophosphorus Pesticide Spike Solution

The LCS/MS solution used in the extraction of organophosphorus pesticides from soil/sediments is a solution of 9 organophosphorus pesticides in methanol at the following concentrations. 1000 uLs of Organophosphorus Pesticide Spike Solution is added to the LCS and MS/MSD.

Compound	Concentration
o,o,o-TEPA	20.0 ug/mL
Thionazin	20.0 ug/mL
Sulfotepp	20.0 ug/mL
Phorate	20.0 ug/mL
Dimethoate	20.0 ug/mL
Disulfoton	20.0 ug/mL
Methyl parathion	20.0 ug/mL
Ethyl parathion	20.0 ug/mL
Famphur	20.0 ug/mL
Malathion	20.0 ug/mL

- Life of Standard: 2 months from preparation date or as documented by the vendor, whichever comes first.
- Storage Requirements: As stated in Section 5.2.

5.2.2.6 PAH Spike Solution

The LCS/MS solution used in the extraction of PAHs from soil/sediments is a solution of 16 analytes in acetonitrile at the following concentrations. The HPLC group prepares the spike solution. 500 uLs of PAH Spike Solution is added to the LCS and MS/MSD.

Compound	Concentration
Acenaphthene	8 ug/mL
Acenaphthylene	16 ug/mL
Anthracene	0.8 ug/mL
Benzo(a)anthracene	0.8 ug/mL
Benzo(a)pyrene	0.8 ug/mL
Benzo(b)fluoranthene	1.6 ug/mL
Benzo(ghi)perylene	1.6 ug/mL
Benzo(k)fluoranthene	0.8 ug/mL
Chrysene	0.8 ug/mL
Dibenzo(a,h)anthracene	1.6 ug/mL
Fluoranthene	1.6 ug/mL
Fluorene	0.8 ug/mL

Compound	Concentration
Indeno(1,2,3-cd)pyrene	0.8 ug/mL
Naphthalene	8.0 ug/mL
Phenanthrene	0.8 ug/mL
Pyrene	0.8 ug/mL

- Life of Standard: Same as the parent solution.
- Storage Requirements: As stated in Section 5.2.

5.2.2.7 DRO Spike Solution

The LCS/MS solution used in the extraction of DRO from soil/sediments is a solution Diesel Fuel #2 at 1000 ug/mL in methanol. The GC group prepares the spike solution. 500 uLs of DRO Spike Solution is added to the LCS and MS/MSD.

Compound	Concentration
Diesel Fuel #2	4000 ug/mL

- Life of Standard: Same as the parent solution.
- Storage Requirements: As stated in Section 5.2.

6.0 CALIBRATION (NON-DAILY)

Not Applicable.

7.0 PROCEDURE

7.1 Quality Control

The following QC is performed with each organic extraction batch. An extraction batch contains samples of similar matrix that are logged in for the extraction method. An extraction batch may contain no more than 20 samples.

7.1.1 Method Blank (MB)

The method blank is heat purified powdered sodium sulfate, which has been spiked with the appropriate surrogate(s) (Sec. 5.2.1), then taken through the entire extraction procedure and is used to monitor the introduction of artifacts into the process. This demonstrates that the materials used are free of interferences.

7.1.2 Laboratory Control Sample (LCS)

The LCS is heat-purified powdered sodium sulfate which has been spiked with a predetermined quantity of spike solution (Sec. 5.2.2) with the appropriate analytes of interest and the appropriate surrogate solution (Sec. 5.2.1).

7.1.3 Matrix Spike / Matrix Spike Duplicate (MS/MSD)

In the MS/MSD analysis, predetermined quantities of spike solutions of specified analytes (Sec 5.2.2) and surrogate(s) (Sec. 5.2.1) are added to a sample matrix prior to sample extraction and analysis. Samples are split into duplicates, spiked and analyzed. Percent recoveries are calculated for each of the analytes detected by the analysis. The relative percent difference between the samples is calculated and used to assess analytical precision.

7.1.4 Surrogate

A surrogate is an organic compound(s) which is similar to the analytes of interest in chemical composition, extraction and chromatography, but which is not normally found in environmental samples. The surrogate is added to **all** MBs, LCS, samples, and MS/MSDs prior to extraction and analysis. Percent recoveries are calculated for each surrogate.

7.2 Sample Collection, Preservation and Handling

Sample container, preservation technique and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract/client requests. In general, samples collected for soil/sediment extractions are collected in 8 oz. wide-mouth glass jars, with Teflon-lined screw-cap lids. If a Teflon-lined lid is not available, solvent-rinsed aluminum foil can be used as a liner.

NOTE: If the sample matrix is highly acidic or basic, corrosion of the foil may occur and contaminate the sample.

Samples are stored at 4 $\pm$ 2°C prior to extraction. Any samples received by the preparation group that do not comply must be noted. Deviations in results "could" be explained by the failure of sample collector/client/custodian to comply with sample collection and storage requirements. Samples, sample extracts and standards are stored separately.

Matrix	Holding Time (vts)
Soils / Wastes	14 days

vts = verified time of sample collection

7.3 Sample Preparation

7.3.1 Glassware Preparation

7.3.1.1 All glassware (except Snyder columns, volumetric flasks, volumetric pipets, and syringes) must be washed thoroughly with warm soapy water, rinsed **5** times with hot tap water and rinsed **3** times with DI water. The stopcocks of the separatory funnels should be cleaned with a small brush. **It is absolutely mandatory that all glassware be scrupulously clean.** Failure to rinse well with water, may leave a soap film that is incompletely removed with solvent rinsing, and with subsequent extraction, "soap" peaks will appear in the chromatograms.

7.3.1.2 If glassware is very wet it may be towel dried. **All** Glassware should be rinsed with acetone, and the excess should be discarded into the appropriate waste container. This step is done to ensure that the glassware is dry. **If after rinsing once, the glassware still contains any water, repeat the acetone rinse.** At this point let the glassware dry before continuing to ensure that all of the water is gone. All glassware should then be rinsed with DCM using a Teflon squeeze bottle, and the excess discarded into the appropriate waste container. Repeat this step at least three times and allow the glassware to dry. Failure to remove all water prior to DCM rinsing prevents the DCM solvent from coming into contact with all surfaces on the glassware. The solvent rinse is then incomplete, and may leave contaminants on the glass, which are then co-extracted with the sample.

NOTE: DCM is considered a health hazard. It is harmful if swallowed or inhaled. The vapor is irritating and thus should be used in a hood. It is readily absorbed through the skin and contact may be irritating.

7.3.2 Procedures for Return of Glassware to Dishroom

Any glassware that has organic residue present, all K-D receivers, and all separatory funnels should be rinsed with acetone, or whatever other solvent which removes the residue, prior to return to the dishroom from the lab. Glassware in which the residue can not be removed should be segregated from other glassware being returned to the dishroom. Glassware should be carefully placed in a tub and placed on the "Dirty" side of the dish racks. In order to reduce glassware breakage, glassware should not be stacked in the tubs. Severely chipped glassware should be removed from service. Some items are repairable. Check with the unit leader as to what items get repaired.

7.4 Calibration / Standardization

Not Applicable.

7.5 Preventive Maintenance

- Balance should be cleaned and checked for levelness prior to each use. Class "S" weights should be weighed and documented each day the balance is used. Consult your unit leader if the weights are out of acceptable limits. Do not use the balance until the situation is back in control.
- The probe tips of the sonicator should be periodically examined for extensive wear. To assure optimum operation, periodically tune the generator in accordance to the instructions listed on page 13 of the Misonix XL2020 "Instruction Manual, SON-IM".
- The K-D water bath should contain DI water only. The water level should be checked prior to each use, and should not fall below the heating coils. If the heating coils do become exposed to the air while in use, they could burnout and would require replacement. Keep the water level approximately one inch from the top of the bath edge.
- The N-Evap water bath should also contain DI water. The water level in the bath should be sufficient to cover 3/4 of the receivers when submerged.
- The thermometer used in the extraction water baths are checked against a reference NIST thermometer on a yearly basis or sooner if necessary.
- The desiccant used in the desiccator should be removed and dried in an oven at 130°C whenever the color indicates that it is saturated with moisture. This is usually indicated by a change of color from blue to purple/pink.
- To avoid the breakage of sample extracts, the analyst needs to take care that the containers are properly balanced on the centrifuge. The container should fit snugly in the holder. Use a paper towel to cushion the centrifuge bottles if necessary.

7.6 Sample Analysis

7.6.1 Analytical (Preparation) Sequence

The following preparation sequence will be required of each extraction batch of at most, 20 samples:

Quality Control	Frequency
MB	1 per extraction batch of at most 20 samples
LCS [1]	1 set per extraction batch of at most 20 samples
MS / MSD [2]	At least 1 set in 20 samples (may be requested by the client)
Surrogate	Every sample / MB / LCS / MS / MSD

[1] LCS Duplicate (LCD) is performed only when insufficient sample is available for an MS/MSD or when requested by the client/project/contract.
[2]The sample randomly selected for MS/MSD unless otherwise designated bye the client.

7.6.2 Extraction Process

NOTE: All soils and sediments receive total solids analysis on them by the metals department, so the extraction analyst should not have to perform this step. Results are available on LabNet.

7.6.2.1 Sample Homogenization

Prepare the mixing pan by completely covering the inside with aluminum foil. The dull side of the foil should be toward the sample. Complete the following steps as quickly as possible so as to avoid losses of the more volatile extractables. Transfer the entire contents of the sample container to the mixing pan. Mix the sample well. Using a wooden spatula or solvent-rinsed, stainless steel spatula, break up any chunks of soil material. The objective is to get as representative of a sample as possible. If objects such as rocks and plant material seem "foreign", they should not be used for the sample. However, sometimes material other than soil constitutes a large portion of the sample. These materials should be represented in the sample.

NOTE: If a soil or sediment sample contains more than 90% moisture, it is generally extracted using the separatory funnel method. Contact your unit leader immediately in this case.

Weigh out 30 grams of sample into a labeled 250-mL beaker. Repeat for each sample. Weigh out three, 30 g aliquots of the sample designated/chosen to have the MS and MSD. Label as the sample, sample MS, and sample MSD. Record the sample weights to the nearest 0.001 g in the extraction logbook. Dispose of the aluminum foil and wooden spatulas into a lab waste container. Cover each sample with foil.

NOTE: If previous experience has shown very high concentrations and/or background, a 10-gram sample size can be used. It is advisable to weigh out samples with high moisture content into a 400-mL beaker. This allows for additional sodium sulfate needed to dry the sample. It is extremely important to stir those types of samples very well and very often once the sodium sulfate has been added. The sodium sulfate / wet sample mixture has a tendency to solidify.

Add powdered sodium sulfate to each sample, MS and MSD and mix well using separate spatulas. Add sodium sulfate until the sample has a free-flowing consistency. Recover with foil. Make sure all glassware is appropriately labeled with the sample #.

7.6.2.2 pH Determination

Weigh out the pH sample aliquot at the time as the extraction aliquot is weighed out. Weigh out 50 g of sample into a 250-mL beaker for pH determination. Add 50 mLs of de-

ionized water. Add a Teflon-coated stir bar and cover tightly with aluminum foil. Stir for one hour on a magnetic stir plate. Determine the pH of the sample with wide range pH paper. Record the pH value in the extraction logbook. If the pH of the sample is <5 or >11, notify the unit leader. If sample is limited, use 5 g of soil and 5 mLs of reagent water for pH determination. Denote this in the extraction logbook. Solid and liquid waste from pH determination should be placed in appropriate waste containers. No pH waste is to be put in the sink.

7.6.2.3 Sonication

Add ~30 g of heat-purified, powdered sodium sulfate to each of three 250 mL beakers. Label the beakers as the MB and LCS.

NOTE: All spiking solutions MUST be at room temperature before use. Actual concentrations will change at colder temperatures. Furthermore, some components may come out of solution in the freezer. Warming to room temperatures reverses the process.

Add the appropriate amount of the appropriate surrogate solution (Sec. 5.2.1) to each sample, including the blank and the LCS.

Add the appropriate amount of the appropriate spiking solution (Sec. 5.2.2) to the LCS and MS/MSD.

Add 100 mLs of DCM:Acetone (1:1) extraction solvent to each sample. Wipe off the tip of the sonicator with a acetone-soaked paper towel. Repeat with another acetone-soaked paper towel and then rinse with acetone, into a waste beaker.

The sonicator processor output control should be set at 10 and the %duty cycle at 50. The unit should be set on "pulsed" operation.

Put the first sample into the sonabox acoustic enclosure and place the sonicator tip into the sample. Make sure the tip is below the solvent layer but not touching the sample. Turn the sonicator on. Start the sonication cycle and sonicate for three minutes. Open the sonabox acoustic enclosure, lift the tip out of the solvent, and touch the tip to the inside of the beaker above the solvent layer.

Label a collecting flask for each sample. Fold a 18.5 cm, Whatman #41, filter paper and place in a 100 mm glass funnel. Fill the funnel half full with heat-purified, granular, sodium sulfate. Place a prepared funnel on each collecting flask.

NOTE: Vacuum filtration apparatus (Buchner funnel, filtering flask, and vacuum pump) is available, but not normally used.

Decant the solvent layer of the sonicated sample through the prepared funnel and into the collecting flask. Add another 100 mL aliquot of DCM:Acetone (1:1) to the soil sample.

Repeat the extraction and decanting steps two more times. Combine the three solvent extracts in the same 500 mL collection flask.

After the final sonication, pour the entire sample into the funnel and rinse with the extraction solvent. Rinse the beaker with approximately 10 mLs of solvent, repeat twice. Add the solvent rinses to the funnel.

In between each sample, wipe and rinse the sonicator tip as described before.

The samples are now ready for concentration using the K-D apparatus. Proceed to section 7.6.2.4 for instructions.

7.6.2.4 Sample Concentration

All samples being concentrated must be recorded in the "Sample Concentration Log".

**Occasionally, samples extracted from soil/sediments for subsequent BNA analysis and/or Pesticide/PCB analysis receive a gel permeation cleanup (GPC). These samples need to be identified prior to concentrating. Refer to USP-003 for this procedure.

Assemble a K-D concentrator by attaching a 10 mL concentrator tube to a 500 mL K-D flask. Add a couple of boiling chips. Transfer each extract to it's own K-D concentrator (making sure that each flask is appropriately labeled). Rinse the Erlenmeyer flask 3 times with DCM, adding each rinse to the K-D flask. Rinse down the joint with DCM and then attach a 3-ball Snyder column to each and place on the water bath. The temperature control should be set to medium. This setting should correspond to 80-90°C. Concentration to < 10 mLs is usually completed in 60 - 90 minutes. The balls should chatter but the chambers should not flood.

Refer to appropriate test for further concentration instructions.

BNAs When the apparent final volume reaches about 2-5 mLs, remove from the bath. Allow to drain and cool for 10 minutes. Remove the Snyder column, rinsing the joint and flask with 1-2 mLs DCM. Allow to drain. Dry off the outside of the joint between the flask and receiver to remove the water. Pull the 2 pieces apart gently, in a twisting motion. Rinse off the joint with DCM into the receiver. Cover the receiver with a piece of aluminum foil. If the extracts are to sit overnight, they are to be stored at 4 ± 2°C.

Proceed to section 7.6.2.5 for further concentration using nitrogen evaporation.

PCB, Pesticide/PCB, and Organophosphorus Pesticides When the apparent final volume reaches about ~5 mLs, a solvent exchange is required. Add 50 mLs of hexane to the K-D flask (through the Snyder column). Concentrate the extract by raising the temperature of the water bath, if necessary, to maintain proper distillation. The Snyder column may be wrapped with foil to aid proper evaporation. When the apparent volume reaches 3-5 mLs, remove from the bath. Allow to drain and cool for 10 minutes. Remove the Snyder column, rinsing the joint and flask with 1-2 mLs hexane. Allow to drain. Dry off the outside of the joint between the flask and receiver to remove the water. Pull the 2 pieces apart gently, in a twisting motion. Rinse off the joint with hexane into the receiver.

Transfer the extract into a labeled, 16 X125 test tube that has been previously marked at 10.0 mLs. Rinse the receiver 3 times with hexane, transferring the rinsate each time to the 16X125 test tube. Refrigerated the extracts if they are not going to be immediately concentrated.

Proceed to section 7.6.2.5 for further concentration using nitrogen evaporation.

PAHs When the apparent final volume reaches about ~5 mLs, a solvent exchange is required. Add 5 mLs of acetonitrile to the K-D flask (through the Snyder column). Concentrate the extract by raising the temperature of the water bath, if necessary, to maintain proper distillation. The Snyder column may be wrapped with foil to aid proper evaporation. When the apparent volume reaches 3-5 mLs, remove from the bath. Allow to drain and cool for 10 minutes. Remove the Snyder column, rinsing the joint and flask with 1-2 mLs acetonitrile. Allow to drain. Dry off the outside of the joint between the flask and receiver to remove the water. Pull the 2 pieces apart gently, in a twisting motion. Rinse off the joint with acetonitrile into the receiver.

Transfer the extract into a labeled, 16 X125 test tube that has been previously marked at 5.0 mLs. Rinse the receiver 3 times with acetonitrile, transferring the rinsate each time to the 16X125 test tube. Refrigerated the extracts if they are not going to be immediately concentrated.

Proceed to section 7.6.2.5 for further concentration using nitrogen evaporation.

DRO When the apparent final volume reaches about 2-5 mL, remove from the bath. Allow to drain and cool for 10 minutes. Remove the Snyder column, rinsing the joint and flask with 1-2 mLs DCM. Allow to drain. Dry off the outside of the joint between the flask and receiver to remove the water. Pull the 2 pieces apart gently, in a twisting motion. Rinse off the joint into the receiver using DCM.

Transfer the extract into a 16 X 125 test tube that has been previously marked at 5.0 mL*. Rinse the receiver 3 times with DCM and transfer the rinsate to the 16 X 125 test tube.

* Volumetrically pipet 5.0 mL of DCM into a 16 X 125 test tube. Mark the meniscus using a fine-tipped marker. Discard the solvent into the an appropriate waste vessel.

Proceed to section 7.6.2.5 for further concentration using nitrogen evaporation.

7.6.2.5 Nitrogen Evaporation

For further concentration, place each receiver or test tube on the N-Evap tray. The N-Evap outlet needles should be stored in a 600 mL beaker containing DCM:Acetone (1:1) mixture prior to each use. Wipe each outlet needle with a KimWipe and lock into place on the N-Evap. Lower the outlet tube into the receiver being careful not to touch the sides of the receiver. The outlet tube should remain above the surface of the extract. Open the valve of the nitrogen tank and adjust the pressure in order to achieve the appropriate nitrogen stream. The nitrogen stream should make a slight "dimple" in the surface of the extract. If the extract bubbles, the nitrogen stream is **not** gentle enough. Lower the entire N-Evap tray into the warm water bath to aid the evaporation process. Heat is not necessary and if used the temperature should not exceed 35°C.

Some soil extracts contain sediment after concentrating on the water bath. If this is the case, the extraction analyst will transfer the sample extract (including the sediment) from the receiver to a screw-top test tube. The sample extract is centrifuged and the supernatant is transferred back to the appropriate receiver. The residue that is left in the screw top test tube is washed with 1 mL of appropriate solvent (see corresponding test instructions below for final solvent) and centrifuged. The "wash" supernatant is added to the appropriate receiver and the sample is placed on the Nitrogen evaporator to be concentrated. All samples requiring this centrifuging step are documented in the comment section of the K-D logbook.

The extracts must never be allowed to go dry. While the extracts are concentrating, occasionally rinse down the sides of the receiver or test tube with appropriate solvent (see corresponding test instructions below).

Refer to appropriate test below for further concentration instructions.

BNAs

a. Once the extracts reach ~0.5 mLs, remove from the N-Evap. Label a 1.5 - 2 mL screw capped vial with appropriate sample #. Transfer the 0.5 mLs to the vial using a transfer pipet. Rinse the receiver well with a little (< 1/4 mL) DCM and add to the vial. Compare the sample volume in the vial to a pre-marked, 0.9 mL vial. Rinse receiver with a little more DCM (< 1/4 mL). Transfer to sample vial. Compare volume to the pre-marked 0.9 mL vial. Bring up sample volume (if necessary) to 0.9 mLs with another DCM rinsate. The extraction analyst must rinse the receiver at least two times and stay at or below 0.9

mLs. The use of a 500 uL syringe gives the analyst more control when adding the small-volume DCM rinses to the receiver. If the rinsates make the extract more than the 0.9 mLs, the analyst may hold the vial under the stream of nitrogen momentarily to reduce the volume back down to 0.9 mLs. The GC/MS analyst will bring the sample extract to exactly 1.0 mL prior to analysis. Seal vial with a Teflon-lined screw-cap.

b. There will be samples that will not concentrate to a 1 mL final volume. In these cases, bring the sample up to the smallest final volume (increments of 1 mL)* that the sample and three rinses will transfer into. All changes in final volume must be documented in the extraction logbook. Notify your unit leader.

* Volumetrically add the appropriate volume of DCM to a 16 X 125 screw top test tube and mark the meniscus using a fine-tipped marker. Discard the DCM into an appropriate waste vessel. Bring up sample to volume using this test tube.

c. All samples pertaining to one extraction batch are placed in a plastic vial holder and secured. A listing of the entire contents of the batch, including clients, sample #'s, batch number and date extracted, is to be placed WITH the set. To relinquish samples, the extraction analyst takes the sample extracts and the extraction logbook to the sample extract refrigerator (located in the GC/MS Lab).

d. An analyst from the GC/MS BNA group must be present to receive the samples. Both analysts check for completeness and correctness of the information and sign in the appropriate spaces of the extraction logbook. All extracts are to be kept at 4 +/- 2°C in the dark, until analysis.

PCBs, Pesticide/PCB, and Organophosphorus Pesticides

a. Concentrate the sample to the 10 mL mark. If the solvent goes below the 10 mL mark, bring up to 10 mLs with hexane.

***PCBs** refer to mandatory sulfur acid cleanup (Sec. 7.6.2.4.5)

b. All samples pertaining to one extraction batch are placed in a test tube rack. Each test tube should have the extraction batch number, sample #, and test code written on it.

c. To relinquish samples, the extraction analyst takes the sample extracts and the extraction logbook to the sample cooler area (located in the GC Extractables Lab). An analyst from the GC Extractables group must be present to receive the samples. Both analysts check for completeness and correctness of the information and sign in the appropriate spaces of the extraction logbook. All extracts are to be kept at 4 ± 2°C in the dark, until analysis.

PAHs

a. Concentrate the sample to ~ 2 mLs to remove any remaining DCM. Dilute the sample up to 5.0 mLs with acetonitrile.

b. All samples pertaining to one extraction batch are placed in a test tube rack. Each test tube should have the extraction batch number, sample #, and test code written on it.

c. To relinquish samples, the extraction analyst takes the sample extracts and the extraction logbook to the sample cooler area (located in the GC Extractables Lab). An analyst from the HPLC group must be present to receive the samples. Both analysts check for completeness and correctness of the information and sign in the appropriate spaces of the extraction logbook. All extracts are to be kept at 4 ± 2°C in the dark, until analysis.

DRO

a. Concentrate the sample to 5.0 mLs. Use DCM to bring up to the 5.0 mL mark if the extract volume goes below the 5.0 mL.

b. All samples pertaining to one extraction batch are placed in a test tube rack. Each test tube should have the extraction batch number, sample #, and test code written on it.

c. To relinquish samples, the extraction analyst takes the sample extracts and the extraction logbook to the sample cooler area (located in the GC Extractable Lab). An analyst from the GC Extractable group must be present to receive the samples. Both analysts check for completeness and correctness of the information and sign in the appropriate spaces of the extraction logbook. All extracts are to be kept at 4 ± 2°C in the dark, until analysis.

7.6.2.6 Screening and Cleanup

Samples are not pre-screened prior to extraction. Unless previous experience has proven high concentrations and/or background a 30 gram sample will be extracted.

Sludge samples are a mixture of water and suspended solid materials. If the percent moisture of a given sludge is greater than 90%, a 10 g or 30 g portion may be weighed and added to 1000 mLs of reagent water. It is then extracted like a water matrix as described in the water extraction SOPs. Aqueous drum liquids may be prepared in the same manner.

7.6.2.7 Extract cleanup by Gel Permeation Chromatography (GPC)

Organophosphorus pesticide samples and PAH samples receive no cleanup procedures.

It is not mandatory BNA samples are subjected to further cleanup steps prior to analysis. However, if it is requested that the BNA sample set receives a GPC cleanup, refer to the appropriate section of USP-003 for this procedure.

It is not mandatory that Pesticide/PCB samples be subjected to further cleanup steps prior to analysis. However, if it is requested that the Pesticide/PCB sample set receives a GPC cleanup, refer to the appropriate section of USP-003 for this procedure.

It is not mandatory that Pesticide/PCB samples be subjected to further cleanup steps prior to analysis. However, if it is requested that the Pesticide/PCB set receives a Florisil cleanup, refer to the appropriate sections of USP-003 for this procedure.

7.6.2.8 Mandatory Acid Cleanup for PCBs

If the sample is to be analyzed for **PCBs ONLY**, a mandatory sulfuric acid cleanup is performed. Add ~3-4 mLs of concentrated H_2SO_4 to the extract (contained in a screw-top test tube). Shake vigorously for a least 1 minute. Centrifuge the hexane/acid for at least a couple minutes to ensure adequate separation. If the acid layer (the bottom layer) is dark in color, transfer the hexane layer (the top layer) to another screw-top test tube and repeat the acid cleanup. The acid cleanup should be repeated until the acid layer no longer turns dark in color. The hexane extract must always be immediately removed from the acid and transferred into another clean, labeled, screw top test tube. Document acid cleanup in comment section of the extraction logbook. Relinquish the samples as described in the nitrogen evaporation section.

7.7 Documentation

All extraction information must be carefully documented in the appropriate extraction log. Any additional sample or extraction information is recorded in the comment section of the extraction log. All problems and/or deviations from normal procedures must be documented in the extraction log. The unit leader should be notified and a Sample Discrepancy Report (SDR) may need to be initiated.

An extraction batch contains samples of similar matrix that are logged in for the same LabNet test method. Different parameters are given different test methods for use with LabNet. The test method for PAHs is 3550PN; Organophosphorus Pesticides is 3550PP; PCBs is 3550PC; BNAs is 3550BN; Pesticides is 3550CP; DRO is 3550D; BNA SIM is 3550BS.

8.0 QUALITY CONTROL

The following QC is performed with each organic extraction batch. An extraction batch may contain no more than 20 samples.

8.1 QC Summary

8.1.1 At least one method blank and one LCS will be included in each laboratory batch of 20 or fewer samples. The method blank will be examined to determine if contamination is being introduced in the laboratory. The LCS will be examined to determine and accuracy.

8.1.2 Accuracy will be measured by the percent recovery (%R) of the LCS. The recovery must be in range, as determined by statistical analysis, in order to be considered acceptable. The MS and MSD monitor the effect of sample matrix on method precision and accuracy, but are not used to determine if reanalysis is required.

8.1.3 Surrogate compounds will be added to every sample to measure performance of the analysis. Results must agree within statistical control limits in order to be considered acceptable.

8.1.4 Sometimes Pesticide and PCB samples by 3550CP and 3550PC are extracted in the same extraction batch. When this occurs, the QC includes one MB, one LCS for the pesticide compounds, one LCS for PCB compounds, one MS/MSD for the pesticide compounds, and one MS/MSD for PCB compounds.

8.2 Corrective Actions

The extraction analyst must perform the Quality Control described in Section 8.1. The extraction analyst will not know if all QC is in control until the GC/MS, GC/Extractable, or HPLC group analyzes the extracts and determine the results of the method blank, spikes, and surrogate recoveries. It is the responsibility of the analysis group to inform the Organic Extractions Department when a sample or set of samples requires re-extraction by documenting in the "BNA Re-extraction Log" or by initiating a SDR. Re-extractions are to be designated as R1 in the extraction process.

All problems and/or deviations from normal procedures must be documented in the extraction logbook. The unit leader should be notified and a SDR may need to be initiated.

9.0 DATA ANALYSIS AND CALCULATIONS

Not Applicable.

10.0 WASTE MANAGEMENT AND POLLUTION CONTROL

- Mixing waste streams adds to the cost of the waste disposal budget. Care should be taken in the disposal of solvents. All wastes, solvents, reagents, and samples in need of disposal should be placed in the appropriate waste containers. Only DCM waste used to rinse glassware should be placed in the DCM waste container. Non-chlorinated waste solvents such as hexane, acetone, methanol, ethyl ether, or any combination of these solvents should be placed in the waste solvent container. Chlorinated waste solvents, which include any solvents mixed with DCM or DCM mixed with sample extract or residue, should be place in the chlorinated waste solvent container.
- Excess acid waste from PCB cleanups should be placed in the PCB/Acid waste container and the empty test tube in the PCB waste container.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0.

13.0 ATTACHMENTS

Attachment 1: Example: Extraction Logbook
Attachment 2: Example: Extraction Flowcharts

Historical File: Revision 00: 03/17/99
Revision 01: 09/14/00
Revision 02: 03/08/02

Reasons for Change; Revision 02:

- Annual update.
- Added to health and safety section and waste section.
- Added BNA SIM matrix spike information.
- Added DRO to this SOP

U:\QC\SOP\SP\3550.DOC

Attachment 1.

Example: Extraction Logbooks

Extraction Date:_____ STL Chicago Page No.:_____
Method Code:_____ Organic Extraction Record Batch No.:_____
Solvent:_____ GC Extractables/HPLC Analyst Initials:_____
Solvent Lot No.:_____ Balance ID No.:_____
Solvent Dispenser Volume Checked (SW 3510/3550):_____

Matrix:
a. Water
b. Soil
c. Other_____

Extraction Method:
a. SW-846 3510 (Sep Funnel)
b. SW-846 3550 (Sonication)
c. SW-846 3580 (Waste Dil.)
d. SW-846 3520
e. Other_____

Method Extraction Times:
Start Time:_____
End Time:_____

	Sample #	Sample ID	pH	Initial Vol/Wt. (mLs/g)	Total Solids	Final Vol.[1] (mLs)	Clean-Up Absorbent	Multipliers		
								Surr.	Spike	Split
1	-MB									
2	-LCS									
3	-LCD									
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
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16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										

[1]The extract volume is ~2.0 mL for Herbicides and 10 mL for TCLP Pesticides. The final volume documented for these extracts, 10 mLs and 100 mLs respectively, reflects the adjusted measures prepared by the instrumentation analysts. This process allows for the comparison of the extraction logbook to the extraction spreadsheet.

___ Insufficient Sample for MS/MSD ___ MS/MSD Not Requested (Limited Vol.) ___ MS/MSD Designated ___MS/MSD Chosen
___ Sample Container Shaken ___ Sample Container Shaken & Rinsed with Solvent ___ Sample Container Not Shaken Due To:_____

Comments:_____

Surrogate:_____ Volume:_____ Std. ID#:_____
SB/MS Solution:_____ Volume:_____ Std. ID#:_____
SB/MS Solution:_____ Volume:_____ Std. ID#:_____

Analyst Signature:_____ Date:_____

Reviewer Signature:_____ Date:_____

Extraction Custody Record

Extracts Transferred	Relinquished by	Date	Time	Received by	Date	Time	Reason for Transfer

Extraction Date:_____ STL Chicago Page No.:_____
Method Code:_____ Organic Extraction Record Batch No.:_____
Solvent:_____ GC/MS Semi-Volatiles Analyst Initials:_____
Solvent Lot No.:_____ Balance ID No.:_____
Solvent Dispenser Volume Checked:_____

Matrix:
a. Water
b. Soil
c. Other_____

Extraction Method:
a. SW-846 3510 (Sep Funnel)
b. SW-846 3550 (Sonication)
c. SW-846 3580 (Waste Dil.)
d. SW-846 3520
e. Other_____

Method Extraction Times:
Start Time:_____
End Time:_____

	Sample #	Sample ID	pH[1]			Initial Vol/Wt. (mLs/g)	Total Solids	Final Vol.[2] (mLs)	Clean-Up Absorbent	Multipliers		
										Surr.	Spike	Split
1	-MB											
2	-LCS											
3	-LCD											
4												
5												
6												
7												
8												
9												
10												
11												
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27												

[1]Sample pH / Acid Adjusted pH / Base Adjusted pH
[2]The extract volume for BNAs is either ~0.5 mL or ~1.0 mL when the final volume is documented as 0.5 mL or 1.0 mL, respectively. The documented final volume reflects the adjusted measures prepared by the instrumentation analysts. This process allow for the comparison of the extraction logbook to the extraction spreadsheet. Any final volume greater than 1.0 mL is measured exactly by the extraction group.

___ Insufficient Sample for MS/MSD ___ MS/MSD Not Requested (Limited Vol.) ___ MS/MSD Designated ___MS/MSD Chosen
___ Sample Container Shake ___ Sample Container Shaken & Rinsed with Solvent ___ Sample Container Not Shaken Due To:____
_____

Comments:_____
_____
_____

Surrogate:_____ Volume:_____ Std. ID#:_____
SB/MS Solution:_____ Volume:_____ Std. ID#:_____
SB/MS Solution:_____ Volume:_____ Std. ID#:_____

Analyst Signature:_____ Date:_____

Reviewer Signature:_____ Date:_____

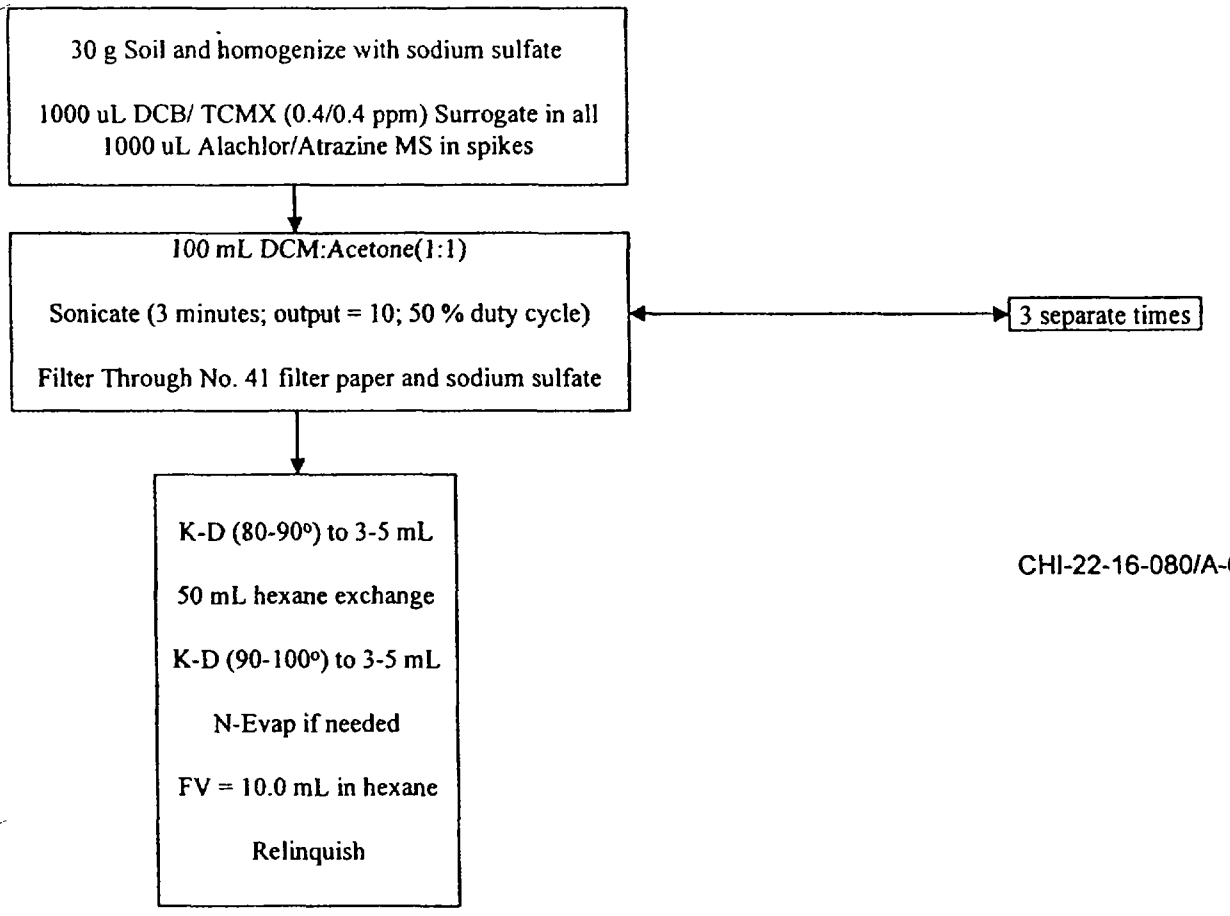
Extraction Custody Record

Extracts Transferred	Relinquished by	Date	Time	Received by	Date	Time	Reason for Transfer

Attachment 2.

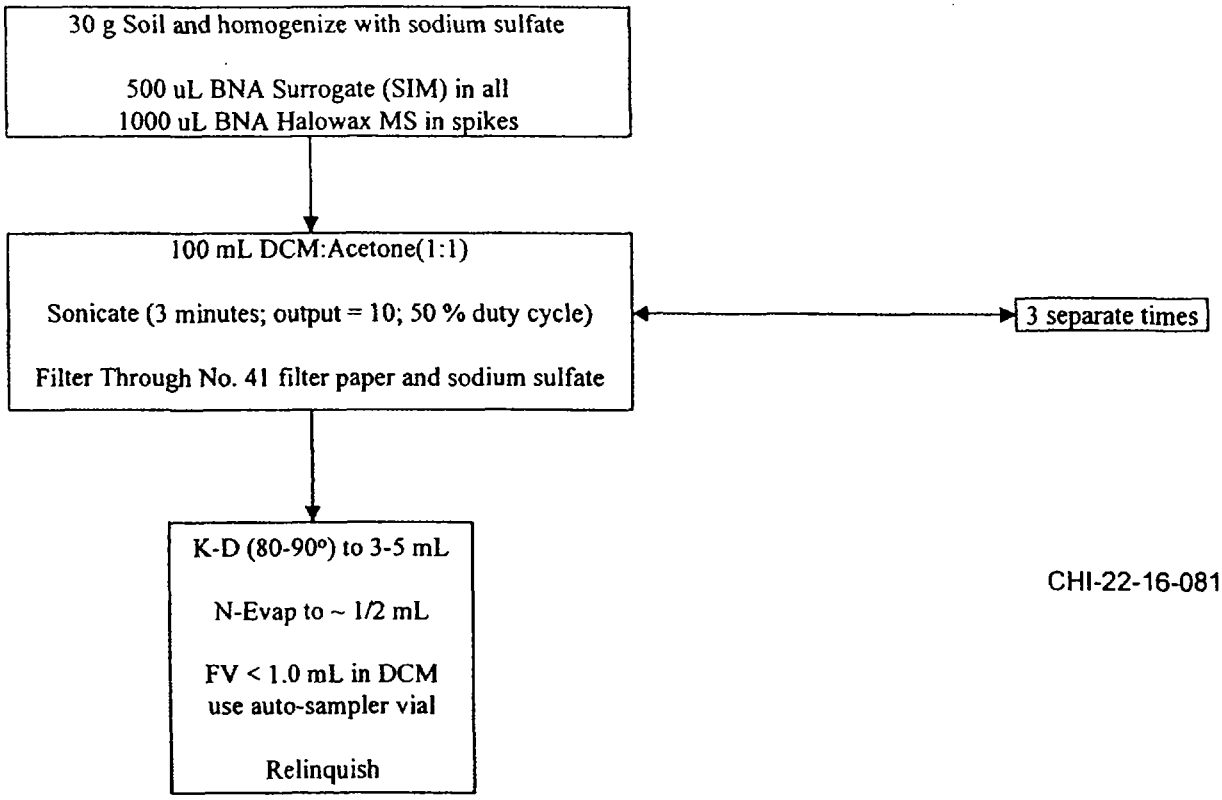
Example: Extraction Flowcharts

Flowchart for Alachlor/Atrazine Soil (8081)
by 3550
3550AA



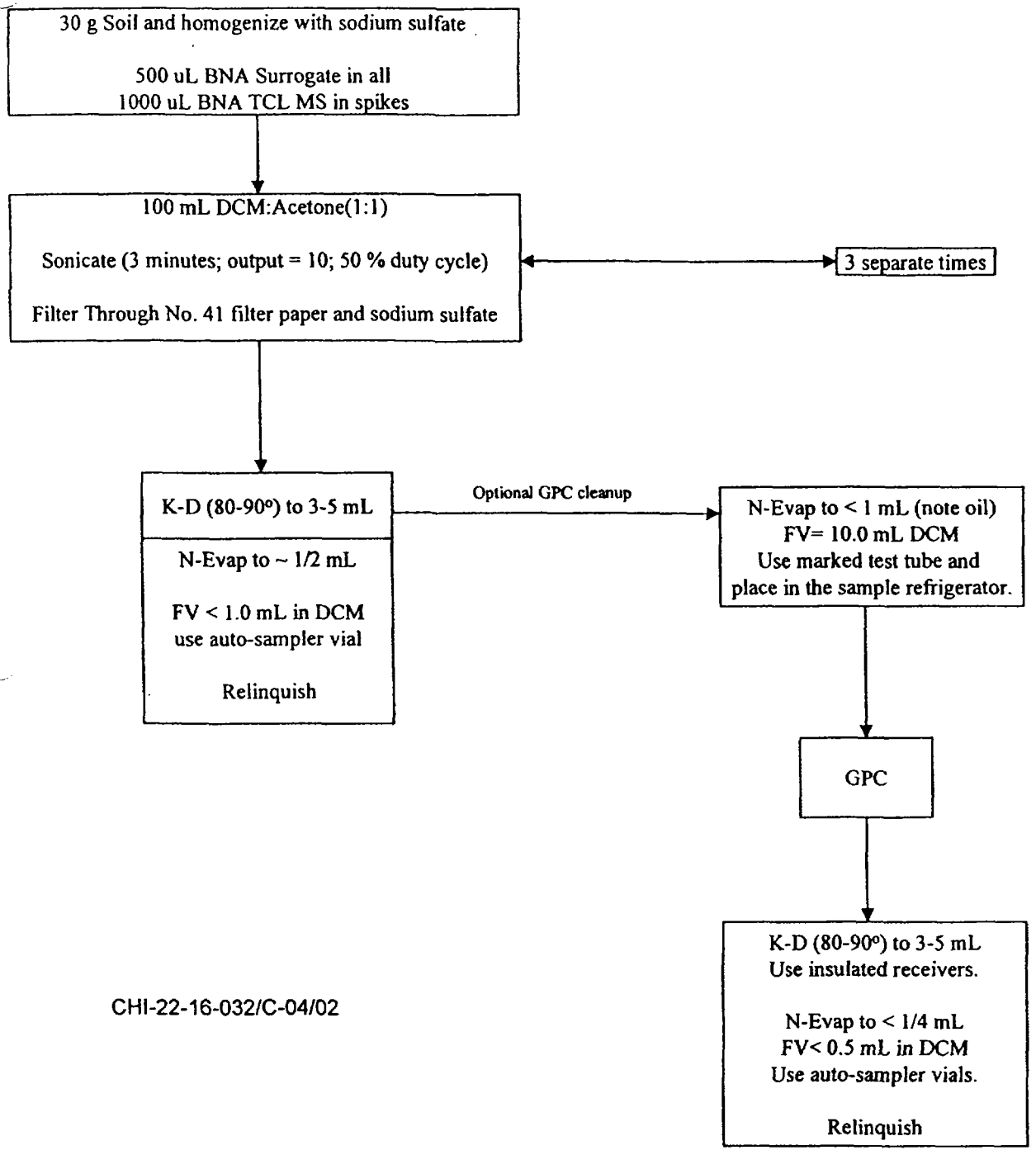
CHI-22-16-080/A-04/02

Flowchart for BNA Halowax Soil
by 3550
3550BH



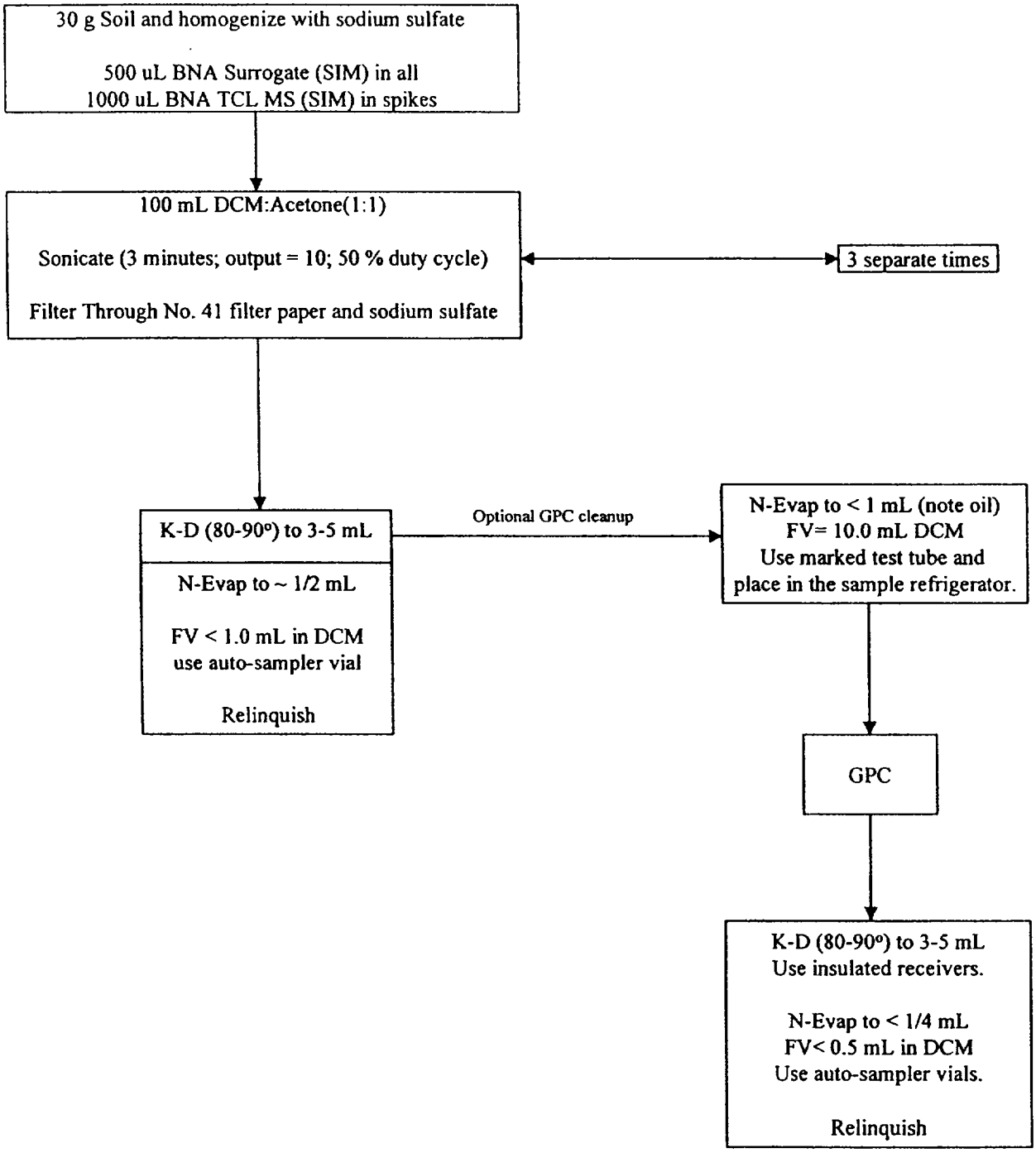
CHI-22-16-081/A-04/02

Flowchart for BNA Soil (8270)
by 3550
3550BN



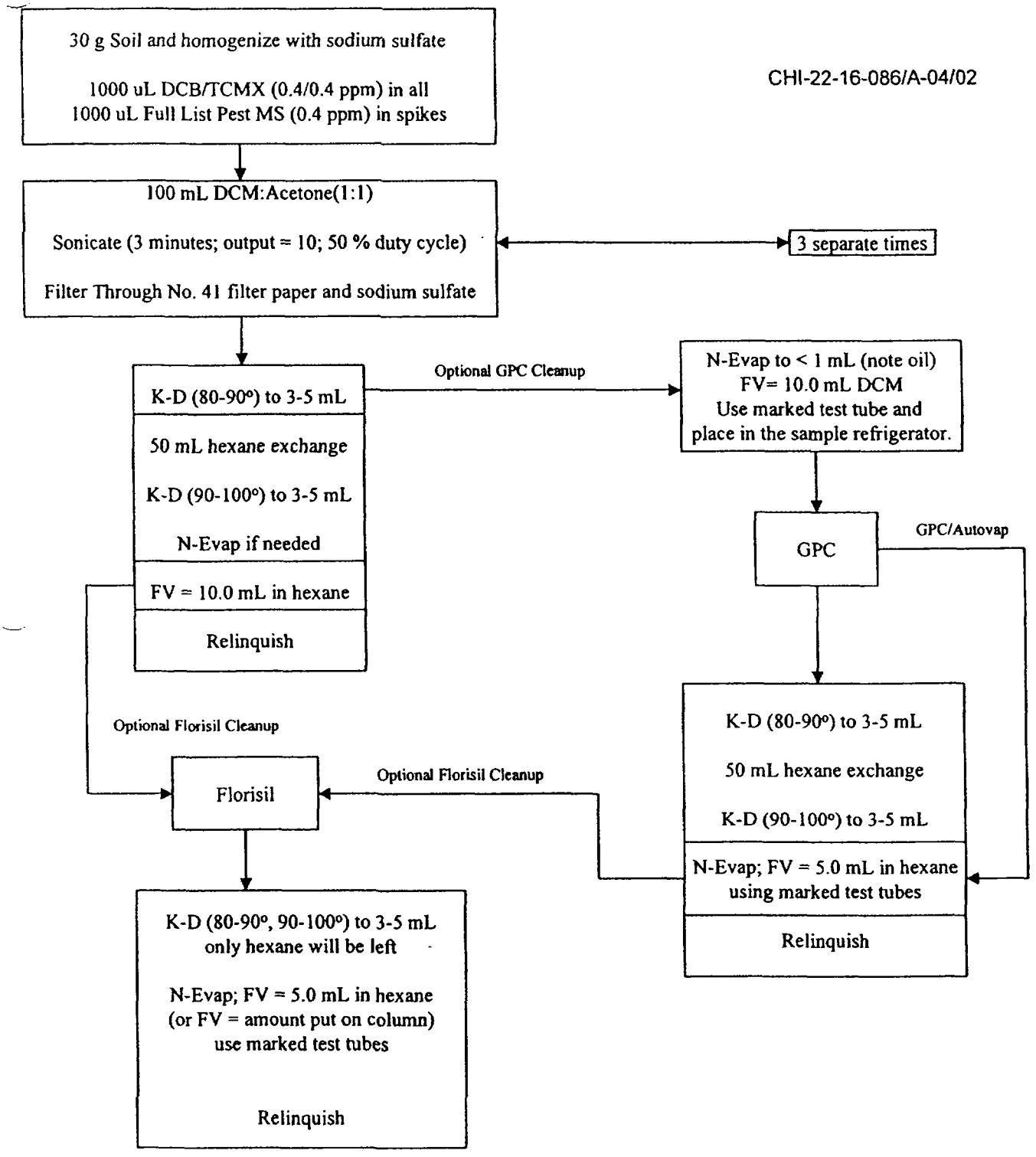
CHI-22-16-032/C-04/02

Flowchart for BNA SIM Soil
by 3550
3550BS

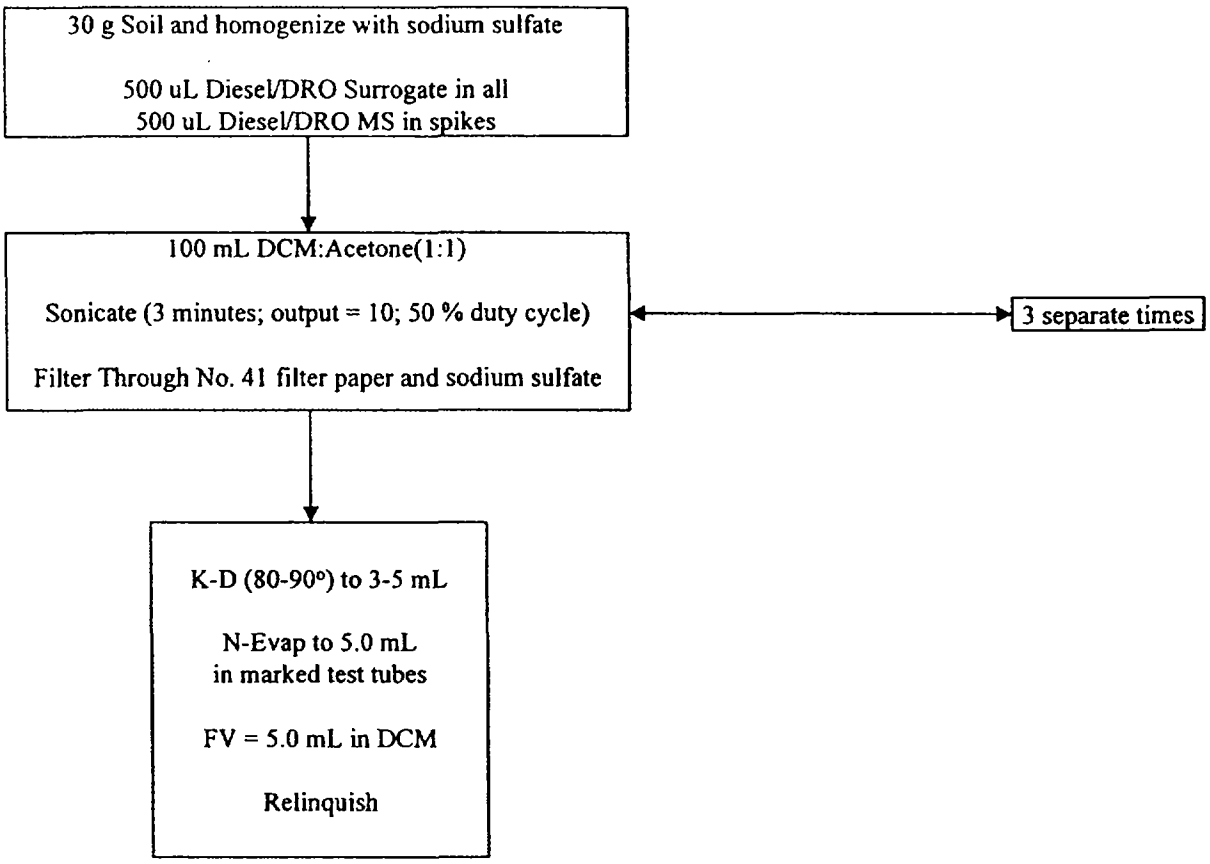


Flowchart for Pesticide Soil (8081)
by 3550
3550CP

CHI-22-16-086/A-04/02

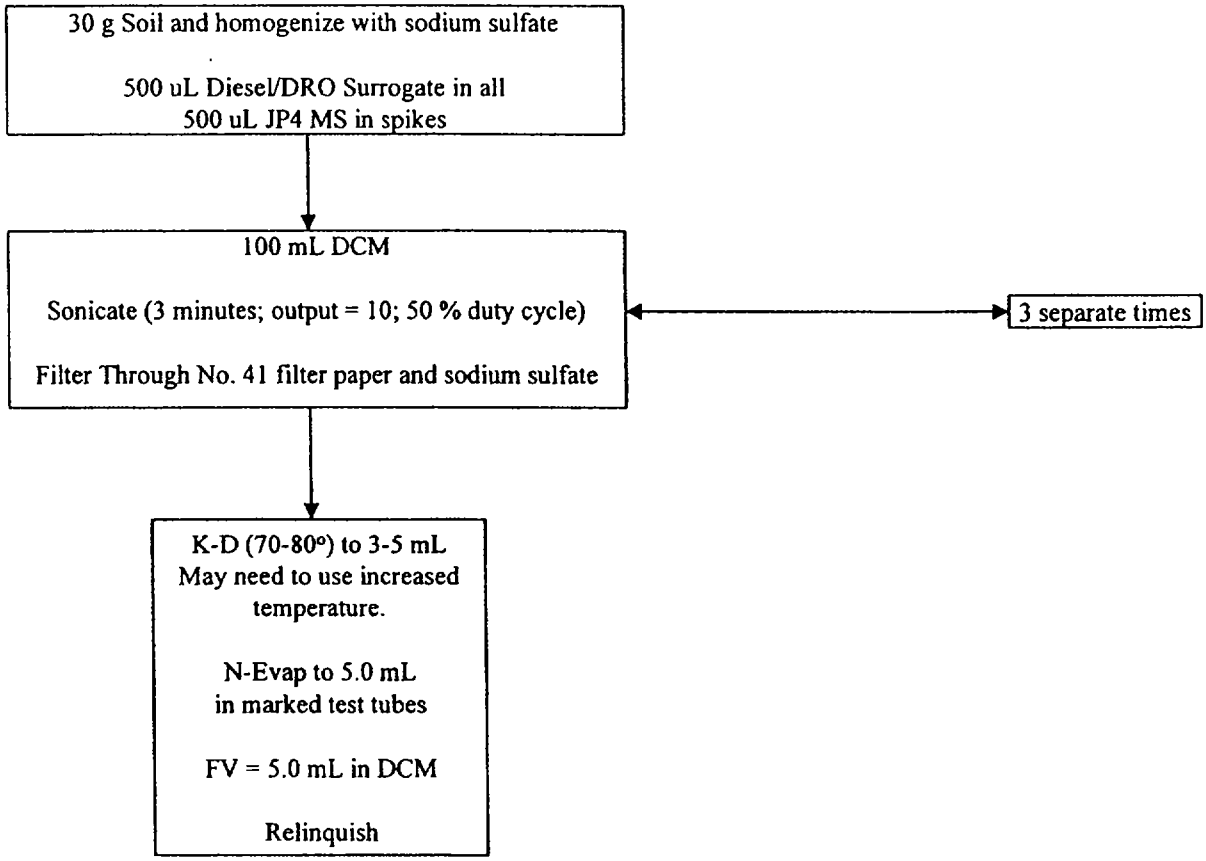


Flowchart for Diesel/DRO Soil (8015m)
by 3550
3550D



CHI-22-16-022/C-04/02

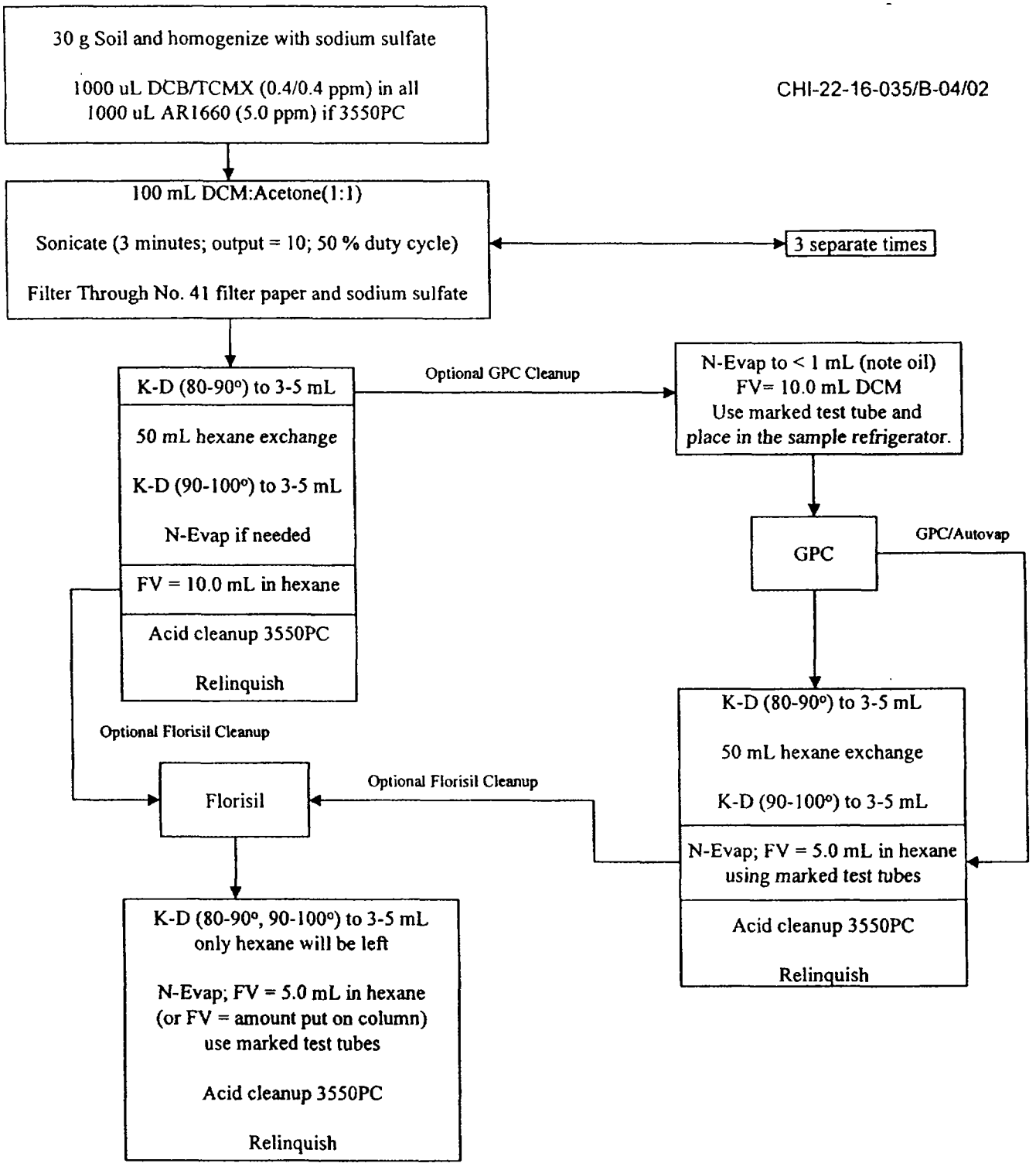
Flowchart for JP4 Soil
by 3550
3550J4



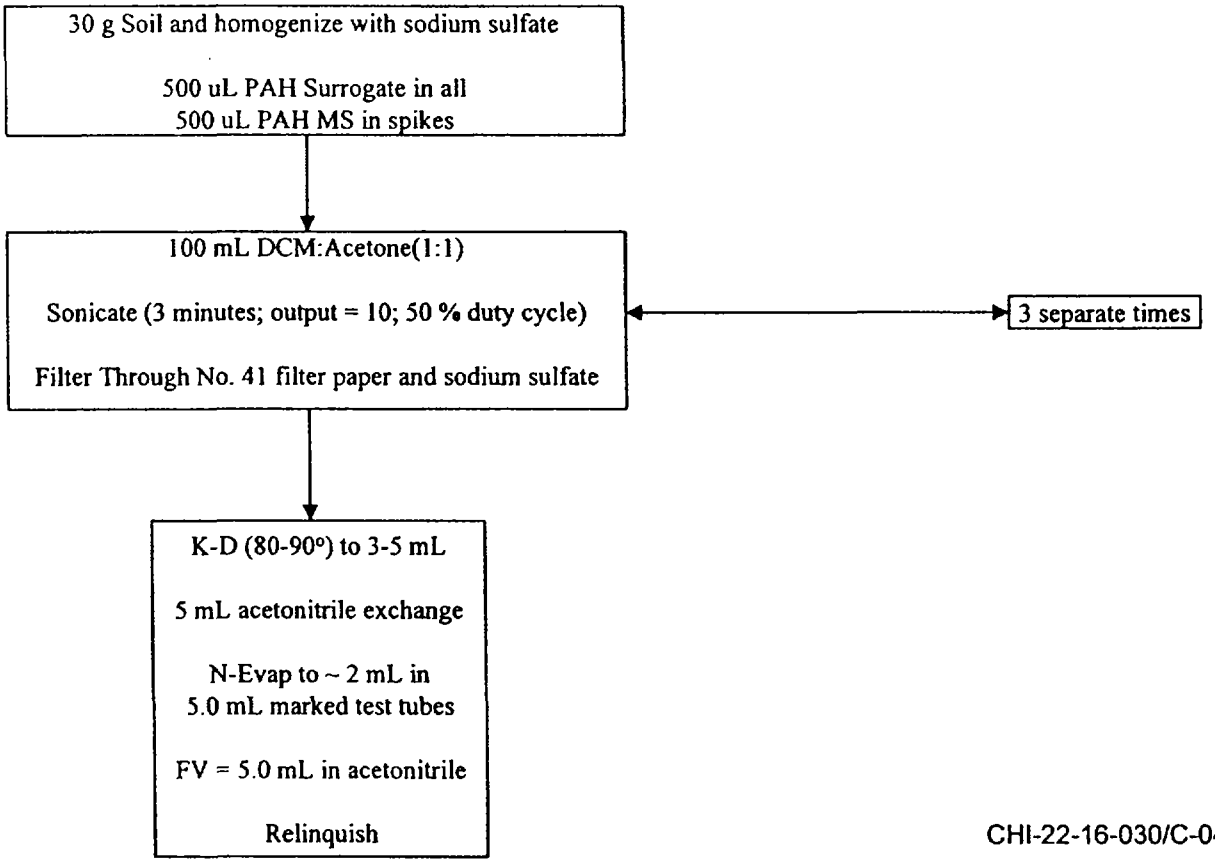
CHI-22-16-083/A-04/02

Flowchart for PCB Soil (8082)
by 3550
3550PC

CHI-22-16-035/B-04/02

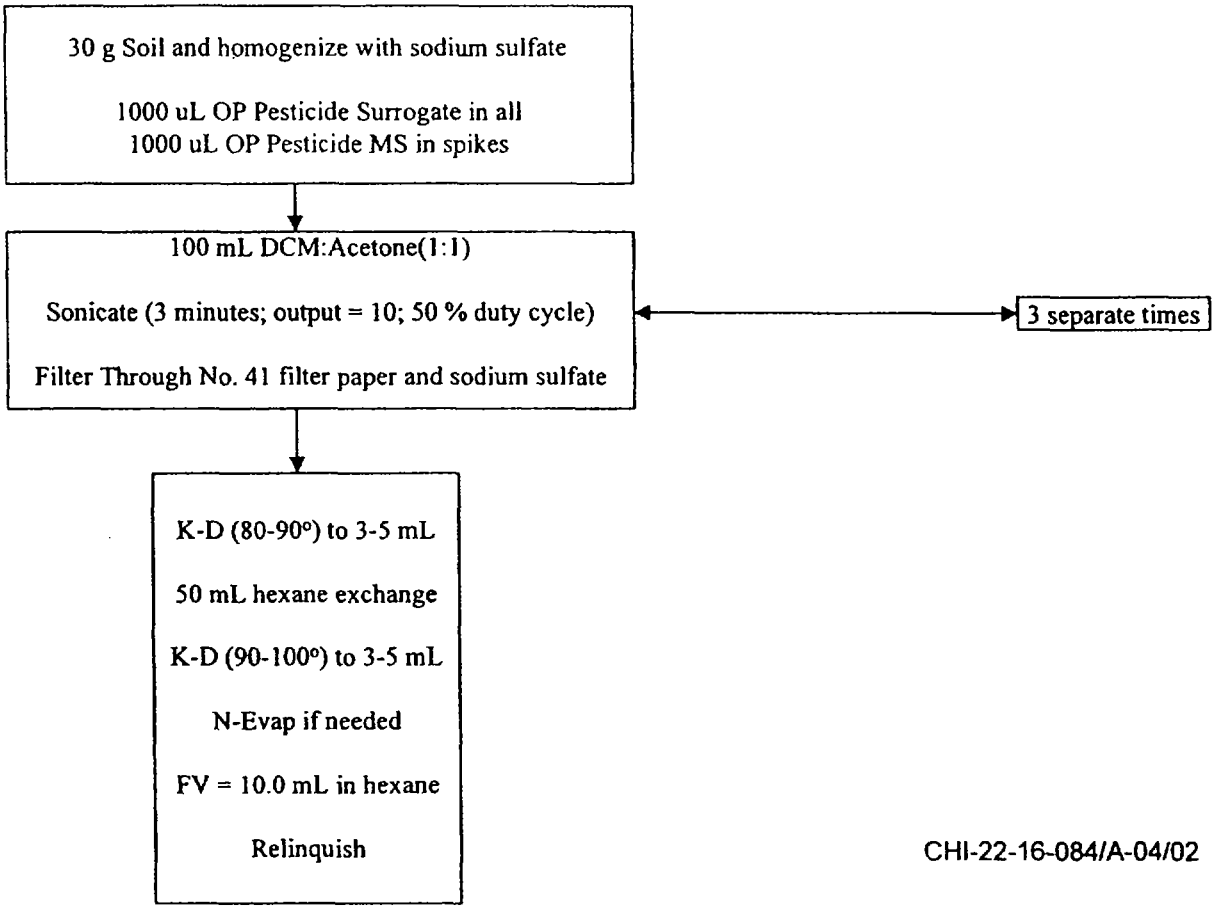


Flowchart for PAH Soil (8310)
by 3550
3550PN



CHI-22-16-030/C-04/02

Flowchart for Organophosphorus Pesticide Soil (8141)
by 3550
3550PP



CHI-22-16-084/A-04/02

STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURES

SOP No.	Revision No.	Date	Page
UMV-8260	13	10/24/02	1 of 64

TITLE: Gas Chromatography Mass Spectrometry - Volatiles SW-846 Method 8260

Updated by:	Signature:	Date:
JoAnn Petruszak Supervisor, GC/MS Volatiles		10-22-02

Approved by:	Signature:	Date:
Gary Rynkar Section Manager, GC/MS Dept.		10/22/2
David L. Kaczka Env. Health & Safety Coor.		11/6/02
Terese Preston Quality Manager		11/6/02

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ISSUED TO : **Gloria Chojnacki, S.E.H.**
Re: Ashland/NSP Lakefront Site QAPP

Full Signature Approvals Are Kept on File with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

To outline the guidelines for the analysis of Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) using SW-846 Methods 8260B and 8000B as references. The preparation of all volatile samples is based on Methods 5000, 5030A and 5030B. Method 5035 is covered by a separate SOP (USP-5035), but can also be found in this SOP.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Reporting Limits

Reporting Limits [a.k.a., Estimated Quantitation Limits (EQLs)] are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory maintains reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported.

Method detection level studies are performed annually, and reporting limits are assessed. If the MDL does not meet the routine laboratory reporting limit or the method specified limit, it is repeated or the laboratory reporting limit is reassessed. If the laboratory continually demonstrates that the method reporting limits are not achieved, equipment, technique, and the method are reviewed to assure optimal performance or appropriate

action is taken. Table 1 defines the reporting limits and analyte list for SW-846 Method 8260B.

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM, Revision 02).

1.2 Summary of Method

This method is used to determine volatile organic compounds in a variety of matrices. It is applicable to water, soil, sediment, sludge and waste drum samples.

This method can be used to quantify most volatile organic compounds that have a boiling point less than 200°F. It is also limited to those compounds that elute as sharp peaks from a capillary column. A listing of applicable compounds and their characteristic ions appears in Table 2.

A portion of sample, measured into a sample vessel, is purged with an inert gas. The volatile compounds are transferred to a trap, containing retarding materials. The trap is then backflushed with the inert gas and rapidly heated to effectively transfer the compounds to the GC column. The GC oven is then, temperature ramped to separate the compounds and introduce them to the source. The mass filter separates the ions, which are then detected by the analyzer. The data system then provides qualitative and quantitative information concerning the sample.

Instrument calibration occurs about every 12 hours, or prior to analysis. Instrument maintenance is performed as needed or daily basis.

2.0 INTERFERENCES

1. External interferences can be caused by contaminants from sample containers, preparative glassware and reagents, syringes and columns and manifest themselves as high background and/or discrete peaks. Some contaminants are also introduced through the sample vial seal and/or instrument sample connections. Proper glassware preparation, sample handling and instrument maintenance should eliminate these sources. A laboratory method blank (MB) is analyzed prior to any analysis to show absence of any contaminants. Reagent water sampled in the lab and carried through all field operations is also analyzed to show absence of contaminants from field sampling.

2. Carryover is also another source of contamination. Any time a high level sample is analyzed, the next sample in the batch is checked for carryover. If carryover is suspected, that sample is re-analyzed. The position is rinsed with methanol/water. If the carryover is excessive and continues into the next samples, the batch is aborted/paused, the column

and trap baked, and/or blanks analyzed until all contamination is absent. If further response is required (i.e., trap replacement), it is documented in the maintenance logbook. Refer to Section 7.4 for information on preventive maintenance.

3. Internal interferences can be purged from the sample with the target compounds and appear as elevated baselines or distinct peaks. Internal interferences most often manifest themselves as low/high recoveries of surrogate/matrix spike compounds. Matrix interferences vary from sample to sample.

4. The volatile lab must be free of solvents. All analytes must be less than their EQL (Estimated Quantitation Limit). The volatile lab is under positive pressure to reduce lab contamination, however, intermittent low levels of acetone and methylene chloride may be detected, usually below the EQL. Refer to Section 8.2 (Corrective Action) for clarification for blank contamination.

3.0 SAFETY

- All employees will adhere to the practices and policies in the STL Corporate Safety Manual (CSM) and will read the MSDS's for the materials used in this method before handling or using the material.
- Special care needs to be taken with the solvents used in this method.
- Interior parts of the GC/MS can be very hot. Care should be taken during maintenance.

4.0 EQUIPMENT AND SUPPLIES

4.1 Current Hardware/Software

- 3 Hewlett-Packard 5890 GC interfaced with a 5971 MSD. Equipped with DB-624 column.
- 3 Hewlett-Packard 5890 GC interfaced with a 5972 MSD. Equipped with DB-624 column.
- 1 Hewlett-Packard 6890 GC interfaced with a 5973 MSD. Equipped with DB-624 column.
- 6 Tekmar 3000 concentrators, 1 PTS Enchon concentrator in connection with 2 Tekmar 2016 Autosamplers for two systems and 5 Varian Archon Autosamplers for four systems.
- 1 Combi PAL Static Headspace Screener in connection with Hewlett-Packard 5890 GC interfaced with a FID equipped with DB-624 column.
- 8-Hewlett-Packard Chemstations B.02.04 software and peripheral hardware.
- 1-Hewlett-Packard Chemserver 9000 series running HP-UX10.2 OS with Target 3.5.

The GC/MS has a temperature programmable chromatograph interfaced with a mass-selective detector capable of scanning from 35 - 260 amu every second or less using 70

volts of electron energy in the electron ionization mode. The system is capable of producing an acceptable spectrum of bromofluorobenzene when 50 ng/5 mLs is purged.

4.2 Data System

The analytical systems are interfaced with stand alone PC's which are Pentium based systems running Agilent Chemstation. This system is capable of continuous acquisition and storage of mass spectral data. Completed data files are automatically transferred to the Chemserver Target 3.5 processing software which is capable of plotting specific masses versus time or scan numbers (Extracted Ion Current Profile) and integration of that abundance. The system also stores the data. The NBS Library resides on the Chemserver.

4.3 Data File Name/ Batch Directory Assignment

Each job # is assigned a code at the time that the first sample is analyzed. Tune, standard, blank, and laboratory control sample (LCS) data files are designated by specific letters unique to each instrument in conjunction with the appropriate month and day (example : 3a0318 = instrument #3, first 12 hour BFB tune, March 18). During transfer of the files to the Chemserver, a unique batch directory is created on Target per instrument, date and tune.

4.4 Miscellaneous

- assorted syringes (10, 25, 50, 100, 500 and 1000 uL)
- 5 mL luer-lock gas-tight syringes
- assorted purge vessels (water, 5/25 mL)
- top-loading balance, capable of weighing to ± 0.1 g, stainless steel spatula
- assorted amber and clear Teflon-lined screw-capped vials (1.5-2.0 mL, 3.5-5.0 mL)
- cleaned 40 mL vials w/Teflon-lined screw-caps
- assorted volumetrics (10 mL, 25 mL, 50 mL and 100 mL)

5.0 REAGENTS AND STANDARDS

The majority of the calibration standards are EPA certified, A2LA or second-source verified by the standard vendor in situations where suitable SRMs (Standard Reference Material) was available. For those compounds where standards must be made from neat material (due to instability) or some non-routine compounds, **where available**, a second-source is purchased and used in the LCS to verify the standard

Each time new standards are prepared and a new initial calibration is required, the standards are verified against a second-source LCS prior to any sample analysis. This holds for all routine compounds and those available as second-source material in the LCS.

All neat standards/kits received are entered into LabNet (LIMS) (and recorded in the Neat Standards Logbook). A code is written on the bottle/kit and entered into LabNet (and recorded in the logbook). All neat standards are then stored in a separate freezer at approximately –10 °C until needed. The standard is issued a unique ID# [i.e., Neat Standards Reference Number (NSRN)] which is used to track all standards as they are used as is or in preparation of stock/working solutions. The format of the standards in LabNet will prevent working or intermediate level solutions from being used past the expiration date of the neat or stock solutions.

5.1.1 Reagent Water

One (1) liter of water is continuously purged with pre-purified nitrogen. The reagent water is routinely demonstrated to be interference-free. All compounds are < EQL or 5x EQL for methylene chloride and acetone.

5.1.2 Methanol

Methanol is purchased from B&J (Purge and Trap interference-free). Each lot number of methanol is checked for contamination prior to laboratory use and is documented in the Methanol Lot Number Logbook in the GC/MS VOA department.

5.2 Surrogate Spiking Solution

Stock surrogates are purchased as a mix from Ultra. The following surrogates are used:

Compound	Concentration
4-Bromofluorobenzene 1,2-Dichloroethane-d_4 Toluene-d_8 Dibromofluoromethane	\ 2500 ppm /

The transfer is entered into LabNet (and recorded in the Standard Preparation Log). The standard issued is another unique ID# [i.e., SRN (Standard Reference Number)] which can be traced back to the parent ID# (i.e., NSRN with the date of receipt, date of opening, and the supplier). Working surrogate solution is prepared at the same time as the internal standard solution (Section 5.3.)

- Life of Standard: 1-year unopened; once opened, they are used for a period of 6 months or until used.
- Storage Requirements: Stored in a freezer at approximately –10 °C in the dark and kept for a period of one year unopened. *

* If the stock solution has manufacturers' expiration date, that is assigned. If the date is not evident, one year is assigned to un-opened ampules. This is applicable for all "neat" standards.

5.3 Internal Standard Spiking Solutions

Stock internal standards are purchased as a neat solution from Ultra in 1.5 -2.0 mL ampules. The following internal standards are used:

Compound	Concentration
Pentafluorobenzene	\
Chlorobenzene-d_5	2000 ppm
1,4-Difluorobenzene	/
1,4-Dichlorobenzene-d_4	

After opening, the remaining mixture is transferred to a 1.5 - 2.0 mL amber Teflon-lined screw-capped vial. The transfer is entered into LabNet (and recorded in the Standard Preparation Log). The standard issued is another unique ID# [i.e., SRN (Standard Reference Number)] which can be traced back to the parent ID# (i.e., NSRN with the date of receipt, date of opening, and the supplier).

- Life of Standard: 1-year unopened; once opened, they are used for a period of 6 months or until used.
- Storage Requirements: Stored in a freezer at approximately –10 °C in the dark and kept for a period of one year unopened. *

* If the stock solution has manufacturers' expiration date, that is assigned. If the date is not evident, one year is assigned to un-opened ampules. This is applicable for all "neat" standards.

Compound	Volume (uLs)	MeOH (mLs)	Concentration
Internal Standard			
Pentafluorobenzene	\	\ diluted to	\
Chlorobenzene-d_5	625	25 mLs	50 ppm
1,4-Difluorobenzene	/	/	/
1,4-Dichlorobenzene-d_4			
Surrogate			
Bromofluorobenzene	\	\ diluted to	\
1,2-Dichloroethane-d_4	500	25 mLs	50 ppm
Toluene-d_8	/	/	/
Dibromofluoromethane			

NOTE: All standard 'recipes' are listed here in this SOP for guidelines for standard preparation. These 'recipes' are subject to change.

All standard preparation is entered into LabNet (and recorded in the Standards Preparation Logbook). All standard labels contain the following information: standard description, concentration, date prepared, analyst, and expiration date. Addition of 5 uL of each solution to 25 mLs of sample results in a concentration of 10 ppb per each component.

- Life of Standard: Working solutions have an expiration date of 2 weeks.
- Storage Requirements: These are stored in 1.5 - 2.0 mL amber Teflon-lined screw-capped vials at approximately –10°C in the dark.

Stock Purgeables
Calibration Standards

VOC Mix (No Gases)
2000 ug/mL in Methanol

1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethylene
1,1-Dichloropropylene
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,3-Dichloropropane
1,4-Dichlorobenzene
2,2-Dichloropropane
2-Chlorotoluene
4-Chlorotoluene
4-Isopropyltoluene
Benzene
Bromobenzene
Bromochloromethane
Bromoform
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroform
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropylene
Dibromomethane
Dichlorobromomethane
Dichlorobromomethane
Dichloromethane
Ethylbenzene
Hexachlorobutadiene
Isopropylbenzene
m-Xylene
n-Butylbenzene
n-Propylbenzene
Naphthalene
o-Xylene, p-Xylene
sec-Butylbenzene
Styrene
tert-Butylbenzene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropylene
Trichloroethylene

ICAL 2 STD Custom Mix
2000 ug/ml in Methanol
2-Methylnaphthalene
1,3,5-Trichlorobenzene
1,3-Butadiene
Isopropylether
Methyl Acetate
Hexane
Heptane
Cyclohexane
Ethyl ether
Methyl Cyclohexane

APIX Custom STD
2000, 8000 & 10000 ug/mL
Allyl Chloride
Ethyl Methacrylate
Methyl Methacrylate
Methacrylonitrile
Pentachloroethane
Trans-1,4-Dichloro-2-Butene
Iodomethane
Isobutanol
Cyclohexanone
n-Butanol
2-Nitropropane
Ethyl Acetate

Chloroprene
5000 ug/mL

SS Volatile Organic Compound Mix
2000 ug/mL in Methanol
Chloroethane
Methyl Bromide (Bromomethane)
Methyl chloride (Chloromethane)
Trichlorofluoromethane
Dichlorodifluoromethane
Vinyl chloride

Vinyl Acetate
2000 ug/mL in Methanol

Trichlorotrifluoroethane
2000 ug/mL in methanol

Volatile Ketone
Acetone
2-Hexanone
Methyl ethyl ketone
4- Methyl-2-pentanone
5000 ug/mL in Methanol

Carbon Disulfide
2000 ug/mL in Methanol

MTBE
2000 ug/mL in Methanol

THF
2000 ug/mL in methanol

Chlorohexane
1000 ug/mL in methanol

Nitriles and Acrolein Mix
Acetonitrile
Acrylonitrile
Propionitrile
Acrolein

2-Chloroethylvinylether
2000 ug/mL in methanol

5.4 Stock Purgeable Standards

These are obtained as neat solutions from Ultra, Supelco and Restek. The contents of each solution and concentration appear on the previous page. Upon opening, all contents are transferred to 1.5 - 2.0 mL amber, Teflon-lined screw-capped vials. Listed are compounds in the EPA TCL and includes compounds done on a regular basis. Other standards, if needed, are either purchased as neat solutions or neat standards from Supelco, Chem Service or other certified supplier. See appropriate entries in LabNet.

5.4.1.1 Main 8260 Mix

Waters

Stock Compound/Mix	Volume (uLs)	Vol. (MeOH)	Conc.
2000 ppm VOC MegaMix™ 2000 ppm Trichlorotrifluoroethane	100 100	Diluted to 2 mLs	100 ppm each component

5.4.1.2 Gases

Waters

Mix	Volume (uLs)	MeOH (mLs)	Conc.
2000 ppm Gas Mix	100	Diluted to 2 mL	100 ppm each component

5.4.1.3 Extra Compounds

Waters

Stock Compound/Mix	Volume (uLs)	MeOH (mLs)	Conc.
5000 ppm VOA CAL Mix 1 2000 ppm CEVE 2000 ppm Carbon Disulfide 2000 ppm Vinyl Acetate	40 100 100 100	Diluted to 2 mL	100 ppm each component
2000 ppm Tetrahydrofuran 2000 ppm MTBE 1000 ppm Chlorohexane	500 50 100	Diluted to 1 mL	1000 ppm THF 100 ppm MTBE 100 ppm Chlorohexane

The Acrolein/Nitriles Working Standard is a vial transfer:

Compound / TCL Mix	Volume (mL)	Concentration (ppm)
Nitriles/Acrolein Custom Mix Stock Std	1	800 ppm Nitriles 4000 ppm Acrolein

5.4.1.4 Main 8260 Mix

Soils

Stock Compound/Mix	Volume (uLs)	MeOH (mLs)	Conc.
2000 ppm VOC MegaMix™ 2000 ppm Trichlorotrifluoroethane	100 100	Diluted to 2 mL	100 ppm each component

5.4.1.5 Gases

Soils

Mix	Volume (uLs)	MeOH (mLs)	Conc.
2000 ppm Gas Mix	100	Diluted to 2 mL	100 ppm each component

5.4.1.6 Extra Compounds

Soils

Stock Compound/Mix[1]	Volume (uLs)	MeOH (mLs)	Conc.
5000 ppm VOA CAL Mix 1 2000 ppm CEVE 2000 ppm Carbon Disulfide 2000 ppm Vinyl Acetate	40 100 100 100	Diluted to 2 mL	100 ppm each component
2000 ppm Tetrahydrofuran 2000 ppm MTBE 1000 ppm Chlorohexane	50 50 100	Diluted to 1 mL	100 ppm each component

The Acrolein/Nitriles Working Standard is a vial transfer:

Compound/TCL Mix	Volume[1] (mL)	Concentration (ppm)
Nitriles/Acrolein Custom Mix Stock Std	1	800 ppm Nitriles 4000 ppm Acrolein

- Life of Standard: Working solutions have an expiration date of 2-weeks/1 week respectively.
- Storage Requirements: These mixtures are stored in 1.5-2.0 mL amber Teflon-lined screw-capped vials at approximately –10 °C in the dark

5.4.1.7 Appendix IX (either matrix)

Mix	Volume (uLs)	MeOH (mLs)	Conc.
2000 ppm Appendix IX 5000 ppm Iodomethane 20,000 ppm Isobutanol	250 100 1000	Diluted to 2 mLs	250 ppm Appendix IX 250 ppm Iodomethane 10,000 ppm Isobutanol

5.4.1.8 Low Level Standard

A low level standard is prepared by making a 1/10 dilution of the stock standards of each of the above (nitriles and acrolein included). This standard is used to prepare the low points in the initial calibration. The low level standard may contain the Main 8260 Mix, gases, nitriles and acrolein, and any other required standard. A low-level standard for the Appendix IX compounds is also prepared separately due to duplication of some compounds.

A low level surrogate solutions is also prepared by a 1/10 dilution of the working for low points in the water curve. The calibration levels may vary with the compounds. See recipes in the calibration section for the levels. The low point in the calibrations is based on each compounds reporting limit.

All solutions are stored in a 1.5 - 2.0 mLs amber Teflon-lined screw-capped vials at –10 °C in the dark. All standard preparation is recorded in the LabNet system. Solutions are prepared every two weeks (1 week for the gases; 1 month for the nitriles).

Purgeable Spike Standard Mixes
ACCUSTANDARD and Absolute Standard

VOC LIQUID MIXTURE
2000 ug/mL in Methanol

1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethylene
1,1-Dichloropropylene
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,3-Dichloropropane
1,4-Dichlorobenzene
2,2-Dichloropropane
2-Chlorotoluene
4-Chlorotoluene
4-Isopropyltoluene
Benzene
Bromobenzene
Bromoform
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroform
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropylene
Dibromomethane
Dichlorobromomethane
Dichloromethane
Ethylbenzene
Hexachlorobutadiene
Isopropylbenzene
m-Xylene
n-Butylbenzene
n-Propylbenzene
Naphthalene
o-Xylene
p-Xylene
sec-Butylbenzene
Styrene
tert-Butylbenzene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropylene
Trichloroethylene

Bromochloromethane
2000 ug/mL in methanol

Heptane
2000 ug/mL in methanol

MTBE
2000 ug/mL in Methanol

1,3,5-Trichlorobenzene
2000 ug/mL in methanol

Clorohexane
1000 ug/mL in methanol

Ethyl Ether
1000 ug/mL in methanol

Hexane
1000 ug/mL in methanol

Trichlorotrifluoroethane
2000 ug/mL in methanol

Volatile Organic Compound Gas Spike
2000 ug/mL in Methanol
Chloroethane
Methyl Bromide (Bromomethane)
Methyl chloride (Chloromethane)
Trichlorofluoromethane
Dichlorodifluoromethane
Vinyl chloride

Volatile Mix Additional Spike Compounds
2000 ug/mL in Methanol
Acetone
2-Hexanone
Methyl ethyl ketone
4- Methyl-2-pentanone
Carbon Disulfide
Vinyl Acetate
2-Chloroethylvinylether
Iodomethane

THF
2000 ug/mL in methanol

5.5 Stock Matrix Spike Solution

The matrix spike compounds are obtained as solutions from a second source (i.e., Accustandard) in 1.5-2.0 mL ampules. These are listed on the previous page. A different analyst than the one who prepared the calibration solutions usually prepares matrix spike solutions. These are stored at approximately -10°C in the dark prior to use. Neat standards are kept for a period of one year un-opened or the manufacturer's expiration date. Once opened, the stock may be used for 3 months.

The matrix spike solutions are prepared as follows:

5.5.1 VOC Spike

Stock Compound/Mix	Volume (uLs)	MeOH (mLs)	Conc.
2000 ppm VOC Liquid Spike	25	Diluted to 1 mL	50 ppm each component
2000 ppm 8260 Additional Spike	25		
1000 ppm 1,3,5-Trichlorobenzene Spike	50		

5.5.2 Gas Spike

Mix	Volume (uLs)	MeOH (mLs)	Conc.
2000 ppm Gas Spike	50	Diluted to 2 mL	50 ppm each component

5.5.3 Additional Spike Compound Mix

Compound	Volume (uLs)	Volume (MeOH)	Concentration
2000 ppm Bromochloromethane	25	Diluted to 1 mL	50 ppm each component
1000 ppm Ethyl Ether	50		
1000 ppm Chlorohexane	50		
1000 ppm Hexane	50		
2000 ppm MTBE	25		
1000 ppm Heptane	50		
1000 ppm Trichlorotrifluoroethane	50		

5.5.4 Tetrahydrafuran Spike

Mix	Volume (uLs)	MeOH (mLs)	Conc.
2000 ppm Tetrahydrafuran	50	Diluted to 1 mL	100 ppm

For waters, addition of 5 uLs of each solution results in all spike compounds at 10 ppb, with the exception of THF which is at 20 ppb.

For soils; addition of 5 uLs of each solution, except THF at addition of 2.5 uLs, results in all compounds at 50 ppb.

These solutions are stored at approximately -10°C in several 1.5 -2.0 mL amber Teflon-lined screw-capped vials. All standard preparation is recorded in the LabNet system. Working matrix spike solutions have a 2-week/1-week expiration date or until low recoveries of the matrix spike compounds indicate a new solution is needed. See above for label information.

5.6 Stock BFB Solution

The BFB standard is purchased as a neat solution from Supelco.

Stock	Amount	MeOH (mL)	Concentration
2000 ppm BFB	25 uLs	diluted to 2 mLs	25 ppm

- Life of Standard: This stock can be kept for a period of one year until opening. Upon opening, the solution is transferred to a 1.5 - 2.0 mL vial and assigned an SRN. Once opened, it is used for a period of 6 months.
- Storage Requirements: The standard is stored at approximately –10°C in the dark

Addition of 2 uLs to 5 mLs results in a concentration of 50 ng/5 mLs.
All preparation is recorded in the LabNet system. All labels are completed as above.

NOTE: Intermediate and Working Solutions are never assigned an expiration date exceeding the expiration date of the neat/stock standards/solutions.

5.6 Reagents

5.6.1 Reagent Water

One (1) liter of water is continuously purged with pre-purified nitrogen. The reagent water is routinely demonstrated to be interference-free. All compounds are less than their EQL.

5.6.2 Methanol

Methanol is purchased from B&J (Purge and Trap interference-free). Each lot number of methanol is checked for contamination prior to laboratory use and is documented in the Methanol Lot Number Logbook in the GC/MS VOA department.

6.0 CALIBRATION

Before an instrument is used as a measuring device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration is documented.

6.1 PFTBA Autotune or Manual Tune

The instrument is first tuned in one of two ways: autotune or manual tune. The ion abundances in the calibration gas are best monitored near the temperature of analysis of BFB. Monitoring at this temperature produces the most representative cal gas scan and therefore the best estimate of BFB response.

1. If an AUTOTUNE is to be done, continue below. If not, skip to step 6. An autotune is not run before every initial calibration. If the instrument has been down for any reason previously listed or major difficulties in manual tune are encountered, an autotune is performed. Autotunes are generally NOT performed when an existing initial calibration is being met.

2. The Enviroquant software has a menu driven tune program. Begin the autotune program. Key masses are 69, 219 and 502.

3. Follow instructions and retrieve a hardcopy of the autotune results. Check the following:

- passed/fail: in itself, not necessarily an indication of MS performance
- repeller and ion focus settings
- electron multiplier voltage

4. The repeller and EM voltages are good indicators of the sources' cleanliness. Generally, the lower the setting the cleaner the source. Other factors may however, supersede (i.e., the age of the multiplier) and a clean source will not always autotune these low. The EM is set by autotune program to produce a target abundance for mass 69 (varies depending on the tune program and instrument). The operator may plan on having to increase this by 100-200 to achieve normal analysis sensitivity (depends on the tune program and the instrument).

5. Observe peak shape, absence of lead-ons/tailing, the resolution between isotopes, peak width and mass axis. A hardcopy of the profile scan is desirable, and can be filed with the autotune results.

6. If an AUTOTUNE has just been performed, continue here. If not, skip to step 9. Enter MANUAL TUNE and read the autotune (which was automatically stored in a file). For volatiles, edit the scan parameters to monitor ions 69, 131 and 219.

7. Enter one of several methods available and adjust the parameters (usually the ion focus, entrance lens and amu gain) to achieve the following relative abundances:

Mass	Relative Abundance
69	100%
131	32-40%
219	35-45%

These will vary with the MS. Mass 219 is usually 5-9% greater than mass 131. If necessary, adjust the amu gain for peak shape and high-end isotope resolution. An overall peak-width of 0.500 is desirable.

Again, these adjustments and relative abundances may not guarantee that BFB will meet requirements, but is a good place to start.

8. Hardcopy the profile scan. This should be filed with the autotune results. This file can serve as a diagnostic tool and can also provide a starting point in the event the operator has trouble meeting the initial calibration.

Save the changes to the appropriate Tune File. Exit the program.

9. If an AUTOTUNE has not been performed, enter MANUAL TUNE and adjust any parameters, if need be. Adjustment may not be necessary, and not desirable, if problems in tuning or meeting the initial calibration have not been encountered. Hardcopy a profile scan and exit.

6.2 BFB Analysis

Once the instrument is tuned, a 50 ng/5 mLs injection of 4-Bromofluorobenzene must meet criteria. The BFB can be purged or directly injected. The mass spectrum must meet the following criteria:

Mass	Ion Abundance
50	15-40% of mass 95
75	30-60% of mass 95
95	Base Peak, 100% rel. abund.
96	5 - 9% of mass 95
173	<2% of mass 174
174	>50% of mass 95

Mass	Ion Abundance
175	5 - 9% of mass 174
176	>95% but <101% of mass 174
177	5 - 9% of mass 176

The BFB is analyzed by one of the methods in Attachment 1. **(Method parameters listed in the appendices are examples only. This statement applies to all references made to these methods).** Typical Tekmar conditions also appear in Attachment 1. The EM voltage may be 100-200 volts above autotune. The abundances of the designated masses above MUST meet the criteria before analyses can begin. If necessary, enter MANUAL TUNE and adjust parameters. The instrument is tuned about every 12 hours of analysis.

6.3 Description of Initial Calibration

An initial calibration may be completed:

- as needed - continuing calibration can not be met
- after a source cleaning and/or column change or any time a major repair or change has occurred with the instrument that affects calibration where a new calibration is indicated.

Confirm that the GC/MSD or bench-top is stable and equilibrated. If at all possible, allow the instrument to equilibrate overnight at all operating temperatures if the source/column has been cleaned/changed. Prior to beginning initial calibration it is a good idea to:

- check the background of air/water levels and base ion by scanning for appropriate ions and also visually inspecting the spectrum scan for any other possible and undesirable background.
- recheck the multiplier settings, after a source is cleaned the EM can most often be dropped.

6.4 Initial Calibration

Each calibration standard is analyzed according to one of the methods in Attachment 1. These are examples. The actual number of points in the calibration is determined by the calibration and acceptance criteria table (Attachment 4). The EM voltage may be 100-200 volts above autotune.

Allow standards to come to ambient temperature.

Fill ten 5 mLs or 25 mLs (must be loaded separately) luer-lock gas-tight syringes with reagent water to overflowing. Replace the plunger and invert. Adjust to 5 mLs (or 25

mLs), confirming the absence of any air bubbles. Pull back slightly on the plunger to allow addition of standards. Use the following as guides :

Waters: 25-mL Purge Volume

Conc. Level[1]						Recipe (uLs)					
Main Mix /Gas/ MTBE/ Other	Extra	THF	Nit	Acrol	APIX	Main Mix/Gas/ MTBE/THF/ Other (100 ppm)	LL Extra 5 ppm	Surr (50 ppm)	Nit/Acrol (800/4000 ppm)	APIX (250 ppm)	ICAL 2 (100/ 1000 ppm)
0.3	NA	NA	NA	NA	NA	1.5 (LL)	NA	1.5 (LL)	1.5 (LL)	NA	NA
0.5	NA	5	16	80	NA	2.5 (LL)	NA	2.5 (LL)	5 (LL)	1(LL)	2.5 (LL)
1	2	10	32	160	2	5 (LL)	5	5 (LL)	1	2(LL)	5 (LL)
2	4	20	48	240	5	10 (LL)	10	10 (LL)	1.5	5(LL)	10 (LL)
5	5	50	80	400	10	25 (LL)	NA	2.5	2.5	1	25 (LL)
8	8	80	112	560	15	2	NA	4	3.5	1.5	2
10	10	100	160	800	20	2.5	NA	5	5	2	2.5
14	14	140	192	960	30	3.5	NA	7	6	3	3.5
20	20	200	240	1200	40	5	NA	10	7.5	4	5
40	40	400	320	1600	60	10	NA	20	10	6	10

[1] Stocks referred to here are listed on pages 7 thru 12, and include the regular compounds, Gas, Extra compounds, Appendix IX, Nitriles and Acrolein. Appendix IX and ICAL 2 curve is separate.

Soils: 5-mL Purge Volume

Conc. Level[1]						Recipe (uLs)				
Main Mix/Gas/ MTBE/Other	Extra	THF	Nit	Acrol	APIX	Main Mix/Gas/ MTBE/THF/ Extra/Other (100 ppm)	Surr (50 ppm)	Nit/Acrol (800/4000 ppm)	APIX (250 ppm)	ICAL 2 100/1000 ppm
2	2	2	NA	NA	NA	2 (LL)	2 (LL)	1 (LL)	1 (LL)	2 (LL)
5	5	5	40	200	10	5 (LL)	5 (LL)	2.5 (LL)	2 (LL)	5 (LL)
20	20	20	160	800	40	20 (LL)	20 (LL)	10 (LL)	8 (LL)	20 (LL)
30	30	30	240	1200	50	30 (LL)	30 (LL)	15 (LL)	10 (LL)	30 (LL)
50	50	50	400	2000	100	2.5	5	2.5	2	2.5
70	70	70	560	2800	150	3.5	7	3.5	3	3.5
100	100	100	800	4000	200	5	10	5	4	5
150	150	150	1200	6000	300	7.5	15	7.5	6	7.5
200	200	200	1600	8000	400	10	20	10	8	10

[1] Stocks referred to here are listed on pages 7 thru 12, and include the regular compounds, Gas, Extra compounds, Appendix IX, Nitriles and Acrolein. The Appendix IX curve must be analyzed separately.

The same tables appear in the standard section. Immediately add the standards to a clean and baked purge vessel. Following the parameters in Table 1, analyze the 50 ppb standard (soil samples) or the 10 ppb standard (water samples). A normal standard will appear very similar to the ones in Figures 1 and 2. Quantitate the standard against the appropriate method file. A short list example of one file appears in Attachment 2. Sufficient areas for the first internal standard will vary somewhat between instruments. Acceptable areas should be based on maintaining sufficient sensitivity for poor

responders without saturating the detector at the upper end of the calibration range. Too low an area will almost guarantee poor/unsatisfactory responses of low-response compounds and too high an area will result in saturation of some compounds at higher levels, resulting in false low response factors at high concentrations.

It is helpful to analyze a medium level standard first and assess the areas before continuing with the low/high level standards.

Response factors are calculated by the data system as follows:

$$RF = \frac{A_x \times Q_s}{A_s \times Q_x}$$

Where:
A_x = ion abundance for analyte
A_s = ion abundance for its internal standard
Q_s = concentration of its internal standard
Q_x = concentration of analyte
(Response Factors have no units)

The appropriate quant ion must be in the method file. See an example of a file in Attachment 2. A listing of the target compounds with their appropriate internal standards also appears in Attachment 2. Confirm the presence of all targets and the separation of non- co-eluting compounds. Note the response factors for the gasses. If necessary, prepare new standards.

If adjustments to the acquisition parameters are necessary, make them and re-analyze the 50 ppb standard (soil samples) or the 10 ppb standard (water samples).

When a standard is analyzed and processed on target as part of the initial calibration the RF's are automatically updated in the daily method. After all initial calibration standards are processed, checked and confirmed as being accurate and passing method criteria, the initial calibration is saved to the source method. This ensures that the correct initial calibration is used for each ensuing continuing calibration check. A hardcopy of the calibration report is generated. All method criteria are assessed for compliance. Confirm that 1) all CCC's are below 30% and 2) the RF's for all SPCC compounds are >0.300 (Minimum RF for Chloromethane, Bromoform and 1,1-Dichloroethane is 0.100).

Calibration curves are evaluated following the "Evaluation and Acceptance Criteria" table (Attachment 4). For all compounds in the initial calibration with a %RSD > 15.0%, calibration curves of area ratio versus concentration using a first or higher order regression curve of the calibration curve points will be performed.

Method 8000B/8260B specifies a minimum coefficient of determination of 0.990. The methods also specify a minimum of 5 calibration points for a linear model and a minimum of 6 calibration points for a higher order regression. The laboratory, in order to meet AFCEE requirements, will analyze a minimum number of points to satisfy both the new SW846 and AFCEE. All efforts will be made to meet the minimum COD of 0.990. However, there are some compounds that historically present a problem meeting this requirement. These compounds are usually those listed in the analyte table of Method 8260B with qualifying remarks. Many of these have various known (or unknown) issues that would effect reproducibility (i.e., Acetone qualifier pp = poor purger). These typically include many of the Appendix IX compounds as well. The laboratory will take minimal action for these compounds.

The 'recipes' noted above will be modified to include the necessary calibration levels. Recipes are for guidance only and may change as needed.

An example of an acceptable initial calibration appears in Attachment 2. The BFB tune, and all standard raw data are kept near the instrument if current, otherwise can be found in a file. Each instrument has its own initial calibration.

NOTE: The actual number of points in the calibration and the low point in the calibration may vary with client and project need. Clients may have additional requirements, which would be covered in a client-specific QAP.

6.5 Daily or Continuing Calibration

Continuing calibration occurs prior to analysis.

If time remains after the initial calibration, and the 50 ppb standard (soil samples) or the 10 ppb standard (water samples) meets continuing calibration criteria, samples can be analyzed up to the 12 hour tune limit. The samples are quantitated against the average RF or appropriate as per method. See later sections describing calculations.

After having satisfied BFB tune requirements, a continuing calibration standard must be analyzed. Analyze a 50 ppb (soil samples) or 10 ppb (water samples) standard following the procedure outlined above. Confirm Form 7 that all CCC's are <20% Drift and the RF's for all SPCC's are >0.300 (Minimum RF for Chloromethane, Bromoform and 1,1-Dichloroethane is 0.100). If so, the continuing calibration is acceptable and analysis can begin.

If continuing calibration can not be met, either new standards and/or a new calibration are needed.

NOTE: Method 8260B stipulate that if the CCC's are not part of the analyte list then all compounds being reported must be < 20% drift.

All internal standard areas and retention times are assessed immediately after calibration. Areas and times compared to the mid point of the initial calibration. Internal standard areas should not deviate by a factor of two or the retention times should not deviate by > 30 s. If the situation occurs, appropriate action is taken and the standard re-analyzed. All corrective action and return to control are documented in the CAR logbook for the appropriate instrument.

7.0 PROCEDURE

7.1 Quality Control Checks

Quality Control is accomplished through 1) daily tuning and calibration checks and 2) preparation QC traceable through individual batches.

7.1.1 Initial Calibration

PFTBA BFB TUNE	Prior to Initial Cal	*limits in Section 6.2
200 or 40 ng \ 150 or 20 ng | 100 or 14 ng | 70 or 10 ng | 50 or 8 ng | 30 or 5ng | 20 or 2 ng | 5 or 1 ng | 0.5 ng /	Initial Cal need dependent on situation.	*limits in Section 6.4

NOTE: As stated, the actual number of points in the calibration and the low point in the calibration may vary with client and project need. Minimum number of points for AFCEE and/or 3rd Edition SW-846 may be 9 (nine) or 10 (ten) depending on matrix. Other clients may have additional requirements, which would be covered in a client-specific QAP.

7.1.2 Method Blank (MB)

Prior to any analysis, the reagent water must be shown to be free of interference's and target compounds.

A 5 mL or 25 mL portion of reagent water is analyzed using one of the methods in Attachment 1. All target compounds must be less than the quantitation limit (See Section 2.0). Once the MB analysis is complete and acceptable, analysis can proceed.

7.1.3 Daily Analysis

PFTBA		
BFB	Prior to continuing	* See above calibration
Daily Calibration Standard	Prior to samples	* See Section 6.5
Samples *		

*Any given 12 hour period contains a tune, standard, blank and LCS. Preparation QC is at a 5% frequency. Instrumental controls are outlined above and further discussed in the procedure section.

Prep QC	Frequency
MB	Prior to analysis
LCS	1 set per analysis batch (see below *)
MS/MSD's[1]	at least 1 set in 20
Surrogates	every blank, sample and QC Sample
QC Charting	LCS/LCD[2] set per frequency to satisfy charting requirements.

[1] The sample selection for MS/MSD is rotated among client samples so that various matrix problems may be noted and/or addressed.
[2] LCS Duplicate (LCD) is performed when insufficient sample is available for an MS/MS.

7.2 Sample Preservation and Storage

Sample containers, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance and/or specific contract or client requests. Listed below are the holding times and the references that include container and preservation requirements for compliance with the Resource Conservation and Recovery Act (RCRA).

Matrix	SW-846
All	14 days

All samples received for volatile analysis are refrigerated upon receipt at 4 ± 2°C. Refrigeration is the only preservative for 5030 soil samples, while water samples are additionally preserved with 3 drops of 36% HCl to a pH >2. Water samples marked as un-preserved are analyzed within 7 days.

7.3 Sample Preparation / Analysis

7.3.1 Waters

1. Allow samples and standards to come to ambient temperature.

2. Remove the plunger from a 25 mL luer-lock gas-tight syringe and fill to near over-flowing. Replace the plunger. The pH of all samples is verified at time of analysis. If the pH < 2, a check-mark is placed in the appropriate column in the logbook. If the pH > 2, the actual estimated pH is written in the same column. pH checks and verification of hold-times are documented on the review form. Samples lacking preservation may be noted in the case narrative. Invert the syringe, and adjust the volume to 25 mLs. Confirm the absence of all air bubbles.

3. Draw back slightly on the plunger. Add 5 uLs of the working ISS/SSS solutions. Immediately add the sample to a clean purge vessel. Using the methods described in Attachment 1 analyze the sample.

4. If a batch is going to be analyzed, which is usually the case, load all samples following the procedure above. After the batch is loaded, replace all samples and standards back in storage.

5. If a dilution is required the following guidelines are followed. If the dilution is > 1/100 (250 uLs of sample) an initial dilution is made into a volumetric flask. If serial dilutions are required, no less than 1 mL is taken for further dilutions. The final sample aliquot taken for analysis from the volumetric is no less than 250 uLs. If the dilution is < 1/100, the appropriate sample amount is added directly to the 25 mL syringe. In either case, ISS and SSS are added to the 25 mL syringe.

6. Using those parameters listed in Attachment 1, analyze all samples. After analysis, remove the purge vessel from the Tekmar, rinse the purge line and vessel, and place the vessel in the oven to bake at 100°C for at least an hour.

7. Opened sample vials are used only once unless: 1) any necessary dilutions/reruns are done the same day or 2) there are no other vials for that sample.

7.3.2 Soils

1. As some clients still request method 5030 at the present time, soils are still being analyzed as indicated below. As clients convert to Method 5035 completely, this section will be removed.

2. Before weighing any samples, check the balance using the appropriate class weights. Record the actual weights in the Balance Logbook. If a problem is noted, contact the QC department.

3. Allow samples and standards to come to ambient temperature.

4. Weight out 5 grams of the sample into a clean and previously baked purge vessel. Record the weight to 0.1 g. Place the vessel on the Tekmar. Add reagent water to overflowing to a 5 mL syringe. Replace the plunger, invert the syringe, and with tapping, adjust to 5 mLs. Confirm there are no air bubbles. Add 5 uLs of the working ISS/SSS solutions. Transfer the contents to the purge vessel. Using the methods described in Attachment 1, analyze the sample. All soil samples are analyzed with a heated purge (40°C).

5. If a batch of samples is to be analyzed, prepare each as above. After the batch is loaded, replace all samples and standards in storage.

6. For blanks and LCS samples associated with soil analyses, 5 grams of pre-heated sand is weighed into a purge vessel.

7. Any sample that contains targets above the calibration range is diluted to accurately quantitate those compounds. Any sample that, based on historical data has shown to contain high concentrations of compounds is analyzed at an initial dilution. Any sample screening high, is analyzed at an initial dilution. If an initial analysis over-diluted the given sample it is re-analyzed as a low level soil. If the low-level analysis contains compounds above the calibration range, and the same compounds are within range in the dilution, both sets of data may be reported to the client.

8. If a 1/2 or 1/5 dilution is required, 2.5g/1.0g of sample is weighed into the purge vessel.

7.3.3 Medium-Level Soil Extracts

1. If a larger dilution is required, a medium-level soil extract is prepared as follows. Five grams of sample is weighed into a tarred vial. Five (5) mLs of methanol is added to the vial and the vial sealed. A portion of the extract (100 uLs maximum) is taken for analysis. Internal standard and surrogate solutions are added to the 5 mL syringe. Serial dilutions, if needed, are made from the extract and appropriate amounts taken for analysis. A portion is also removed and stored in a 1-1.5 mL Teflon-lined screw-capped vial for storage.

2. If the sample upon which a medium-level prep as been performed also required an MS/MSD, the appropriate amount of MS solution is also added.

3. All samples prepared in this manner will be analyzed against a medium-level soil curve. This standards, blanks and LCS samples will contain 100 uLs of methanol. The curve will be at ambient temperature.

NOTE: Some soils are analyzed initially at low levels due to increasing client requests for lower reporting limits. The same samples may then require large dilutions to bring compounds into the calibration range of the instrument. Some compounds, most notably the ketones, have very different responses when heated versus non-heated, despite the sample matrix. Traditionally, the lab heats soils. Therefore, the match between original analyses and dilutions for compounds such as these may not appear to correlate.

Dilution	Sample Weight	Vol. MeOH (1/2.5) Extract
1/2	2.5 grams	---
1/5	1.0 grams	---
1/50	5 grams / 5 mLs	100 uLs
1/250	5 grams / 5mLs	20 uLs
1/500	5 grams / 5 mLs	10 uLs

4. Using those parameters in Attachment 1, analyze all samples in the batch.

5. Sample vials/jars are only used once unless: 1) any dilutions/reruns are analyzed the same day or 2) there is only one jar for analysis.

6. For each new lot number of methanol used, 100 uLs is added to 5 mLs of OFW (organic free water) and analyzed. Absence of target compounds is verified and recorded in the MeOH Lot Check Logbook.

7.3.4 Method 5035

NOTE: ICAL Standards are prepared with 5 mL milli-Q water.

1. Samples for low level VOA soil analysis may be received at the lab in one of two manners: First, as replicate 5 gram core samples in 40 mL vials containing a Sodium Bisulfate preservative solution (refer to USP-5035 for collection/preservation). Alternatively, unpreserved 5 gram core samples may be received in Encore containers. These core samples must be placed in the bisulfate preservative solution within 48 hours of collection. This time requirement is currently under review by appropriate regulatory agencies and may be extended beyond the 48 hours. Until such time, the laboratory will endeavor to "fix" the sample cores in preservative within 48 hours of collection. The laboratory may receive replicate 5 gram soil cores to be used for reanalysis if needed.

2. In addition to low level samples, an additional soil aliquot should be received for use as a screen and possible use as a mid-level extraction/analysis. This additional core must also be fixed in methanol within 48 hours of collection. The amount of methanol added must closely correspond to a soil to solvent ratio of 1:1. Though not specified in the method, STL will pursue a goal of removing the methanol from the soil within 24-48 hours after the initial extraction. A portion of the methanol be removed and placed in an amber 1.5 - 2.0 mL Teflon-lined screw-capped vial for storage. This time limit should standardize the amount of time the methanol comes in contact with the sample.

3. Methanol extracts of soils will be analyzed as stated above at ambient-temperature against a medium-level soil initial calibration. All surrogate and internal standard solutions will be added at time of analysis.

4. Low level soils will be analyzed using the Archon Closed Purge and Trap Auto Sampler System. Surrogate and internal standard solutions will be added at the time of analysis. Initial concentrations of both surrogate and internal standard solutions shall be such that "sample concentrations" of the analytes conform to the method and the spike and surrogate tables provided in this SOP. The concentration of the solution and amounts spiked may vary depending on the precision obtained with a given solution/volume combination. However, the final concentrations of such compounds in the samples will follow the same guidelines as previously stated in this SOP for all other samples.

5. As with the internal standard and surrogate, all QC spike solutions must also be added to the closed sample container. This is accomplished by the addition of the spike solutions through the septum with a small gauge (10 uL) syringe just prior to the sample being placed on the instrument for analysis.

6. Some calcareous matrices may react with sodium bisulfate and cause effervescence. The method indicates that such samples need to be recollected without bisulfate preservative and analyzed within 48 hours of collection. Alternatively, some clients and/or regulatory agencies allow optional preservation and holding time criteria. On a per project basis, samples that react with sodium bisulfate may be collected and placed in vials containing water without the preservative. The vials are kept ≤ -12 °C until analysis. Such samples must be thawed prior to analysis. The maximum holding time for this type of collection and preservation is 14-days from the collection date. This alternative approach must be approved by the client/project prior to use.

7.3.5 Drum/Waste Samples

- Non-methanol Miscible
- Methanol Miscible

1. These samples are normally treated as medium level soils or waste dilutions. Waste dilutions normally consist of 1 gram of sample diluted to 10 mLs of methanol. Serial dilutions, if needed, are made from this extract. A portion of the extract is then added to the 5 mL syringe containing surrogate and internal standard. The lab can pre-spike the surrogates and spike compounds if client-specified to do so. As most drum/waste samples result in very high dilutions, it has been the labs experience that surrogates and MSs are most often diluted out and provide no useful information. Unless, specifically assigned to do so, surrogate and matrix spiking will take place at time of analysis.

7.4 Preventive Maintenance

Instrumental maintenance can be categorized as daily and "as required".

7.4.1 Daily Maintenance

The most routinely performed maintenance includes:

- position rinse
- tube baking after sample analysis
- oven bake after high level samples

7.4.2 "As Required"

Most maintenance is done on an "as needed" basis, is operator determined and can be categorized as GC, Tekmar, or MS related.

1. **GC Related**

- change column; condition new column
- clean separator; change separator
- check helium flow rate
- change gas cylinders and moisture trap

2. **MS Related**

- clean source/rods and anything associated with that activity

3. **Tekmar Related**

- rinse positions
- change positions; change parts of positions
- change transfer line; clean transfer line
- replace trap; condition new trap
- refurbish Tekmar
- check purge pressure and flow rate
- analysis of position blanks after high-level samples

- change bulk head fitting

Required maintenance may be performed for a variety of reasons. Certain trouble-flags will indicate what maintenance procedures may be required. A description of the situation, actions taken and follow-up must be documented in the instrument maintenance logbook. An example of the maintenance logbook appears in Attachment 3. In addition, the entry number must be transferred to the appropriate instrument logbook on the day of maintenance, initialed and dated.

7.5 Documentation/Tracking of Sample Analyses

1. The preparation and analysis is recorded in the GC/MS Volatiles Logbook (Attachment 3), and must be completed for each day's analysis.

2. The GC/MS VOA lab employs several forms that serve both a tracking and review function. The Sample Tracking Sheet (BigBoard) is filled out for each job. It contains information the analyst needs as for method, QC requirements, special reporting requirements, etc.., in addition for space to track the analysis of every single sample in the job and the outcome of that analysis.

3. The Tune Form is filled out for every 12 hour tune and contains several kinds of information. The forms main function is to track the analysis of all the samples analyzed during the 12 hours, initial review and data crunching documentation for the samples in the batch, tune and standard information etc.. The Tune Form is not necessarily specific to a single job. The Tune Form is discussed again in the initial review section.

4. In addition, all samples logged into the department appear on a hold-time summary sheet where ALL samples in-house are listed by hold-times and due dates. This summary is utilized by the analysts when making decisions as to methods and analyses that are needed for the day. As samples are analyzed and reviewed, the summary sheet is constantly updated to reflect those samples completely analyzed, those requiring dilutions and re-analyses (essentially a posted summary of the Sample Tracking Sheets). At the beginning of each day, the completed analyses are removed from the summary sheet by updating the analyzed samples into LabNet. The Sample Tracking Sheet and Tune Form can be found in Attachment 3.

7.5.1 Archival of Data

There are three full back-ups performed per week.

- Every Thursday a full back up of VOA data is performed.
- Every Friday a full back up of SVOA data is performed.

- Every Tuesday a system back up (minus the NBS Library) is performed. There are two tapes provided for this back up, and are rotated each week. Most current tapes are kept off site. Older tapes are in locked storage.

The system maintains a database, or logs, of each back-up session. Successful completion of each back-up can be verified each morning by accessing the job report logs in ARCServe. This is done each morning. Any missed jobs can be rescheduled and completed in the morning of the following day. As noted above, this database is re-archived after every normal back-up and can be retrieved at any time necessary.

7.5.2 Removal of Data

1. Although there is a substantial amount of space available to both BNA's and VOAs during busy periods the system can fill rather quickly. As an estimate, with a total of twelve (12) instruments, a maximum of about 2-3 months (per instrument) can be kept on the system at one time. There is not necessarily a set definite schedule of removing data from the system. As per laboratory SOP's, once the data package has been removed and all data associated from that batch has been reduced, reviewed, packaged and sent to report generation, the tune form is placed in designated location. Either by necessity or at the supervisors discretion, these are compiled and the data then actually removed from the system.

2. The tune forms are then filed in the office area. Once a year, these forms are compiled and boxed and stored in a general data storage area.

8.0 QUALITY CONTROL

8.1 QC Summary

The department will review the quality controls as follows:

8.1.1 Method Blank (MB) / Laboratory Control Standard (LCS)

At least one MB and LCS will be included in each laboratory batch. Regardless of the matrix being processed, the LCS and MBs will be in an aqueous media.

The MBs will be examined to determine if contamination is being introduced in the laboratory. The LCS will be examined to determine accuracy and precision.

8.1.2 Accuracy

Accuracy will be measured by the percent recovery (%R) of the LCS. Method 8260B list or suggest accuracy limits for an initial demonstration of precision and accuracy. There

are no further guidelines for spike recoveries. The current limits for the suggested spike compounds listed in the methods are listed in Attachment 2 of this SOP. Internally, QA/QC will monitor %R, and will plot control charts to monitor method accuracy and generate control limits when deemed necessary. The number of compounds being used for bench level control and the accuracy limits assigned to those compounds may vary with client, QAP, project etc.. This information is transmitted to the bench via the COC, kick-off meetings, tech profiles etc.., and indicated on one of the forms used at the bench. The accuracy limits are also posted on controlled boards in both the analytical and data areas (includes both method/sop limits and in-house generated limits. In-house generated limits are subject to change, but are included in Table 1).

8.1.3 Precision

Precision will be measured by the reproducibility of the LCS and will be calculated as Relative Percent Difference (RPD). The Methods list guidelines for the initial demo as noted above, but give no further guidelines for spike data. Current limits are listed in Table 1, however, RPD's are not used to assess bench level CA prior to sample analysis. Internally, QA/QC will monitor precision and calculate limits and log in LCS and LCD's at the appropriate time, at which both will be analyzed. Otherwise, only one LCS will be completed.

8.1.4 Surrogates

Surrogate Compounds will be added to every sample to measure performance of the analysis. Results must agree within statistical control limits in order to be considered acceptable. Limits are listed in Table 1. In-house surrogate limits are also generated as per method. As with LCS samples, the limits used to assess accuracy vary with client, QAP, project etc.., and the information transmitted to the bench in the same manner.

8.1.5 QC Charting

Precision and accuracy are monitored using LCS data. In-house criteria have been generated and are in use at present. Additional data may be added at QA/QC discretion during the year. During that period of time, additional LCSs will be logged into the system until adequate data are generated. Spike levels are 50 ppb/10 ppb for soils/waters. Only those compounds listed above are spiked and should be representative of the whole. The more non-routine compounds are not part of the spiking solutions. Other limitations (availability of second source) may also prevent adding these to spiking solutions. See comments in Section 6 for application of in-house control limits.

8.2 Corrective Actions

Listed below are the steps to be taken when an out-of-control situation occurs. The analyst must address the following issues as described below in the individual sections.

- demonstrate that all of the problems creating the out-of-control situation were addressed;
- document the problem and the action that was taken to correct the problem;
- document that an in-control situation has been achieved; and
- receive approval (signature) of the supervisor, section manager, QC personnel or other qualified personnel prior to release of data associated with the problem.

Bound corrective action (CA) logs are located in each run-log. In addition, a separate CA form, specific to a unique job, is attached to the COC and sample tracking form when the samples are initially entered into the sample tracking documentation used by the department. The log-book and sample # are used to note all out-of-control events, the actions taken to try and correct the problem, the return to control and qualification of data is needed.

Discussed below are the suggested and required courses of action when an out-of-control situation has occurred.

8.2.1 Surrogates

All surrogate recoveries are calculated. If ANY surrogates are outside limits in the MB, it must be re-analyzed. Analyses CAN NOT proceed until an in-control situation is demonstrated. Re-analyze the blank. If surrogates are still out, the instrument may need to be re-tuned (BFB) and/or another calibration standard analyzed. If the problem persists, further maintenance action may be required (i.e., trap replacement, clean separator).

Before pursuing other measures, check to be sure that:

- calculations are correct
- concentrations of the surrogates in the spiking solution are correct
- the correct amount of ISS/SSS solution was added
- ISS/SSS areas are reasonable

If any surrogates in a sample are outside limits, check the above first. Any sample that has a surrogate out must be re-analyzed. The re-analysis can take the form of a dilution, if there is reasonable expectation that a high concentration of a target compound is causing a matrix effect. If the surrogate(s) is/are still outside limits, a matrix effect is demonstrated and both reports are submitted. Depending on the client, the best result may be reported and the other result narrated. If all surrogates are in-control on the re-analysis, only the second analysis is reported.

Every effort is made to complete the re-analysis within hold-time. If this is impossible (i.e. , capacity hold-times preclude re-analyses hold-time)m both reports may be submitted. This is documented in the narrative.

If the sample with the out-of-control surrogates is the same sample on which the MS and MSD has been performed, and the pattern is duplicated, then re-analysis is NOT required. Documentation of the similarities is required.

Surrogate corrective action is documented on the Individual CA Sample # Report for samples, and in the CAR logbooks for blanks and LCS samples.

8.2.2 BFB Criteria

If BFB criteria can not be met, determine if the source of the problem is instrumental or tune related. Inspect overall sensitivity, possible excessive background, the proportionality of the masses, relative abundances of the target masses. If it seems tune-related, adjust the tune parameters in Manual Tune slightly, until acceptance is achieved. If the problem seems instrumental, perform suggested trouble-shooting to locate and correct the problem (Suggestions can be found in most of the manuals). NO analysis can proceed until criteria are met. Corrective action for BFB analysis is documented in the CA logbook associated with the instrument in question. 'Return to control' must be documented.

8.2.3 Initial Calibration

If initial calibration can not be met, determine if the problem is analytical or instrumental. Some suggested questions to ask would be:

- were the standards prepared correctly?
- was the proper amount analyzed?
- check the chromatogram - did something happen on one or two analyses; i.e., a leak
- check the response factors - is one concentration level very high or low? re-analyze
- how old are the standards?

All calibration criteria must be met (Section 6.4). If the ICAL does not meet specified criteria, at minimum, the appropriate levels must be re-analyzed. If necessary, new standards should be prepared and the levels re-analyzed. During analysis of an initial calibration, documentation of the re-analyses of specific levels is not required. See previous section outlining CA for minimum COD values as well.

8.2.4 Continuing Calibration

If continuing calibration can not be met, determine if the problem is analytical or instrumental. Some suggestions:

- check the chromatography
- is overall sensitivity low?
- excessive background?
- how old is the standard?
- need a new 5-point?
- has the tune shifted?

Compare the relative abundances of 69, 131 and 219 from that days manual tune to those on the day the initial calibration was analyzed. Slight adjustments to the tune may bring the standard in. Certain compounds will help indicate what the problem is.

All calibration criteria must be met (Section 6.5). If the CCAL does not meet specified criteria, at minimum the standard should be re-analyzed. A new standard may be prepared and then re-analyzed. If necessary, a new ICAL must be run. All action taken for CCAL's must be recorded in the CAR logbook for that instrument. 'Return to control' must be documented.

8.2.5 Method Blank (MB)

If the MB is/appears to be contaminated, re-analyze it on a different position. If contamination is still present, the problem may be in one of the common elements, such as the trap, transfer line, port valve or column. Baking the trap/column and running position blanks may be necessary. If contamination has occurred beyond that, and maintenance is required (i.e., replace trap) it is documented in the Maintenance Logbook. Corrective action and return to control for MBs is recorded in the CAR logbook for the appropriate instrument. Under extenuating circumstances, if analysis continues, qualification must be made as to the positive hits above the EQL for the compounds in question. Any associated samples analyzed in the tune must be noted. Any samples containing positive hits must be noted. IF, the samples containing positive hits can not be re-analyzed (i.e., past hold-time), the positive hits are flagged with "B" and the situation and data noted and qualified in a case narrative.

8.2.6 Laboratory Control Sample (LCS)

As specified in Section 8.1.2, the number of compounds and the limits used to assess accuracy vary with client, QAP, project etc.. Both method/SOP and in-house generated limits are listed in the Appendices. The in-house limits are subject to change. The need and course of corrective action varies with the number of compounds being used for

bench control and positive detected of compounds outside limits. The following guidelines are used :

(1) AFCEE : All compounds are used for bench control.

- If any compound exhibits low recoveries, the LCS is re-analyzed. If the compound is still low a new spike may be prepared and the LCS re-analyzed. Analysis should not continue until the situation is taken care of. All corrective action is documented at the time and return to control demonstrated for low compounds. IF, in extenuating circumstances, analysis is continued, the low compounds must be noted in the CAR book, associated samples must be qualified in the qualification section, absence of CA documented etc.. Data must be qualified for those compounds in the narrative.

- If any compound exhibits high recoveries, the LCS may be re-analyzed, and/or a new solution prepared, and/or a new standard prepared and calibrations repeated.

All corrective action is recorded at the time in the CAR logbook and return to control documented if applicable. AFCEE allows for high recoveries on a one time basis if the said compounds are not detected in the associated samples. Any high compounds must be noted in the CAR logbook, the associated samples listed in the qualification section, and the presence or absence of these compounds in the associated samples. If positive detects are noted, and the samples are unable to be re-analyzed, the situation must be documented and noted in the case narrative. Following the first occurrence of high recoveries, the bench will take appropriate note and follow-up with appropriate CA within a reasonable amount of time.

(2) QAP's etc.., specifying five compounds.

- ALL five compounds must be within limits for analysis to proceed. The LCS samples may be re-analyzed. New spike solutions may be prepared. Or new standards or CCAL's may be analyzed. All corrective action and return to control must be documented at the time in the CAR logbook of the appropriate instrument.

- The actual limits used for the five compounds may be QAP specific (usually those listed in the table in the appendix) or in-house generated by matrix and method. In either case, the above CA and required documentation apply.

- For all other compounds in the full-list spike, all recoveries are assessed, although no immediate corrective action may be required. If the recoveries are low, in general another LCS may be re-analyzed. The spike solution and standard may be verified for correct concentrations. However, no corrective action is absolutely required by the bench unless an error is discovered. The recoveries may or may not be documented

in the narrative, however, they are noted on the review form. The recoveries of the "un-controlled" compounds may be used for data interpretation.

- Although not strictly required to take immediate corrective action, the purpose of the full-spike is two-fold in that the bench should use it as an indicator of the status of the calibration standards, instrument conditions etc.., as well as a tool for data interpretation. Therefore, in keeping with good lab practice, the situation should be noted and assessed and any corrective action deemed necessary should be taken within a reasonable amount of time (Example: High recoveries on gases => new calibration standard may be needed).

8.2.7 Matrix Spikes (MS)

As specified in Section 8.1.2, the number of compounds and the limits used to assess accuracy vary with client, QAP, project, etc.. Both method/SOP and in-house generated limits are listed in the Appendices. The in-house limits are subject to change. The need and course of corrective action varies with the number of compounds being used for bench control and recoveries of same compounds in the associated LCS samples. The following guidelines are used :

(1) AFCEE : All compounds are used for bench level control.

- If the MS exhibits recoveries outside limits, AFCEE requires it to be re-analyzed as the MSD. No further action is required. Documentation is required however, on the individual CAR form and association made to the LCS for those compounds and in the case narrative. See above specifications for associated LCS samples.

(2) QAP's etc.., specifying five compounds.

- ALL five compounds are assessed. If recoveries are outside limits, the LCS is reviewed for those compounds. If the recoveries are within limits in the associated LCS samples, no further action is required. See above section concerning LCS CA for further information and action required for recoveries outside limits in LCS samples.

- The actual limits used for the five compounds may be QAP specific (usually those listed in the table in the appendix) or in-house generated by matrix and method. In either case, the above CA and required documentation apply.

- For all other compounds in the full-list spike, all recoveries are assessed, although no immediate corrective action may be required. The affected compounds may be compared to the same compounds in the associated LCS samples. See the above section for further information and action required for these compounds in the LCS samples. The recoveries may or may not be documented in the narrative, however,

they are noted on the review form. The recoveries of the "un-controlled" compounds may be used for data interpretation.

8.2.8 Internal Standard Policy

Method 8260 does not require re-analyses of samples for low internal standard areas. However, it is STL's policy to monitor areas and retention times, therefore, the following guidelines apply.

Situations requiring re-analyses :

- If ALL areas are outside limits the sample will be re-analyzed.
- Any sample that has a positive hit associated with any internal standard outside limits will be re-analyzed.
- If ANY surrogates are outside limits the sample will be re-analyzed.

Situations NOT requiring re-analyses :

- If all surrogates are within limits and there are no positive hits associated with those internal that are outside limits, the sample does not have to be re-analyzed. Situation should be addressed in the case narrative and noted on the sample CAR form.
- If all surrogates are within limits, but there is an obvious matrix effect occurring, even if positive hits are noted, the sample does not need to be re-analyzed. This decision will be approved by the supervisor or section manager. The situation must also be addressed on the sample CAR form and narrative.
- If there is historical evidence that shows a repeated pattern for a certain client and site, and this can be documented by reviewing past projects, the samples do not have to be re-analyzed. This decision will be approved by the supervisor or section manager.
- Internal standard areas for samples are documented on the Individual CAR form. Internal standard areas for CCAL to CCAL are documented in the appropriate CAR logbook.

Any sample showing retention times outside windows will be re-analyzed. This is documented in the appropriate manner as in the preceding paragraph.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 Computer Data Production/Reduction

The Target 3.5 software produces a Total Ion Chromatogram (TIC), header, quant report and background subtracted spectra. For those clients requiring it, a 5 tentatively identified compound (TIC) search is also performed. The data system will produce an integration listing and tentative identification of each hit found at the selected percentage of the largest peak present.

9.1.1 Quantitation of Target Compounds

Quantitation of the target compounds is performed by the data system can be accomplished as follows:

WATERs: concentration (mg/L) = $\frac{[A_x \times I_s]}{[A_{is} \times RF]} \times DF$

Where:
A_x = area of characteristic ion for target
I_s = concentration of internal standard (ng)
A_{is} = area of characteristic ion for int. std.
RF = response factor for target
DF = dilution factor (if any)

SOILs: concentration (mg/kg) = $\frac{[A_x \times I_s]}{[A_{is} \times RF \times D]} \times DF$

Where:
All variables are equal and
D = (100 - % moisture in sample/100) or 1 for wet weight. (As in the case of drum samples)

The target methods all contain calculations for waters and soils that allow automatic processing and calculations of concentrations to be completed. The user may enter some variables (Dilution Factor) and others are imported from LabNet. Sample prep info for VOA's is entered directly into LabNet. The sample volume is considered to be "constant" for calculation purposes. Less sample volume (in the case of waters) and soil weight (in the case of soils) are taken into account in the dilution factor entered by the user. For medium-level soils and waste/drum type samples medium level calculations are needed and actual weights are brought into LabNet.

NOTE: As noted previously, weights are recorded to 0.1 gram. It is SOP to weigh out 5.0 grams (or as appropriate for the dilution), however, to keep data entry and calculations simple. The same holds true for all water volumes.

9.1.2 Accuracy:

$$\%R = \frac{(A_T - A_0)}{A_F} \times 100$$

Where:
A_T = Total amount recovered in fortified sample
A_0 = Amount recovered in unfortified sample
A_F = Amount added to sample

9.1.3 Precision: $\% D = \frac{|B_1 - B_2|}{B_1} \times 100$

$$RPD = \frac{|B_1 - B_2|}{(B_1 + B_2)/2} \times 100$$

Where:
B_1 = %Recovery MS (or LCS)
B_2 = %Recovered MSD (or LCS)

9.1.4 Modifications for 8260B quantitation

1. Initial Calibration Criteria

Methods 8000B/8260B require the use of linear or higher order calibration curves for those compounds exceeding 15%.

The following equations apply :

Linear Regression :

$$y=a_0 + (1/a_1)x$$

Quadratic Curve:

$$y = a_o + (a1 * x) + (a2 * x^2)$$

Power Curve :

$$y=e^{a0} * x^{(1/a1)}$$

which is converted to :

$$\ln (y) = (1/a_1) * \ln (x) + a_0$$

$x = Area_{UKN}/Area_{ISTD}$
$y= Amount_{UNK}/Amount_{ISTD}$

Once the $Amount_{UNK}$ is solved, the value is adjusted for total solids, dilution factors etc.., to calculate a final concentration.

The quantitation of compounds using either a linear regression, quadratic curve or a power curve as performed automatically by the Target software has been confirmed to be accurate.

Method 8000B/8260B specifies a minimum COD.

The corrective action regarding an initial calibration for method 8260B as it relates to the 0.990 correlation coefficient acceptance criteria is outlined. When a compound has a correlation coefficient less than 0.990, the occurrence is documented by the analyst in the GC/MS VOA CAR section of the instrument's logbook. Any corrective action or data qualification is also documented in the CAR section of the logbook. All corrective actions taken may include those listed below.

Samples may be analyzed against an initial calibration that have compounds with a correlation coefficient less than 0.990 and the corrective actions taken may also include some but not all of the following:

- The data for these samples may be reported without qualification if the compounds with a correlation coefficient less than 0.990 are not detected in the sample, therefore no further corrective action is required.
- If a compound is detected in the sample that has a correlation coefficient less than 0.990, the samples may be reanalyzed against an initial calibration with an acceptable correlation coefficient and only the reanalysis will be reported on the sample. If this reanalysis occurs beyond analysis hold times then both analyses on the sample will be reported.
- If a compound is detected in the sample that has a correlation coefficient less than 0.990, the decision to reanalyze or to reported the data without further corrective action is made on a case by case basis with the approval of the supervisor, the section manager, the project manager and the client. The sample results may require qualification for this compound on the report and will be addressed in the case narrative.

2. Continuing Calibration Check

Prior to sample analysis a 10 ppb/ 50 ppb calibration check is completed. All minimum RF's must meet same limits. All CCC's must be less than 20% Drift as calculated below; the analysts may verify %DIFF and only calculate those that are close. (Error may only be made in favor of tighter control).

$$\%Drift = \frac{(Ci - Cc)}{Ci} \times 100$$

Where:
Ci = standard conc. (10/50)
Cc = measured conc. in cal check

9.1.5 Quantitation of TIC's (Tentatively Identified Compounds)

Quantitation of TIC's is performed by the Target processing software. The formulas above for waters and soils can be used with the following modifications. A_x and A_{is} should be taken from the total ion integration listing accompanying the TIC report produced by the data system. The nearest non-interfered with internal standard should be used. The RF is assumed to be one (1). The concentration is therefore an estimate and is flagged as such with a "J". Any TIC also found in the MB is flagged with a "JB". Any TIC identified with a CAS number is also flagged with an "N", indicating that the ID was based on the mass spectra. The operator should visually confirm that the integration is correct. If not, the peak in question must be manually integrated. The target system automatically calculates the actual concentration of the TIC's, including dilutions and total solids, once that information is retrieved from LabNet.

9.2 Operator Data Reduction/Review

The operator does on-screen review of all data and 1) makes judgments concerning the "realness" of those target compounds found and 2) makes judgments concerning the identification of the tentatively identified compounds and 3) modifies the output to produce a data package reflective of those decisions.

9.2.1 Initial Review

The GC/MS VOA area uses two kinds of corrective action documentation. The first consists of the CAR section of logbooks, that are specific to each instrument. These logbooks contain sections to report out-of-control situations, CA, return-to-control and qualification sections for documenting problems related to general QC: tune, ICAL, CCAL, internal standard areas from CCAL to CCAL, and LCS samples. The second are the Individual CAR's that refer to a single job. These are used to record events, CA and final actions for surrogates, internal standard areas, carry-over situations, analyses past tune time, MS/MSD data etc.., for each sample in the batch. These forms are attached to the COC, along with the samples tracking sheets. Both may be used during initial review of the data. Examples of both can be found in Attachment 3. See Section 8.2 of this SOP for details on CA.

All data is initially reviewed on-screen. The review is both a QC review and a general review as described below.

- The MB contains no interferences or target compounds at the EQL.
- ALL surrogates are in control in the blank. Surrogate limits are listed in Table 1;
- ALL surrogates in samples are in control;

- LCS recoveries meet the limits listed in Table 1. See Section 8.2 concerning compounds and limits for LCS samples. In-house limits have been generated and are in use.
- Internal standard areas and retention times are checked and meet guidelines. Limits are listed in Attachment 2. Additional guidelines can be found in Section 8.2.
- The sample does not require any further dilutions or analysis at a more concentrated level. Dilutions are made to keep the target in the upper half of the calibration range. The MS and MSD are never diluted to get spiked or non-spiked compounds within range, as this would reduce the matrix affect assessment.
- Visually confirm complete integration for any large and/or saturated target compounds.
- The sample does not require re-analysis for any other reason (i.e., leak, analysis past tune time, ISTD areas low, etc..).

9.2.2 Identification of Targets

The following guidelines are used in the positive identification of target compounds.

1. "elution of component at the same relative retention time as the standard component."

The elution times should compare within +- 30 s. The standard must be run on the same 12 hour period as the sample. If co-eluting analytes interfere with the comparisons of retention times, other ions characteristic to that compound can be used to confirm relative retention times.

2. "correspondence of the sample component and standard component mass spectrum." Comparisons of sample spectra to standard spectra must be made using standard spectra obtained from the GC/MS system.

All ions present in the standard spectrum at a 10% relative intensity (most abundant ion being 100%) should be present in the sample.

The relative intensities of the above ions should agree within ±20%, between the standard and sample. If an ion is 50% intensity in the standard the corresponding ion must be between 30 and 70% in the sample.

Ions >10% in the sample but not present in the standard should be considered and accounted for. (A user program exists to aid in this).

3. **Operator judgment**. If a compound can not be verified by the above, but in the operators technical judgment the ID is correct, it is reported as such.

4. Once all positive identification is made, the file is modified to reflect these decisions. At this time TIC's may also be reviewed and name. In each case where the file has been edited or manual integrations have taken place the operator must identify, initial and date the changes on the hardcopy. The following guidelines apply :

- Manual integrations should be consistent between all files integrated.
- Manual integrations should not be performed to meet QC criteria.
- Manual integrations are automatically flagged with an "M" on the raw data.
- Excessive manual integrations may reflect an instrumental or methodological problem that should be addressed.

9.2.3 Manual Integration Policy

In each case where the file has been edited or manual integrations have been performed the operator must identify, initial, and date the changes on the hardcopy report. The following guidelines apply:

- Manual integrations should be consistent between all files integrated.
- Manual integrations should not be performed to meet QC criteria.
- Manual integrations are automatically flagged with an 'M' on the raw data.
- Excessive manual integrations may reflect an instrumental or methodological problem that should be addressed.
- Manual integrations shall follow the STL Corporate SOP for manual integrations (#S-Q-004).

Manual integrations are most often performed for the following reasons:

- Assignment of correct peak that was mis-identified by the data system.
- Incomplete auto-integration due to high level of target compound detected.
- Incomplete auto-integration due to background interference.
- Incorrect auto-integration due to co-elution or near co-elution of compounds.
- Missed peaks.

The analysts review all integrations. Spectra and Extracted Ion Chromatography Profiles (EICP) are printed after any integration takes place for target compounds and are routinely included in the data packages. If EICP's for internal standards, surrogates and calibration standards are required to satisfy client deliverables, they can be provided, but will not be routinely added. Manual integrations may be documented in the case narrative if so required, however, references to this SOP will be used for explanations, and any further documentation beyond initials and dates will not be done.

9.2.4 Identification of TIC's

In general, up to as many as 5 non-target compounds are tentatively identified by the data system and operator. Compounds with responses >10% of the nearest ISTD are identified. The data system provides the operator with a SUB ADC C sample spectrum, spectra of the first three matches and a listing of two other possibilities. Molecular formulas, molecular weights and CAS #'s are included. The following guidelines are used:

Relative intensities of major ions in the reference spectrum should be present in the sample (ions >10%).

- Relative ions should agree within ±20%;
- Molecular ions in the reference should be in the samples;
- Review the possibility of background and/or co-eluting compounds for those ions present in the sample but not in the standard;
- If ions are present in the sample but not in the standard, review the possibility of the presence of background or co-eluting compounds;
- If ions are present in the standard but not in the sample, review the possibility that the ions were subtracted out because they are also common to the background or co-eluting compounds;
- In the event no valid interpretation can be made, the compound is called "unknown".
- Interpretation can be often narrowed down to a class of compounds, molecular formula or weight.

9.3 Final Review

1. Once 1) the analysis is determined to be acceptable and 2) the initial review and data reduction has occurred (verifiable on the Tune Form) and 3) the analyst has entered sample prep info into LabNet, the following steps occur. The sample prep information, client ID information and some data applicable to fields in the forms is retrieved from LabNet. At this point, the analyst then usually prints hard-copies of all the necessary raw data. The analysts review the hard-copies and initial and date them, documenting that review.

2. All required forms are then generated using the Target software. Most, if not all of these steps, are documented on the tune form. The package is then assembled and ready for the first review.

3. Upon the first 100% review, the review form is initialed and dated as reviewed. The initial review is normally done by the analyst preparing the data package. The package, with its review sheet, comments and any CAR forms is submitted to the supervisor or section manager for a second review and validation. Once the data passes review in the department, it is submitted to report generation/QA/QC for appropriate follow-up action.

4. The complete analysis scheme can be summarized below (Section 7.1.1 & 7.1.2) and in Attachment 5. The entire sample tracking system can be summarized in Attachment 5. The Tune Form is used to verify many of these steps of review and data reduction.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

- Waste from this procedure will enter the 'Flammable Vials' wastestream.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0

13.0 ATTACHMENTS

Table 1. Estimated Quantitation Limits for Volatile Analytes; Laboratory Statistical Control Limits
Table 2. Characteristic Mass for Purgeable Organics Compounds

Figure 1. Example: Total Ion Chromatogram for 25 mL Purge Water
Figure 2. Example: Total Ion Chromatogram for 5 mL Purge Soil

Attachment 1. Example: Method Listings; Tekmar Conditions; Flow Settings
Attachment 2. Example: Target and Internal Standards; ICAL/CCAL; Surrogate Recovery Limits; LCS / MS Recovery Limits; Internal Standard Guidelines
Attachment 3. Example: GC/MS Volatiles/CAR Logbook; Tune Form; Sample Tracking Sheet; Maintenance Logbook
Attachment 4. Calibration Evaluation and Acceptance Criteria
Attachment 5. Example: Analysis and Sample Tracking Flowcharts
Attachment 6. Example: Data Review Form

Historical File:

Revision 00: 06/22/92	Revision 07: 04/10/97
Revision 01: 04/26/93	Revision 08: 06/13/97
Revision 02: 05/26/93	Revision 09: 02/11/98
Revision 03: 01/24/94	Revision 10: 01/29/99
Revision 04: 07/15/94	Revision 11: 03/08/99
Revision 05: 11/20/95	Revision 12: 09/28/00
Revision 06: 04/09/96	Revision 13: 10/21/02

Reasons for Change, Revision 13:

- Annual review.
- Updated the Health & Safety (3.0) and Waste Disposal (10.0) sections.

U:\QC\SOP\UMV\8260.DOC

Table 1.

Example: Estimated Quantitation Limits for Volatile Analytes[a] Laboratory Statistical Control Limits

[a]Estimated Quantitation Limit (EQL) - The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The EQL is generally 5 to 10 times the MDL. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes the EQL analyte concentration is selected for the lowest non-zero standard in the calibration curve. Sample EQLs are highly matrix-dependent. The EQLs listed herein are provided for guidance and may not always be achievable. See the following example information for further guidance on matrix-dependent EQLs.

[b]EQLs listed for soil/sediment are based on wet weight. Normally data is reported on a dry weight basis; therefore, EQLs will be higher, based on the percent dry weight in each sample.

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
Method: Volatile Organics (5mL Purge) (8260.5)										
1,1,1,2-Tetrachloroethane	8260B	Water-5mL	ug/L	0.96	5	78	119	20		
1,1,1-Trichloroethane	8260B	Water-5mL	ug/L	1.2	5	69	130	20		
1,1,2,2-Tetrachloroethane	8260B	Water-5mL	ug/L	1.7	5	72	121	20		
1,1,2-Trichloroethane	8260B	Water-5mL	ug/L	1.5	5	66	135	20		
1,1-Dichloroethane	8260B	Water-5mL	ug/L	1.3	5	56	124	20		
1,1-Dichloroethene	8260B	Water-5mL	ug/L	1.7	5	48	132	20		
1,1-Dichloropropene	8260B	Water-5mL	ug/L	1.1	5	57	150	20		
1,2,3-Trichlorobenzene	8260B	Water-5mL	ug/L	4.3	5	70	126	20		
1,2,3-Trichloropropane	8260B	Water-5mL	ug/L	1.2	5	68	124	20		
1,2,4-Trichlorobenzene	8260B	Water-5mL	ug/L	3.3	5	57	132	20		
1,2,4-Trimethylbenzene	8260B	Water-5mL	ug/L	1.1	5	69	128	20		
1,2-Dibromo-3-chloropropane	8260B	Water-5mL	ug/L	1.8	5	51	119	20		
1,2-Dibromoethane (EDB)	8260B	Water-5mL	ug/L	1.3	5	69	124	20		
1,2-Dichlorobenzene	8260B	Water-5mL	ug/L	1.5	5	80	117	20		
1,2-Dichloroethane	8260B	Water-5mL	ug/L	1.4	5	68	125	20		
1,2-Dichloroethene (total)	8260B	Water-5mL	ug/L	2.4	5	58	129	20		
1,2-Dichloropropane	8260B	Water-5mL	ug/L	1.1	5	67	124	20		
1,3,5-Trichlorobenzene	8260B	Water-5mL	ug/L	2.4	5	67	118	20		
1,3,5-Trimethylbenzene	8260B	Water-5mL	ug/L	1.1	5	68	126	20		
1,3-Butadiene	8260B	Water-5mL	ug/L		5					
1,3-Dichlorobenzene	8260B	Water-5mL	ug/L	1.5	5	76	118	20		
1,3-Dichloropropane	8260B	Water-5mL	ug/L	1.1	5	72	121	20		
1,4-Dichlorobenzene	8260B	Water-5mL	ug/L	1.6	5	78	119	20		
1-Chlorohexane	8260B	Water-5mL	ug/L	0.9	5	60	143	20		
2,2-Dichloropropane	8260B	Water-5mL	ug/L	4.5	5	56	139	20		
2-Butanone (MEK)	8260B	Water-5mL	ug/L	1.9	5	55	140	20		
2-Chloro-1,3-butadiene (chloroprene)	8260B	Water-5mL	ug/L	0.29	5					
2-Chloroethylvinylether	8260B	Water-5mL	ug/L	2.3	5	10	150	20		
2-Chlorotoluene	8260B	Water-5mL	ug/L	1.1	5	75	123	20		
2-Hexanone	8260B	Water-5mL	ug/L	1.4	5	50	136	20		
2-Methylnaphthalene	8260B	Water-5mL	ug/L		5					
2-Nitropropane	8260B	Water-5mL	ug/L		400					
3-Chloropropene (Allyl Chloride)	8260B	Water-5mL	ug/L	1.4	10					
4-Chlorotoluene	8260B	Water-5mL	ug/L	1.2	5	69	122	20		
4-Methyl-2-pentanone (MIBK)	8260B	Water-5mL	ug/L	1.3	5	50	138	20		
Acetone	8260B	Water-5mL	ug/L	4.8	5	33	141	20		
Acetonitrile	8260B	Water-5mL	ug/L	20.2	40					

STL Chicago
Method Limit Report

Project:
Updated: 3/4/02

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
Acrolein	8260B	Water-5mL	ug/L	74.5	200					
Acrylonitrile	8260B	Water-5mL	ug/L	16.3	40					
Benzene	8260B	Water-5mL	ug/L	0.96	5	68	130	20		
bis(chloromethyl)ether	8260B	Water-5mL	ug/L		2000					
Bromobenzene	8260B	Water-5mL	ug/L	1.2	5	73	127	20		
Bromochloromethane	8260B	Water-5mL	ug/L	1.5	5	64	135	20		
Bromodichloromethane	8260B	Water-5mL	ug/L	1.3	5	69	131	20		
Bromoform	8260B	Water-5mL	ug/L	1.1	5	70	128	20		
Bromomethane	8260B	Water-5mL	ug/L	0.86	5	68	144	20		
Carbon disulfide	8260B	Water-5mL	ug/L	1.6	5	50	150	20		
Carbon tetrachloride	8260B	Water-5mL	ug/L	0.89	5	66	121	20		
Chlorobenzene	8260B	Water-5mL	ug/L	1	5	77	121	20		
Chloroethane	8260B	Water-5mL	ug/L	1.3	5	48	177	20		
Chloroform	8260B	Water-5mL	ug/L	1.6	5	66	127	20		
Chloromethane	8260B	Water-5mL	ug/L	2.7	5	62	131	20		
cis-1,2-Dichloroethene	8260B	Water-5mL	ug/L	1.3	5	62	134	20		
cis-1,3-Dichloropropene	8260B	Water-5mL	ug/L	1.2	5	73	127	20		
Cyclohexanone	8260B	Water-5mL	ug/L		400					
Dibromochloromethane	8260B	Water-5mL	ug/L	1.1	5	74	119	20		
Dibromomethane	8260B	Water-5mL	ug/L	1.3	5	65	124	20		
Dichlorodifluoromethane	8260B	Water-5mL	ug/L	1.2	5	41	127	20		
Ethyl acetate	8260B	Water-5mL	ug/L	10.2	50					
Ethyl ether	8260B	Water-5mL	ug/L	0.38	5	35	121	20		
Ethylbenzene	8260B	Water-5mL	ug/L	0.93	5	78	121	20		
Ethylmethacrylate	8260B	Water-5mL	ug/L	0.99	10					
Heptane	8260B	Water-5mL	ug/L	0.59	5	17	124	20		
Hexachlorobutadiene	8260B	Water-5mL	ug/L	3.5	5	58	133	20		
Hexane	8260B	Water-5mL	ug/L	0.66	5	36	76	20		
Iodomethane	8260B	Water-5mL	ug/L	1.1	10	50	150	20		
Isobutyl alcohol	8260B	Water-5mL	ug/L	122	400					
Isopropyl alcohol	8260B	Water-5mL	ug/L							
Isopropyl ether	8260B	Water-5mL	ug/L	0.32	5					
Isopropylbenzene	8260B	Water-5mL	ug/L	0.87	5	72	118	20		
m&p-Xylenes	8260B	Water-5mL	ug/L	1.8	10	73	128	20		
Methacrylonitrile	8260B	Water-5mL	ug/L	1.8	10					
Methylene chloride	8260B	Water-5mL	ug/L	1.4	5	45	130	20		
Methylmethacrylate	8260B	Water-5mL	ug/L	1.5	10					
Methyl-tert-butyl-ether (MTBE)	8260B	Water-5mL	ug/L	2	5	49	139	20		

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
Naphthalene	8260B	Water-5mL	ug/L	3.6	5	60	119	20		
n-Butyl alcohol (1-Butanol)	8260B	Water-5mL	ug/L	400	400					
n-Butylbenzene	8260B	Water-5mL	ug/L	1.5	5	71	128	20		
n-Propylbenzene	8260B	Water-5mL	ug/L	0.96	5	70	124	20		
o-Xylene	8260B	Water-5mL	ug/L	0.98	5	75	123	20		
Pentachloroethane	8260B	Water-5mL	ug/L	1.1	10					
p-Isopropyltoluene	8260B	Water-5mL	ug/L	1	5	75	126	20		
Propionitrile	8260B	Water-5mL	ug/L	14.5	40					
sec-Butylbenzene	8260B	Water-5mL	ug/L	0.96	5	74	124	20		
Styrene	8260B	Water-5mL	ug/L	1.1	5	80	126	20		
tert-Butyl alcohol	8260B	Water-5mL	ug/L							
tert-Butylbenzene	8260B	Water-5mL	ug/L	0.98	5	73	123	20		
Tetrachloroethene	8260B	Water-5mL	ug/L	2.6	5	74	123	20		
Tetrahydrofuran	8260B	Water-5mL	ug/L	1.8	5	22	147	20		
Toluene	8260B	Water-5mL	ug/L	1.1	5	72	122	20		
trans-1,2-Dichloroethene	8260B	Water-5mL	ug/L	1.1	5	63	125	20		
trans-1,3-Dichloropropene	8260B	Water-5mL	ug/L	1.4	5	62	127	20		
trans-1,4-Dichloro-2-butene	8260B	Water-5mL	ug/L	1.1	10					
Trichloroethene	8260B	Water-5mL	ug/L	1.6	5	71	128	20		
Trichlorofluoromethane	8260B	Water-5mL	ug/L	3.2	5	68	133	20		
Trichlorotrifluoroethane	8260B	Water-5mL	ug/L	1	5	50	150	20		
Vinyl acetate	8260B	Water-5mL	ug/L	1.4	5	58	157	20		
Vinyl chloride	8260B	Water-5mL	ug/L	1.2	5	50	141	20		
Xylenes (total)	8260B	Water-5mL	ug/L	1.8	5	76	129	20		
Surrogate										
1,2-Dichloroethane-d4 (surr)	8260B	Water-5mL	ug/L						66	132
4-Bromofluorobenzene (surr)	8260B	Water-5mL	ug/L						79	122
Dibromofluoromethane (surr)	8260B	Water-5mL	ug/L						66	132
Toluene-d8 (surr)	8260B	Water-5mL	ug/L						78	128
Method: Volatile Organics (8260B)										
1,1,1,2-Tetrachloroethane	8260B	Water	ug/L	0.21	1	70	134	20		
1,1,1-Trichloroethane	8260B	Water	ug/L	0.22	1	66	129	20		
1,1,2,2-Tetrachloroethane	8260B	Water	ug/L	0.25	1	72	127	20		
1,1,2-Trichloroethane	8260B	Water	ug/L	0.33	1	69	138	20		
1,1-Dichloroethane	8260B	Water	ug/L	0.2	1	69	127	20		
1,1-Dichloroethene	8260B	Water	ug/L	0.19	1	54	127	20		
1,1-Dichloropropene	8260B	Water	ug/L	0.24	1	70	128	20		
1,2,3-Trichlorobenzene	8260B	Water	ug/L	0.24	1	75	123	20		

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
1,2,3-Trichloropropane	8260B	Water	ug/L	0.2	1	71	126	20		
1,2,4-Trichlorobenzene	8260B	Water	ug/L	0.23	1	77	123	20		
1,2,4-Trimethylbenzene	8260B	Water	ug/L	0.2	1	72	126	20		
1,2-Dibromo-3-chloropropane	8260B	Water	ug/L	0.46	1	66	123	20		
1,2-Dibromoethane (EDB)	8260B	Water	ug/L	0.25	1	71	135	20		
1,2-Dichlorobenzene	8260B	Water	ug/L	0.24	1	74	119	20		
1,2-Dichloroethane	8260B	Water	ug/L	0.25	1	63	133	20		
1,2-Dichloroethene (total)	8260B	Water	ug/L	0.42	1	72	121	20		
1,2-Dichloropropane	8260B	Water	ug/L	0.22	1	71	132	20		
1,3,5-Trichlorobenzene	8260B	Water	ug/L	0.24	1	72	127	20		
1,3,5-Trimethylbenzene	8260B	Water	ug/L	0.2	1	69	123	20		
1,3-Butadiene	8260B	Water	ug/L	0.25	1					
1,3-Dichlorobenzene	8260B	Water	ug/L	0.23	1	73	121	20		
1,3-Dichloropropane	8260B	Water	ug/L	0.23	1	71	133	20		
1,4-Dichlorobenzene	8260B	Water	ug/L	0.22	1	74	121	20		
1-Chlorohexane	8260B	Water	ug/L	0.23	1	71	139	20		
2,2-Dichloropropane	8260B	Water	ug/L	0.2	1	56	141	20		
2-Butanone (MEK)	8260B	Water	ug/L	1.7	5	54	145	20		
2-Chloro-1,3-butadiene (chloroprene)	8260B	Water	ug/L	0.13	1					
2-Chloroethylvinylether	8260B	Water	ug/L	1.4	2	10	200	20		
2-Chlorotoluene	8260B	Water	ug/L	0.22	1	69	120	20		
2-Hexanone	8260B	Water	ug/L	1.2	5	70	144	20		
2-Methylnaphthalene	8260B	Water	ug/L	0.27	1					
2-Nitropropane	8260B	Water	ug/L	20	100					
3-Chloropropene (Allyl Chloride)	8260B	Water	ug/L	0.45	2					
4-Chlorotoluene	8260B	Water	ug/L	0.22	1	68	120	20		
4-Methyl-2-pentanone (MIBK)	8260B	Water	ug/L	0.92	5	66	147	20		
Acetone	8260B	Water	ug/L	1.5	5	43	150	20		
Acetonitrile	8260B	Water	ug/L	6.6	40					
Acrolein	8260B	Water	ug/L	19	200					
Acrylonitrile	8260B	Water	ug/L	5.4	40					
Benzene	8260B	Water	ug/L	0.2	1	74	116	20		
bis(chloromethyl)ether	8260B	Water	ug/L	2000	2000					
Bromobenzene	8260B	Water	ug/L	0.22	1	77	121	20		
Bromochloromethane	8260B	Water	ug/L	0.19	1	57	133	20		
Bromodichloromethane	8260B	Water	ug/L	0.23	1	76	129	20		
Bromoform	8260B	Water	ug/L	0.22	1	73	139	20		
Bromomethane	8260B	Water	ug/L	0.18	1	51	152	20		

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Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
Carbon disulfide	8260B	Water	ug/L	0.4	5	29	136	20		
Carbon tetrachloride	8260B	Water	ug/L	0.24	1	66	136	20		
Chlorobenzene	8260B	Water	ug/L	0.22	1	76	124	20		
Chloroethane	8260B	Water	ug/L	0.21	1	68	135	20		
Chloroform	8260B	Water	ug/L	0.23	1	74	128	20		
Chloromethane	8260B	Water	ug/L	0.16	1	56	129	20		
cis-1,2-Dichloroethene	8260B	Water	ug/L	0.21	1	78	126	20		
cis-1,3-Dichloropropene	8260B	Water	ug/L	0.22	1	75	123	20		
Cyclohexane	8260B	Water	ug/L	0.1	1					
Cyclohexanone	8260B	Water	ug/L	53	100					
Dibromochloromethane	8260B	Water	ug/L	0.23	1	74	137	20		
Dibromomethane	8260B	Water	ug/L	0.26	1	66	131	20		
Dichlorodifluoromethane	8260B	Water	ug/L	0.14	1	56	136	20		
Ethyl acetate	8260B	Water	ug/L	1.9	5					
Ethyl ether	8260B	Water	ug/L	0.31	1	10	190	20		
Ethylbenzene	8260B	Water	ug/L	0.2	1	74	121	20		
Ethylmethacrylate	8260B	Water	ug/L	0.36	2					
Heptane	8260B	Water	ug/L	0.22	1	50	143	20		
Hexachlorobutadiene	8260B	Water	ug/L	0.24	1	56	147	20		
Hexane	8260B	Water	ug/L	0.2	1	50	134	20		
Iodomethane	8260B	Water	ug/L	1.3	2	36	117	20		
Isobutyl alcohol	8260B	Water	ug/L	26	100					
Isopropyl alcohol	8260B	Water	ug/L							
Isopropyl ether	8260B	Water	ug/L	0.15	1					
Isopropylbenzene	8260B	Water	ug/L	0.21	1	67	123	20		
m&p-Xylenes	8260B	Water	ug/L	0.39	2	71	125	20		
Methacrylonitrile	8260B	Water	ug/L	1.5	2					
Methyl acetate	8260B	Water	ug/L	0.52	1					
Methyl cyclohexane	8260B	Water	ug/L	0.1	1					
Methylene chloride	8260B	Water	ug/L	0.19	1	52	133	20		
Methylmethacrylate	8260B	Water	ug/L	0.67	2					
Methyl-tert-butyl-ether (MTBE)	8260B	Water	ug/L	0.21	1	52	156	20		
Naphthalene	8260B	Water	ug/L	0.34	1	69	125	20		
n-Butyl alcohol (1-Butanol)	8260B	Water	ug/L	55	100					
n-Butylbenzene	8260B	Water	ug/L	0.22	1	71	118	20		
n-Pentane	8260B	Water	ug/L							
n-Propylbenzene	8260B	Water	ug/L	0.25	1	67	123	20		
o-Xylene	8260B	Water	ug/L	0.21	1	72	124	20		

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
Pentachloroethane	8260B	Water	ug/L	1	2					
p-Isopropyltoluene	8260B	Water	ug/L	0.22	1	67	126	20		
Propionitrile	8260B	Water	ug/L	9.7	40					
sec-Butylbenzene	8260B	Water	ug/L	0.22	1	69	124	20		
Styrene	8260B	Water	ug/L	0.23	1	80	125	20		
tert-Butyl alcohol	8260B	Water	ug/L							
tert-Butylbenzene	8260B	Water	ug/L	0.21	1	69	123	20		
Tetrachloroethene	8260B	Water	ug/L	0.2	1	69	128	20		
Tetrahydrofuran	8260B	Water	ug/L	3	5	67	166	20		
Toluene	8260B	Water	ug/L	0.21	1	71	122	20		
trans-1,2-Dichloroethene	8260B	Water	ug/L	0.21	1	64	119	20		
trans-1,3-Dichloropropene	8260B	Water	ug/L	0.24	1	76	126	20		
trans-1,4-Dichloro-2-butene	8260B	Water	ug/L	1.3	2					
Trichloroethene	8260B	Water	ug/L	0.21	1	70	120	20		
Trichlorofluoromethane	8260B	Water	ug/L	0.22	1	62	141	20		
Trichlorotrifluoroethane	8260B	Water	ug/L	0.22	1	50	150	30		
Vinyl acetate	8260B	Water	ug/L	0.47	5	70	130	20		
Vinyl chloride	8260B	Water	ug/L	0.18	1	67	137	20		
Xylenes (total)	8260B	Water	ug/L	0.28	1	76	138	20		
Surrogate										
1,2-Dichloroethane-d4 (surr)	8260B	Water	ug/L						61	131
4-Bromofluorobenzene (surr)	8260B	Water	ug/L						73	122
Dibromofluoromethane (surr)	8260B	Water	ug/L						66	132
Toluene-d8 (surr)	8260B	Water	ug/L						78	128
Method: Volatile Organics (8260B)										
1,1,1,2-Tetrachloroethane	8260B	Solid	ug/Kg	0.73	5	83	123	20		
1,1,1-Trichloroethane	8260B	Solid	ug/Kg	0.61	5	63	133	20		
1,1,2,2-Tetrachloroethane	8260B	Solid	ug/Kg	0.64	5	68	139	20		
1,1,2-Trichloroethane	8260B	Solid	ug/Kg	0.71	5	71	143	20		
1,1-Dichloroethane	8260B	Solid	ug/Kg	0.88	5	63	133	20		
1,1-Dichloroethene	8260B	Solid	ug/Kg	1	5	51	132	20		
1,1-Dichloropropene	8260B	Solid	ug/Kg	0.8	5	78	148	20		
1,2,3-Trichlorobenzene	8260B	Solid	ug/Kg	0.99	5	75	125	20		
1,2,3-Trichloropropane	8260B	Solid	ug/Kg	1.1	5	71	129	20		
1,2,4-Trichlorobenzene	8260B	Solid	ug/Kg	0.79	5	76	127	20		
1,2,4-Trimethylbenzene	8260B	Solid	ug/Kg	0.82	5	74	133	20		
1,2-Dibromo-3-chloropropane	8260B	Solid	ug/Kg	1.1	5	59	124	20		
1,2-Dibromoethane (EDB)	8260B	Solid	ug/Kg	0.76	5	72	133	20		

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
1,2-Dichlorobenzene	8260B	Solid	ug/Kg	0.73	5	85	120	20		
1,2-Dichloroethane	8260B	Solid	ug/Kg	0.58	5	69	125	20		
1,2-Dichloroethene (total)	8260B	Solid	ug/Kg	1.9	5	63	144	20		
1,2-Dichloropropane	8260B	Solid	ug/Kg	0.96	5	76	132	20		
1,3,5-Trichlorobenzene	8260B	Solid	ug/Kg	1	5	70	131	20		
1,3,5-Trimethylbenzene	8260B	Solid	ug/Kg	0.58	5	72	128	20		
1,3-Butadiene	8260B	Solid	ug/Kg	0.93	5					
1,3-Dichlorobenzene	8260B	Solid	ug/Kg	0.91	5	83	122	20		
1,3-Dichloropropane	8260B	Solid	ug/Kg	0.93	5	78	127	20		
1,4-Dichlorobenzene	8260B	Solid	ug/Kg	0.89	5	84	121	20		
1-Chlorohexane	8260B	Solid	ug/Kg	1	5	62	145	20		
2,2-Dichloropropane	8260B	Solid	ug/Kg	1.3	5	67	134	20		
2-Butanone (MEK)	8260B	Solid	ug/Kg	4.2	5	50	150	30		
2-Chloro-1,3-butadiene (chloroprene)	8260B	Solid	ug/Kg	0.68	5					
2-Chloroethylvinylether	8260B	Solid	ug/Kg	0.82	5	10	182	20		
2-Chlorotoluene	8260B	Solid	ug/Kg	1	5	63	137	20		
2-Hexanone	8260B	Solid	ug/Kg	1.7	5	69	140	20		
2-Methylnaphthalene	8260B	Solid	ug/Kg	1.2	5					
2-Nitropropane	8260B	Solid	ug/Kg	139	400					
3-Chloropropene (Allyl Chloride)	8260B	Solid	ug/Kg	2.2	10					
4-Chlorotoluene	8260B	Solid	ug/Kg	0.77	5	76	123	20		
4-Methyl-2-pentanone (MIBK)	8260B	Solid	ug/Kg	3	5	68	134	20		
Acetone	8260B	Solid	ug/Kg	4.1	5	46	167	20		
Acetonitrile	8260B	Solid	ug/Kg	26	40					
Acrolein	8260B	Solid	ug/Kg	38	200					
Acrylonitrile	8260B	Solid	ug/Kg	7	40					
Benzene	8260B	Solid	ug/Kg	0.66	5	72	128	20		
bis(chloromethyl)ether	8260B	Solid	ug/Kg							
Bromobenzene	8260B	Solid	ug/Kg	0.71	5	81	123	20		
Bromochloromethane	8260B	Solid	ug/Kg	0.99	5	68	129	20		
Bromodichloromethane	8260B	Solid	ug/Kg	0.68	5	74	128	20		
Bromoform	8260B	Solid	ug/Kg	0.91	5	78	132	20		
Bromomethane	8260B	Solid	ug/Kg	2.9	5	48	127	20		
Carbon disulfide	8260B	Solid	ug/Kg	2	5	23	138	20		
Carbon tetrachloride	8260B	Solid	ug/Kg	0.83	5	67	127	20		
Chlorobenzene	8260B	Solid	ug/Kg	0.91	5	83	125	20		
Chloroethane	8260B	Solid	ug/Kg	1.6	5	59	163	20		
Chloroform	8260B	Solid	ug/Kg	0.62	5	73	135	20		

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Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
Chloromethane	8260B	Solid	ug/Kg	0.94	5	45	141	20		
cis-1,2-Dichloroethene	8260B	Solid	ug/Kg	1.2	5	68	148	20		
cis-1,3-Dichloropropene	8260B	Solid	ug/Kg	0.79	5	80	124	20		
Cyclohexane	8260B	Solid	ug/Kg		5					
Cyclohexanone	8260B	Solid	ug/Kg	280	400					
Dibromochloromethane	8260B	Solid	ug/Kg	0.69	5	77	127	20		
Dibromomethane	8260B	Solid	ug/Kg	0.69	5	70	130	20		
Dichlorodifluoromethane	8260B	Solid	ug/Kg	0.75	5	43	121	20		
Ethyl acetate	8260B	Solid	ug/Kg	9.9	50					
Ethyl ether	8260B	Solid	ug/Kg	1.2	5	50	150	30		
Ethylbenzene	8260B	Solid	ug/Kg	1.1	5	79	123	20		
Ethylmethacrylate	8260B	Solid	ug/Kg	1.5	10					
Heptane	8260B	Solid	ug/Kg	0.75	5	50	150	30		
Hexachlorobutadiene	8260B	Solid	ug/Kg	1	5	66	127	20		
Hexane	8260B	Solid	ug/Kg	0.61	5	50	150	30		
Iodomethane	8260B	Solid	ug/Kg	3.5	10	50	150	30		
Isobutyl alcohol	8260B	Solid	ug/Kg	84	400					
Isopropyl alcohol	8260B	Solid	ug/Kg							
Isopropyl ether	8260B	Solid	ug/Kg	0.64	5					
Isopropylbenzene	8260B	Solid	ug/Kg	0.75	5	77	118	20		
m&p-Xylenes	8260B	Solid	ug/Kg	2.1	10	79	123	20		
Methacrylonitrile	8260B	Solid	ug/Kg	4.3	10					
Methyl acetate	8260B	Solid	ug/Kg		5					
Methyl cyclohexane	8260B	Solid	ug/Kg		5					
Methylene chloride	8260B	Solid	ug/Kg	1.8	5	58	143	20		
Methylmethacrylate	8260B	Solid	ug/Kg	2	10					
Methyl-tert-butyl-ether (MTBE)	8260B	Solid	ug/Kg	0.64	5	61	132	20		
Naphthalene	8260B	Solid	ug/Kg	1	5	65	132	20		
n-Butyl alcohol (1-Butanol)	8260B	Solid	ug/Kg	178	400					
n-Butylbenzene	8260B	Solid	ug/Kg	0.84	5	65	138	20		
n-Pentane	8260B	Solid	ug/Kg							
n-Propylbenzene	8260B	Solid	ug/Kg	0.86	5	77	124	20		
o-Xylene	8260B	Solid	ug/Kg	0.93	5	80	123	20		
Pentachloroethane	8260B	Solid	ug/Kg	5.4	10					
p-Isopropyltoluene	8260B	Solid	ug/Kg	0.68	5	74	126	20		
Propionitrile	8260B	Solid	ug/Kg	19	40					
sec-Butylbenzene	8260B	Solid	ug/Kg	0.81	5	77	128	20		
Styrene	8260B	Solid	ug/Kg	1	5	85	126	20		

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
tert-Butyl alcohol	8260B	Solid	ug/Kg							
tert-Butylbenzene	8260B	Solid	ug/Kg	0.78	5	79	124	20		
Tetrachloroethene	8260B	Solid	ug/Kg	0.67	5	75	129	20		
Tetrahydrofuran	8260B	Solid	ug/Kg	2.5	5	55	135	20		
Toluene	8260B	Solid	ug/Kg	1	5	75	125	20		
trans-1,2-Dichloroethene	8260B	Solid	ug/Kg	0.94	5	58	139	20		
trans-1,3-Dichloropropene	8260B	Solid	ug/Kg	0.84	5	75	134	20		
trans-1,4-Dichloro-2-butene	8260B	Solid	ug/Kg	2.2	10					
Trichloroethene	8260B	Solid	ug/Kg	0.59	5	75	129	20		
Trichlorofluoromethane	8260B	Solid	ug/Kg	0.71	5	57	135	20		
Trichlorotrifluoroethane	8260B	Solid	ug/Kg	1.8	5	50	150	30		
Vinyl acetate	8260B	Solid	ug/Kg	0.56	5	50	150	30		
Vinyl chloride	8260B	Solid	ug/Kg	0.74	5	58	140	20		
Xylenes (total)	8260B	Solid	ug/Kg	2.9	5	82	125	20		
Surrogate										
1,2-Dichloroethane-d4 (surr)	8260B	Solid	ug/Kg						50	145
4-Bromofluorobenzene (surr)	8260B	Solid	ug/Kg						60	140
Dibromofluoromethane (surr)	8260B	Solid	ug/Kg						60	140
Toluene-d8 (surr)	8260B	Solid	ug/Kg						66	141
Method: Volatile Organics (8260B)										
1,1,1,2-Tetrachloroethane	8260B	High/MeOH	ug/Kg	25.5	100	74	120	30		
1,1,1-Trichloroethane	8260B	High/MeOH	ug/Kg	16.5	100	69	133	30		
1,1,2,2-Tetrachloroethane	8260B	High/MeOH	ug/Kg	18.5	100	70	126	30		
1,1,2-Trichloroethane	8260B	High/MeOH	ug/Kg	31.5	100	67	133	30		
1,1-Dichloroethane	8260B	High/MeOH	ug/Kg	13.5	100	68	119	30		
1,1-Dichloroethene	8260B	High/MeOH	ug/Kg	14	100	44	143	30		
1,1-Dichloropropene	8260B	High/MeOH	ug/Kg	18.5	100	65	134	30		
1,2,3-Trichlorobenzene	8260B	High/MeOH	ug/Kg	49	100	68	117	30		
1,2,3-Trichloropropane	8260B	High/MeOH	ug/Kg	49	100	64	118	30		
1,2,4-Trichlorobenzene	8260B	High/MeOH	ug/Kg	41.5	100	61	117	30		
1,2,4-Trimethylbenzene	8260B	High/MeOH	ug/Kg	23	100	69	122	30		
1,2-Dibromo-3-chloropropane	8260B	High/MeOH	ug/Kg	22.5	100	56	102	30		
1,2-Dibromoethane (EDB)	8260B	High/MeOH	ug/Kg	25.5	100	69	122	30		
1,2-Dichlorobenzene	8260B	High/MeOH	ug/Kg	17	100	76	125	30		
1,2-Dichloroethane	8260B	High/MeOH	ug/Kg	21.5	100	64	115	30		
1,2-Dichloroethene (total)	8260B	High/MeOH	ug/Kg	29	100	60	139	30		
1,2-Dichloropropane	8260B	High/MeOH	ug/Kg	17.5	100	70	122	30		
1,3,5-Trichlorobenzene	8260B	High/MeOH	ug/Kg	29	100	65	113	30		

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Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
1,3,5-Trimethylbenzene	8260B	High/MeOH	ug/Kg	19.5	100	66	125	30		
1,3-Butadiene	8260B	High/MeOH	ug/Kg		100					
1,3-Dichlorobenzene	8260B	High/MeOH	ug/Kg	23	100	75	119	30		
1,3-Dichloropropane	8260B	High/MeOH	ug/Kg	23.5	100	71	118	30		
1,4-Dichlorobenzene	8260B	High/MeOH	ug/Kg	20.5	100	76	127	30		
1-Chlorohexane	8260B	High/MeOH	ug/Kg	22.5	100	63	133	30		
2,2-Dichloropropane	8260B	High/MeOH	ug/Kg	11.5	100	41	131	30		
2-Butanone (MEK)	8260B	High/MeOH	ug/Kg	51	100	40	125	30		
2-Chloro-1,3-butadiene (chloroprene)	8260B	High/MeOH	ug/Kg		100					
2-Chloroethylvinylether	8260B	High/MeOH	ug/Kg	76	100	10	100	30		
2-Chlorotoluene	8260B	High/MeOH	ug/Kg	40.5	100	62	134	30		
2-Hexanone	8260B	High/MeOH	ug/Kg	52	100	50	116	30		
2-Methylnaphthalene	8260B	High/MeOH	ug/Kg		100					
2-Nitropropane	8260B	High/MeOH	ug/Kg		8000					
3-Chloropropene (Allyl Chloride)	8260B	High/MeOH	ug/Kg	17	200					
4-Chlorotoluene	8260B	High/MeOH	ug/Kg	23	100	66	131	30		
4-Methyl-2-pentanone (MIBK)	8260B	High/MeOH	ug/Kg	37.5	100	54	119	30		
Acetone	8260B	High/MeOH	ug/Kg	29	100	34	143	30		
Acetonitrile	8260B	High/MeOH	ug/Kg	522	800					
Acrolein	8260B	High/MeOH	ug/Kg	1473	4000					
Acrylonitrile	8260B	High/MeOH	ug/Kg	307	800					
Benzene	8260B	High/MeOH	ug/Kg	14	100	67	122	30		
bis(chloromethyl)ether	8260B	High/MeOH	ug/Kg							
Bromobenzene	8260B	High/MeOH	ug/Kg	27.5	100	74	133	30		
Bromochloromethane	8260B	High/MeOH	ug/Kg	24.5	100	60	124	30		
Bromodichloromethane	8260B	High/MeOH	ug/Kg	19	100	66	128	30		
Bromoform	8260B	High/MeOH	ug/Kg	18	100	70	123	30		
Bromomethane	8260B	High/MeOH	ug/Kg	10.5	100	36	164	30		
Carbon disulfide	8260B	High/MeOH	ug/Kg	20.5	100	21	124	30		
Carbon tetrachloride	8260B	High/MeOH	ug/Kg	16.5	100	59	127	30		
Chlorobenzene	8260B	High/MeOH	ug/Kg	22	100	80	125	30		
Chloroethane	8260B	High/MeOH	ug/Kg	20	100	33	207	30		
Chloroform	8260B	High/MeOH	ug/Kg	18	100	61	129	30		
Chloromethane	8260B	High/MeOH	ug/Kg	23.5	100	55	129	30		
cis-1,2-Dichloroethene	8260B	High/MeOH	ug/Kg	17	100	64	144	30		
cis-1,3-Dichloropropene	8260B	High/MeOH	ug/Kg	22.5	100	68	123	30		
Cyclohexane	8260B	High/MeOH	ug/Kg		100					
Cyclohexanone	8260B	High/MeOH	ug/Kg		8000					

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
Dibromochloromethane	8260B	High/MeOH	ug/Kg	19	100	70	119	30		
Dibromomethane	8260B	High/MeOH	ug/Kg	22.5	100	67	121	30		
Dichlorodifluoromethane	8260B	High/MeOH	ug/Kg	12	100	29	135	30		
Ethyl acetate	8260B	High/MeOH	ug/Kg	108	1000					
Ethyl ether	8260B	High/MeOH	ug/Kg	19	100	10	135	30		
Ethylbenzene	8260B	High/MeOH	ug/Kg	22.5	100	78	128	30		
Ethylmethacrylate	8260B	High/MeOH	ug/Kg	24	200					
Heptane	8260B	High/MeOH	ug/Kg	38	100	10	119	30		
Hexachlorobutadiene	8260B	High/MeOH	ug/Kg	38.5	100	63	126	30		
Hexane	8260B	High/MeOH	ug/Kg	27.5	100	10	108	30		
Iodomethane	8260B	High/MeOH	ug/Kg	25.5	200	50	150	30		
Isobutyl alcohol	8260B	High/MeOH	ug/Kg	3740	8000					
Isopropyl alcohol	8260B	High/MeOH	ug/Kg							
Isopropyl ether	8260B	High/MeOH	ug/Kg	9.5	100					
Isopropylbenzene	8260B	High/MeOH	ug/Kg	20	100	67	133	30		
m&p-Xylenes	8260B	High/MeOH	ug/Kg	50	200	76	133	30		
Methacrylonitrile	8260B	High/MeOH	ug/Kg	40.5	200					
Methyl acetate	8260B	High/MeOH	ug/Kg		100					
Methyl cyclohexane	8260B	High/MeOH	ug/Kg		100					
Methylene chloride	8260B	High/MeOH	ug/Kg	20	100	57	129	30		
Methylmethacrylate	8260B	High/MeOH	ug/Kg	19	200					
Methyl-tert-butyl-ether (MTBE)	8260B	High/MeOH	ug/Kg	30.5	100	47	126	30		
Naphthalene	8260B	High/MeOH	ug/Kg	38	100	51	158	30		
n-Butyl alcohol (1-Butanol)	8260B	High/MeOH	ug/Kg	8000	8000					
n-Butylbenzene	8260B	High/MeOH	ug/Kg	18.5	100	64	118	30		
n-Pentane	8260B	High/MeOH	ug/Kg							
n-Propylbenzene	8260B	High/MeOH	ug/Kg	27.5	100	69	130	30		
o-Xylene	8260B	High/MeOH	ug/Kg	23.5	100	74	127	30		
Pentachloroethane	8260B	High/MeOH	ug/Kg	83	200					
p-Isopropyltoluene	8260B	High/MeOH	ug/Kg	23.5	100	68	129	30		
Propionitrile	8260B	High/MeOH	ug/Kg	360	800					
sec-Butylbenzene	8260B	High/MeOH	ug/Kg	20.5	100	69	139	30		
Styrene	8260B	High/MeOH	ug/Kg	28.5	100	80	129	30		
tert-Butyl alcohol	8260B	High/MeOH	ug/Kg							
tert-Butylbenzene	8260B	High/MeOH	ug/Kg	13.5	100	71	125	30		
Tetrachloroethene	8260B	High/MeOH	ug/Kg	23	100	75	125	30		
Tetrahydrofuran	8260B	High/MeOH	ug/Kg	43	100	36	132	30		
Toluene	8260B	High/MeOH	ug/Kg	18	100	72	123	30		

STL Chicago
Method Limit Report

Project:
Updated: 3/4/02

Method Description	Analytical Method	Test Matrix	Units	MDL	Lab RL	LCL	UCL	RPD	SLL	SUL
trans-1,2-Dichloroethene	8260B	High/MeOH	ug/Kg	13.5	100	66	138	30		
trans-1,3-Dichloropropene	8260B	High/MeOH	ug/Kg	19.5	100	60	115	30		
trans-1,4-Dichloro-2-butene	8260B	High/MeOH	ug/Kg	30.5	200					
Trichloroethene	8260B	High/MeOH	ug/Kg	21.5	100	70	123	30		
Trichlorofluoromethane	8260B	High/MeOH	ug/Kg	19.5	100	59	145	30		
Trichlorotrifluoroethane	8260B	High/MeOH	ug/Kg	15	100	50	150	30		
Vinyl acetate	8260B	High/MeOH	ug/Kg	32	100	54	144	30		
Vinyl chloride	8260B	High/MeOH	ug/Kg	18	100	61	135	30		
Xylenes (total)	8260B	High/MeOH	ug/Kg	50	100	77	131	30		
Surrogate										
1,2-Dichloroethane-d4 (surr)	8260B	High/MeOH	ug/Kg						43	139
4-Bromofluorobenzene (surr)	8260B	High/MeOH	ug/Kg						57	124
Dibromofluoromethane (surr)	8260B	High/MeOH	ug/Kg						64	132
Toluene-d8 (surr)	8260B	High/MeOH	ug/Kg						70	128

Notes:

MDLs will vary based on annual performance.

RLs will vary based on sample volume/size; dilution factors; dry weight reporting (soils) and annual MDL determinations.

Table 2

Characteristic Mass (m/z) for Purgeable Organic Compounds

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion
Benzene	78	—
Bromobenzene	156	77,158
Bromochloromethane	128	49,130
Bromodichloromethane	83	85,127
Bromoform	173	175,254
Bromomethane	94	96
n-Butylbenzene	91	92,134
sec-Butylbenzene	105	134
tert-Butylbenzene	119	91,134
Carbon tetrachloride	117	119
Chlorobenzene	112	77,114
Chloroethane	64	66
Chloroform	83	85
Chloromethane	50	52
2-Chlorotoluene	91	126
4-Chlorotoluene	91	126
1,2-Dibromo-3-chloropropane	75	155,157
Dibromochloromethane	129	127
1,2-Dibromoethane	107	109,188
Dibromomethane	93	95,174
1,2-Dichlorobenzene	146	111,148
1,3-Dichlorobenzene	146	111,148
1,4-Dichlorobenzene	146	111,148
Dichlorodifluoromethane	85	87
1,1-Dichloroethane	63	65,83
1,2-Dichloroethane	62	98
1,1-Dichloroethene	96	61,63
cis-1,2-Dichloroethene	96	61,98
trans-1,2-Dichloroethene	96	61,98
1,2-Dichloropropane	63	112
1,3-Dichloropropane	76	78
2,2-Dichloropropane	77	97
1,1-Dichloropropene	75	110,77
Ethylbenzene	91	106
Hexachlorobutadiene	225	223,227
Isopropylbenzene	105	120
p-Isopropylbenzene	119	134, 91
Methylene chloride	84	86,49
Naphthalene	128	86, 49
n-Propylbenzene	91	120
Styrene	104	78
1,1,1,2-Tetrachloroethane	131	133, 119
1,1,2,2-Tetrachloroethane	83	131, 85
Tetrachloroethene	164	129,131,166

Table 2
(continued)
Characteristic Mass (m/z) for Purgeable Organic Compounds

Analyte	Primary Characteristic Ion*	Secondary Characteristic Ion*
Toluene	92	91
1,2,3-Trichlorobenzene	180	182, 145
1,2,4-Trichlorobenzene	180	182, 145
1,1,1-Trichloroethane	97	99, 61
1,1,2-Trichloroethane	83	97, 85
Trichloroethene	95	97, 130, 132
Trichlorofluoromethane	151	101,153
1,2,3-Trichloropropane	75	77
1,2,4-Trimethylbenzene	105	120
1,3,5-Trimethylbenzene	105	120
Vinyl chloride	62	64
o-Xylene	106	91
m-Xylene	106	91
p-Xylene	106	91
cis-1,3-Dichloropropene	75	77, 39
trans-1,3-Dichloropropene	75	77, 39
Internal Std./Surrogates		
4-Bromofluorobenzene (S)	95	174, 176
1,4-Dichlorobenzene-d_4 (IS)	152	115, 150
Pentafluorobenzene (IS)	168	
Chlorobenzene-d_5 (IS)	117	
1,4-Difluorobenzene (IS)	114	
1,2-Dichloroethane-d_4 (S)	65	
Toluene-d_8 (S)	98	
Dibromofluoromethane (S)	113	

*NOTE: The primary and secondary ions listed here are taken directly from SW-846 Method 8260. The laboratory uses secondary ions in the cases of Ethylbenzene, Toluene, 1,1,2-Trichloroethane, Trichloroethene, 1,2,3-Trichloropropane and Xylenes due to interferences and/or to maintain consistency between methods.

Figure 1.

Example: Total Ion Chromatogram for 25 mL Purge Water

Data File: /var/chem/gc13.i/101802.b/3c1017.d

Date : 18-OCT-2002 08:19

Client ID: VSTD010

Sample Info: CV V02J18DAA

Purge Volume: 25.0

Column phase: Cap

Instrument: gc13.i

Operator: DCT

Column diameter: 0.53

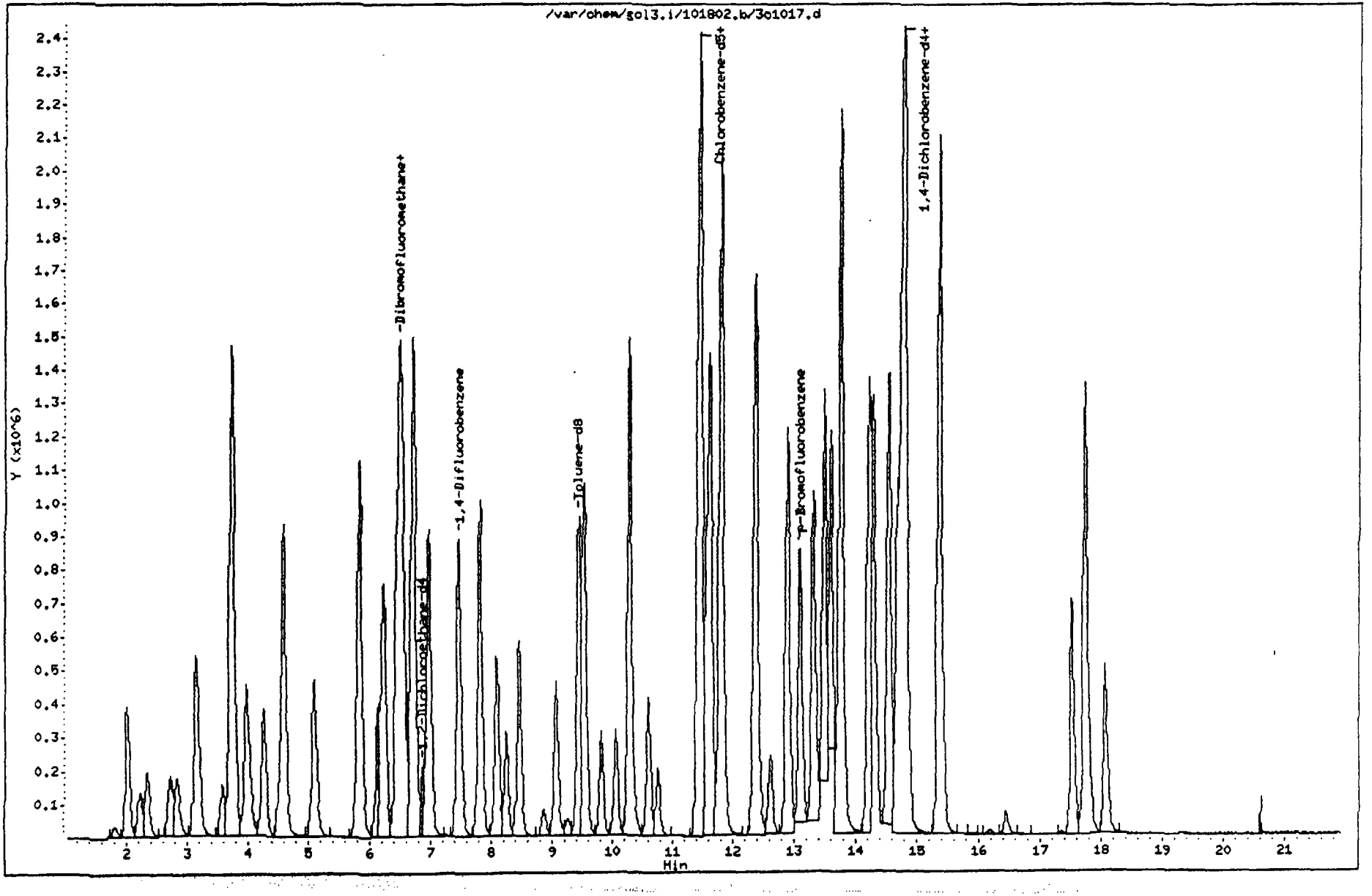


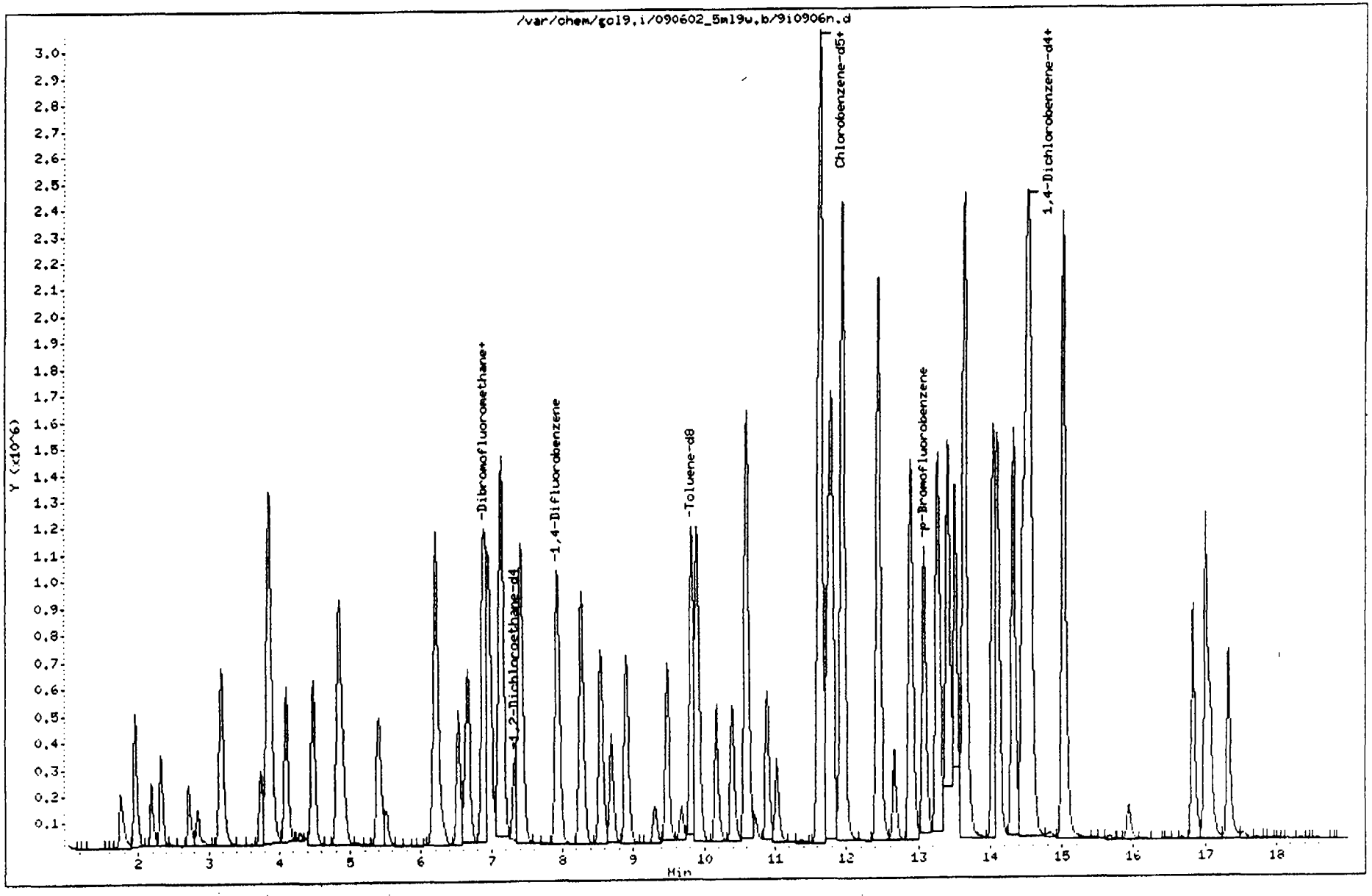
Figure 2.

Example: Total Ion Chromatogram for 5 mL Purge Soil

Data File: /var/chem/gc19.i/090602_5ml9w.b/9i0906n.d
Date : 06-SEP-2002 06:25
Client ID: VSTD050
Sample Info: VSTD050
Purge Volume: 5.0
Column phase: Cap

Instrument: gc19.i

Operator: LH
Column diameter: 0.53



Attachment 1.

Example: Method Listings; Tekmar Conditions; Flow Settings

Example: Volatiles Method for Standards and Samples

GC Oven Parameters

Initial Temperature = 40 °C
Initial Time = 2.0 minutes
Detector A Temperature = 180 °C
Detector B Temperature = 250 °C
Oven Equib. Time = 0.50 min.

Ramp Rate (°C/min.)	Final Temp. (°C)	Final Time (min.)
7.0	65	0.00
12.0	165	0.00
20.0	212	5.00

Run Time = 21.25 min.

Inlet Pressure Program

Gas = Helium
Column length = 75 m
Column Diameter = 0.530 mm
Initial Pressure = 3 psi
Rate (psi/min) = 0.00
Initial Time = 7.0 min.
Oven Temp. 50 °C
Program Time = 7.0 min.

Scan Parameters

Mass Range = 35-260
Threshold = 150
Scans/sec = 1.9
EM Voltage = 1938
Solvent Delay = 3.14 (scan start time): before the elution of the first compound.
Run Time (scan stop time): until after the elution of last compound.

Example: Volatiles Method for BFB Tune

GC Oven Parameters

Initial Temperature = 40 °C
Initial Time = 2.0 minutes
Detector A Temperature = 180 °C
Detector B Temperature = 250 °C
Oven Equib. Time = 0.50 min.

Ramp Rate (°C/min.)	Final Temp. (°C)	Final Time (min.)
7.0	65	0.00
12.0	165	0.00
20.0	212	5.00

Run Time = 16.25 min.

Inlet Pressure Program

Gas = Helium
Column length = 75 m
Column Diameter = 0.530 mm
Initial Pressure = 3 psi
Rate (psi/min) = 0.00
Initial Time = 7.0 min.
Oven Temp. 50 °C
Program Time = 7.0 min.

Scan Parameters

Mass Range = 35-260
Threshold = 150
Scans/sec = 1.9
EM Voltage = 1938
Solvent Delay = 10 min. (scan start time): before the elution of the first compound.
Run Time (scan stop time): until after the elution of last compound.

Tekmar Conditions

Trap Temp. Prior to Purge	< 35
Desorb Preheat	250
Desorb	250
Bake	260
Purge Time	11 min
Desorb	2 min
Bake Time	4 min

Trap = Vocarb 3000

Flow Conditions

Purge Pressure	20 psi
Purge Flow Rate	~40 mLs/min

Flow Adjustment

Capillary Column: 5971/5972/MSD's;

· Make-up gas off/separator pump on: flow through separator is 5-10 mLs/minutes.

· Open make-up gas: adjust until you achieve ~30 mLs/minute through the separator. (On MSD's - adjust to 0.5 torr on gauge)

(Flow into the Mass Spec is ≤ 1 mL/minute)

Approximate Vacuums

5971	~5 x 10^{-6} torr
5972	~5 x 10^{-6} torr

Attachment 2.

Example: Target and Internal Standards;
Initial Calibration/Continuing Calibration
Surrogate Recovery Limits; LCS / MS Recovery Limits
Internal Standard Guidelines

Target and Internal Standards

Pentafluorobenzene
Acetone
Acrolein
Acrylonitrile
Bromochloromethane
Bromomethane
2-Butanone
Carbon disulfide
Chloroethane
Chloroform
Chloromethane
Dichlorodifluoromethane
1,1-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
2,2-Dichloropropane
Iodomethane
Methylene chloride
1,1,1-Trichloroethane
Trichlorofluoromethane
Vinyl acetate
Vinyl Chloride

Chlorobenzene-d_5
Bromoform
Bromofluorobenzene (surrogate)
Chlorodibromomethane
Chlorobenzene
1,3-Dichloropropane
Ethylbenzene
2-Hexanone
Styrene
1,1,1,2-Tetrachloroethane
Tetrachloroethene
Xylene

1,4-Difluorobenzene
Benzene
Bromodichloromethane
Carbon tetrachloride
2-Chloroethyl vinyl ether
1,2-Dibromoethane
Dibromomethane
1,2-Dichloroethane
1,2-Dichloroethane-d_4 (surrogate)
1,2-Dichloropropane
1,1-Dichloropropene
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
4-Methyl-2-pentanone
Toluene
Toluene-d_8 (surrogate)
1,1,2-Trichloroethane
Trichloroethene

1,4-Dichlorobenzene-d_4
Bromobenzene
n-Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
2-Chlorotoluene
4-Chlorotoluene
1,2-Dibromo-3-chloropropane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Hexachlorobutadiene
Isopropyl benzene
p-Isopropyltoluene
Naphthalene
n-Propylbenzene
1,1,2,2-Tetrachloroethane
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
End Cal Date : 04-SEP-2002 05:13
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Calibration File Names:
Level 1: /var/chem/gc16.i/090402_25ml6w_ical2.b/6i0904.d
Level 2: /var/chem/gc16.i/090402-25ml6w_ical2.b/6i0904a.d
Level 3: /var/chem/gc16.i/090402-25ml6w_ical2.b/6i0904b.d
Level 4: /var/chem/gc16.i/090402-25ml6w_ical2.b/6i0904c.d
Level 5: /var/chem/gc16.i/090402-25ml6w_ical2.b/6i0904d.d
Level 6: /var/chem/gc16.i/090402-25ml6w_ical2.b/6i0904e.d
Level 7: /var/chem/gc16.i/090402-25ml6w_ical2.b/6i0904f.d
Level 8: /var/chem/gc16.i/090402-25ml6w_ical2.b/6i0904g.d
Level 9: /var/chem/gc16.i/090402_25ml6w_ical2.b/6i0904h.d

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
1 Dichlorodifluoromethane	39157 1337714	71069 2115698	139450 4000493	346832	800413	1070808	LINR	0.04663	0.52169		0.99787
2 Chloromethane	0.33705 0.27310	0.30726 0.27412	0.28187 0.27691	0.26440	0.28090	0.27369	AVRG		0.28548		7.93729
3 2-Propanol	+++++ +++++	+++++ +++++	+++++ +++++	+++++	+++++	+++++	AVRG		0.000e+00		0.000e+00 <!
4 Vinyl chloride	0.33399 0.34067	0.33547 0.34890	0.32629 0.35023	0.32674	0.33838	0.35039	AVRG		0.33901		2.77218
5 1,3-Butadiene	+++++ 0.16454	0.19071 0.16167	0.16517 0.15891	0.15550	0.17524	0.17008	AVRG		0.16773		6.65034

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
End Cal Date : 04-SEP-2002 05:13
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	ml	m2	%RSD or R^2
6 Bromomethane	0.23835	0.23980	0.17896	0.20284	0.22226	0.23954					
	0.25249	0.25844	0.29868				AVRG		0.23682		14.37674
7 Chloroethane	0.21870	0.21455	0.21124	0.20788	0.20578	0.20705					
	0.20279	0.20547	0.21123				AVRG		0.20941		2.38673
8 tert-Butyl alcohol	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
9 Trichlorofluoromethane	0.83703	0.81527	0.78708	0.78714	0.75862	0.79943					
	0.74508	0.79775	0.78188				AVRG		0.78992		3.49126
10 Ethyl ether	+++++	0.08362	0.07579	0.07203	0.08150	0.07721					
	0.07591	0.07506	0.07547				AVRG		0.07708		4.84254
11 Acrolein	+++++	0.00421	0.00411	0.00405	0.00398	0.00415					
	0.00435	0.00405	0.00427				AVRG		0.00414		3.00288
12 Trichlorotrifluoroethane	0.76959	0.75887	0.71293	0.72786	0.73643	0.73957					
	0.76697	0.73146	0.75768				AVRG		0.74460		2.62127
13 1,1 Dichloroethene	0.33191	0.34084	0.31363	0.32090	0.32449	0.31844					
	0.33942	0.32259	0.33517				AVRG		0.32749		2.95473
14 Acetone	+++++	9564	21917	23823	32764	40741					
	48500	64187	124629				LINR	-0.27751	0.01485		0.99517

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
End Cal Date : 04-SEP-2002 05:13
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
15 Iodomethane	+++++	0.48722	0.52068	0.66488	0.67114	0.71473					
	0.70443	0.70106	0.73275				AVRG		0.64961		14.31034
16 Carbon Disulfide	+++++	1.04025	1.04085	1.03106	1.01126	1.04452					
	1.08102	1.06338	1.11121				AVRG		1.05294		2.97886
17 3-Chloropropene	+++++	0.13576	0.13166	0.14736	0.13622	0.13873					
	0.13252	0.13223	0.13263				AVRG		0.13589		3.86439
18 Acetonitrile	+++++	0.00333	0.00306	0.00302	0.00292	0.00301					
	0.00313	0.00293	0.00317				AVRG		0.00307		4.45171
19 Methyl acetate	+++++	0.04115	0.04185	0.03764	0.03939	0.03823					
	0.03828	0.03689	0.03641				AVRG		0.03873		5.01965
20 Methylene chloride	61630	83247	134095	257213	384502	480778					
	657833	890236	1804838				LINR	-0.07949	0.22395		0.99901
21 Acrylonitrile	+++++	0.01252	0.01237	0.01190	0.01165	0.01193					
	0.01289	0.01209	0.01304				AVRG		0.01230		4.02194
22 trans-1,2-Dichloroethene	0.37667	0.37477	0.36652	0.37254	0.36192	0.36342					
	0.38164	0.36427	0.38282				AVRG		0.37162		2.13406
23 Methyl-tert-Butyl Ether	0.19519	0.19754	0.18760	0.19308	0.17962	0.18467					
	0.18447	0.18778	0.20188				AVRG		0.19020		3.77049

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
End Cal Date : 04-SEP-2002 05:13
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	ml	m2	%RSD or R^2
24 Hexane	+++++	0.47742	0.45314	0.44029	0.49657	0.47793					
	0.46598	0.46287	0.46209				AVRG		0.46704		3.66451
25 1,1-Dichloroethane	0.63074	0.65386	0.64187	0.64979	0.62827	0.61320					
	0.65432	0.62062	0.65801				AVRG		0.63896		2.55271
26 Isopropyl ether	+++++	0.69384	0.66336	0.63824	0.72288	0.69174					
	0.67710	0.67794	0.68170				AVRG		0.68085		3.59695
27 Vinyl Acetate	+++++	0.10934	0.10342	0.10442	0.09682	0.10672					
	0.11132	0.11140	0.11356				AVRG		0.10713		5.10756
28 2-Chloro-1,3-butadiene	+++++	0.49643	0.48947	0.47927	0.54544	0.52427					
	0.52092	0.51603	0.51800				AVRG		0.51123		4.19320
29 cis-1,2-Dichloroethene	0.33006	0.31885	0.31590	0.32003	0.31505	0.30871					
	0.32918	0.31067	0.32844				AVRG		0.31966		2.50455
30 2,2-Dichloropropane	0.55090	0.55456	0.53095	0.54062	0.52930	0.51855					
	0.54667	0.51410	0.53199				AVRG		0.53529		2.61558
31 2-Butanone	+++++	0.02741	0.02302	0.02200	0.02132	0.02174					
	0.02167	0.02058	0.02114				AVRG		0.02236		9.66688
32 Ethyl Acetate	0.06503	0.05755	0.05476	0.05905	0.05625	0.05647					
	0.05804	0.05488	0.04197				AVRG		0.05600		10.88497

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
End Cal Date : 04-SEP-2002 05:13
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
33 Propionitrile	+++++	0.00332	0.00329	0.00327	0.00329	0.00338					
	0.00356	0.00336	0.00349				AVRG		0.00337		3.08896
34 Methacrylonitrile	+++++	0.03048	0.02925	0.03130	0.02931	0.03026					
	0.02805	0.02835	0.02859				AVRG		0.02945		3.87174
35 Bromochloromethane	0.14712	0.14945	0.14583	0.15098	0.14811	0.14596					
	0.15315	0.14711	0.15547				AVRG		0.14924		2.24709
36 Tetrahydrofuran	0.01458	0.01290	0.01215	0.01143	0.01127	0.01126					
	0.01128	0.01133	0.01236				AVRG		0.01206		9.24601
37 Chloroform	0.59355	0.59702	0.60304	0.61248	0.60630	0.58623					
	0.62611	0.58572	0.61988				AVRG		0.60337		2.36083
40 1,1,1-Trichloroethane	0.63602	0.63397	0.61618	0.62727	0.61453	0.60379					
	0.63444	0.61039	0.63361				AVRG		0.62336		1.96215
41 Cyclohexane	+++++	0.61584	0.56015	0.55126	0.63389	0.60884					
	0.58981	0.57444	0.57430				AVRG		0.58856		4.89600
M 42 1,2-Dichloroethene (total)	0.35336	0.34681	0.34121	0.34629	0.33849	0.33607					
	0.35541	0.33747	0.35563				AVRG		0.34564		2.25460
43 1,1-Dichloropropene	0.58998	0.56290	0.54002	0.55507	0.53943	0.54123					
	0.56771	0.53644	0.56076				AVRG		0.55484		3.17416

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
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Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2	
44 Carbon tetrachloride	0.49844	0.51861	0.52698	0.53588	0.54359	0.54050						
	0.56030	0.54585	0.55748				AVRG		0.53640		3.62204	
45 Isobutanol	+++++	51678	86762	159054	246620	268229						
	395231	552369	855921				LINR	-4.33380	0.00138		0.99450	
47 Benzene	0.70232	0.68295	0.68810	0.67813	0.68193	0.68489						
	0.70878	0.67154	0.69919				AVRG		0.68865		1.77758	
48 1,2-Dichloroethane	0.15378	0.15130	0.15211	0.15301	0.15256	0.14861						
	0.15326	0.14900	0.15233				AVRG		0.15177		1.20527	
49 Heptane	+++++	0.45805	0.45648	0.42780	0.51395	0.49157						
	0.47962	0.47516	0.46437				AVRG		0.47087		5.47216	
51 Crotononitrile	+++++	+++++	+++++	+++++	+++++	+++++						
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00	<-
52 n-Butanol	+++++	0.00084	0.00090	0.00089	0.00091	0.00088						
	0.00082	0.00088	0.00091				AVRG		0.00088		3.61232	<-
53 Trichloroethene	0.43224	0.41530	0.41755	0.42077	0.43010	0.42709						
	0.44027	0.42384	0.43293				AVRG		0.42668		1.89372	
54 Methyl cyclohexane	+++++	0.43094	0.42949	0.42248	0.48429	0.47589						
	0.45846	0.45464	0.44922				AVRG		0.45067		4.94594	

INITIAL CALIBRATION DATA

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Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
55 1,2-Dichloropropane	0.26763 0.27352	0.25355 0.25464	0.24897 0.26446	0.25365	0.26017	0.25860	AVRG		0.25946		3.02396
56 Methylmethacrylate	+++++ 0.05123	0.04897 0.05219	0.05007 0.05260	0.05367	0.05107	0.05352	AVRG		0.05166		3.18548
57 Dibromomethane	0.13296 0.14346	0.13502 0.13463	0.13056 0.14008	0.13674	0.14013	0.13845	AVRG		0.13689		2.94960
58 Bromodichloromethane	0.35060 0.41350	0.35932 0.38745	0.35813 0.40545	0.38080	0.40075	0.39491	AVRG		0.38343		5.93503
59 2-Nitropropane	+++++ 0.01076	0.00745 0.01107	0.00808 0.01118	0.01015	0.01038	0.01113	AVRG		0.01002		14.48459 <-
60 2-Chloroethylvinylether	+++++ 0.05841	0.05348 0.05675	0.05546 0.05895	0.05265	0.05730	0.05820	AVRG		0.05640		4.14094
61 cis-1,3-Dichloropropene	0.27279 0.29986	0.26454 0.27833	0.27235 0.29180	0.27242	0.29143	0.28507	AVRG		0.28095		4.15805
62 4-Methyl-2-pentanone	+++++ 0.05127	0.04393 0.04803	0.04801 0.04879	0.04592	0.04716	0.05058	AVRG		0.04796		4.95596
64 Toluene	0.51253 0.51041	0.48385 0.47512	0.47090 0.49422	0.48241	0.49247	0.48724	AVRG		0.48991		2.91980

INITIAL CALIBRATION DATA

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Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
65 trans-1,3-Dichloropropene	0.16082	0.16338	0.16087	0.16413	0.17941	0.17579					
	0.18413	0.17201	0.18008				AVRG		0.17118		5.30878
66 Bis(chloromethyl)ether	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
67 Ethylmethacrylate	+++++	0.13810	0.13752	0.15459	0.14804	0.14974					
	0.14641	0.14517	0.14867				AVRG		0.14603		3.96212
68 1,1,2-Trichloroethane	0.13251	0.13561	0.13344	0.13623	0.14149	0.13817					
	0.14394	0.13181	0.13924				AVRG		0.13694		3.02214
69 Tetrachloroethene	0.64754	0.61450	0.61012	0.60808	0.63078	0.64273					
	0.65249	0.61841	0.62254				AVRG		0.62747		2.65728
70 1,3-Dichloropropane	0.27671	0.26638	0.26184	0.26338	0.27963	0.27891					
	0.28467	0.26755	0.27006				AVRG		0.27212		2.96658
71 2-Hexanone	+++++	0.03946	0.03984	0.04169	0.04336	0.04725					
	0.04388	0.04405	0.04406				AVRG		0.04295		5.92456
72 Dibromochloromethane	0.32972	0.33044	0.33807	0.36214	0.39859	0.39047					
	0.40848	0.39372	0.39643				AVRG		0.37201		8.61171
73 1,2-Dibromoethane	0.17099	0.16916	0.16973	0.17168	0.18323	0.18300					
	0.18819	0.17580	0.18172				AVRG		0.17706		4.00533

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
End Cal Date : 04-SEP-2002 05:13
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	ml	m2	%RSD or R^2
74 1-Chlorohexane	0.54281	0.50632	0.48831	0.48792	0.46229	0.47937					
	0.47406	0.49425	0.53410				AVRG		0.49660		5.40703
76 Chlorobenzene	0.91801	0.84232	0.83922	0.85452	0.90675	0.89054					
	0.92204	0.86387	0.87376				AVRG		0.87900		3.61105
77 1,1,1,2-Tetrachloroethane	0.38736	0.38448	0.38813	0.40500	0.43920	0.42882					
	0.44083	0.41949	0.42308				AVRG		0.41293		5.42031
78 Ethylbenzene	0.46863	0.44438	0.43900	0.44868	0.46893	0.46974					
	0.48635	0.45370	0.46020				AVRG		0.45996		3.25757
79 p,m-Xylene	1.08360	1.02516	1.03021	1.02647	1.09248	1.10006					
	1.14091	1.05148	1.08004				AVRG		1.07005		3.70207
80 o-Xylene	1.03543	0.94634	0.93975	0.96149	1.02903	1.02348					
	1.06366	0.98746	0.99964				AVRG		0.99848		4.31239
81 Styrene	0.72784	0.69309	0.67601	0.70486	0.77158	0.76385					
	0.79388	0.73651	0.75509				AVRG		0.73586		5.31379
82 Bromoform	0.13141	0.13387	0.14083	0.15492	0.17588	0.17323					
	0.17993	0.17198	0.17501				AVRG		0.15967		12.29971
83 Isopropylbenzene	3.85331	3.74328	3.61636	3.65693	3.84165	3.82441					
	3.94888	3.82941	3.79850				AVRG		3.79030		2.71579

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
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Quant Method : ISID
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Integrator : HP RTE
Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	ml	m2	%RSD or R^2
84 Cyclohexanone	+++++	0.01439	0.01223	0.01183	0.01423	0.00835					
	0.00906	0.01131	0.01240				AVRG		0.01172		18.45670
86 1,1,2,2-Tetrachloroethane	0.43627	0.43994	0.41435	0.41608	0.44764	0.45138					
	0.46530	0.44661	0.44170				AVRG		0.43992		3.69894
87 Bromobenzene	0.83789	0.80309	0.78335	0.79138	0.85110	0.83909					
	0.85552	0.83495	0.81701				AVRG		0.82371		3.17448
88 trans-1,4-Dichloro-2-butene	+++++	0.04006	0.03397	0.04035	0.03915	0.03997					
	0.04040	0.04158	0.04223				AVRG		0.03971		6.32488
89 1,2,3-Trichloropropane	0.11264	0.10836	0.09902	0.10156	0.11283	0.10773					
	0.11045	0.10908	0.10663				AVRG		0.10759		4.34425
90 n-Propylbenzene	4.71647	4.43560	4.27986	4.32397	4.62684	4.61627					
	4.75229	4.49461	4.55052				AVRG		4.53294		3.62943
91 2-Chlorotoluene	2.79144	2.67380	2.59295	2.60773	2.75970	2.75567					
	2.82818	2.67041	2.70430				AVRG		2.70935		2.98199
92 1,3,5-Trimethylbenzene	2.74484	2.60556	2.54395	2.62663	2.79334	2.76719					
	2.86563	2.70901	2.73931				AVRG		2.71061		3.73369
93 4-Chlorotoluene	2.99357	2.74676	2.74577	2.71983	2.85795	2.88932					
	2.97619	2.78664	2.79864				AVRG		2.83496		3.55440

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Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
94 tert-Butylbenzene	3.35689 3.41903	3.24019 3.27619	3.08606 3.28595	3.15558	3.32478	3.30799	AVRG		3.27252		3.09850
95 Pentachloroethane	+++++ 0.22747	0.17963 0.22370	0.19286 0.22641	0.21705	0.21213	0.23532	AVRG		0.21432		8.86035
96 1,2,4-Trimethylbenzene	2.54668 2.63501	2.39968 2.43782	2.36464 2.45373	2.40152	2.54693	2.55818	AVRG		2.48269		3.69682
97 sec-Butylbenzene	4.91570 4.94519	4.59409 4.69174	4.42433 4.74716	4.53056	4.75875	4.77394	AVRG		4.70905		3.62438
98 1,3-Dichlorobenzene	1.57285 1.63299	1.51503 1.56874	1.47793 1.55730	1.48569	1.58959	1.58054	AVRG		1.55341		3.27954
99 p-Isopropyltoluene	3.52675 3.67306	3.30374 3.48773	3.29214 3.50119	3.33214	3.50086	3.54397	AVRG		3.46240		3.68067
101 1,4-Dichlorobenzene	1.65683 1.57175	1.54618 1.48176	1.44381 1.50972	1.43190	1.53119	1.52426	AVRG		1.52193		4.48828
102 n-Butylbenzene	3.61517 3.46513	2.95755 3.19926	3.00693 3.23011	3.03937	3.30688	3.36131	AVRG		3.24241		6.78055
103 1,2-Dichlorobenzene	1.19871 1.19659	1.10039 1.13386	1.05455 1.12951	1.08662	1.17411	1.15897	AVRG		1.13814		4.44649

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Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1 / 14 Level 7	1 Level 2 / 20 Level 8	2 Level 3 / 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
104 1,2-Dibromo-3-Chloropropane	3265 63888	5189 88583	8960 173297	19793	37720	47332	LINR	-0.03792	0.06187		0.99867
M 105 Xylene (total)	1.03543 1.06366	0.94634 0.98746	0.93975 0.99964	0.96149	1.02903	1.02348	AVRG		0.99848		4.31239
106 1,3,5-Trichlorobenzene	+++++ 1.21573	1.04319 1.18781	1.08304 1.19108	1.05171	1.22476	1.21747	AVRG		1.15185		6.81249
107 1,2,4-Trichlorobenzene	0.73967 0.74564	0.66124 0.71705	0.66396 0.71889	0.68413	0.72302	0.74928	AVRG		0.71143		4.75110
108 Hexachlorobutadiene	1.04898 1.00436	0.87466 0.95111	0.90546 0.94848	0.91523	0.96182	0.98593	AVRG		0.95511		5.59204
109 Naphthalene	0.61701 0.55214	0.42357 0.48929	0.43206 0.51793	0.44234	0.50338	0.52861	AVRG		0.50070		12.52319
110 1,2,3-Trichlorobenzene	0.54795 0.54786	0.48344 0.51428	0.47340 0.51555	0.48008	0.53329	0.53322	AVRG		0.51434		5.65770
111 2-Methylnaphthalene	+++++ 215823	8562 314686	12605 584747	49429	113968	154109	LINR	0.06389	0.22119		0.99671

INITIAL CALIBRATION DATA

Start Cal Date : 03-SEP-2002 16:36
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Method file : /var/chem/gc16.i/090402_25ml6w_ical2.b/25ml6w.m
Cal Date : 20-Sep-2002 11:40 beeson

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
$ 38 Dibromofluoromethane	0.62426	0.62689	0.59883	0.58905	0.57449	0.58121					
	0.60429	0.59655	0.63566				AVRG		0.60347		3.52983
$ 46 1,2-Dichloroethane-d4	0.13821	0.14374	0.13568	0.12921	0.13110	0.13482					
	0.13518	0.13361	0.13877				AVRG		0.13559		3.18286
$ 63 Toluene-d8	0.79815	0.80377	0.79859	0.77898	0.78005	0.80514					
	0.82448	0.81143	0.85300				AVRG		0.80595		2.81106
$ 85 p-Bromofluorobenzene	0.66688	0.60303	0.58396	0.59553	0.58209	0.59800					
	0.60057	0.59267	0.61080				AVRG		0.60373		4.19427

INITIAL CALIBRATION DATA

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Target Version : 3.50
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Cal Date : 20-Sep-2002 11:40 beeson

Average %RSD Results.

Calculated Average %RSD = 4.79873943
Maximun Average %RSD = 15
* Passed Average %RSD Test.

Curve	Formula	Units
Averaged	Amt = Rsp/ml	Response
Linear	Amt = b + Rsp/ml	Response

CONTINUING CALIBRATION COMPOUNDS

Instrument ID: gcl3.i
Lab File ID: 3c1017.d
Analysis Type: WATER
Lab Sample ID: VSTD010
Method: /var/chem/gcl3.i/101802.b/hydr3w.m

Injection Date: 18-OCT-2002 08:19
Init. Cal. Date(s): 09-OCT-2002 18-OCT-2002
Init. Cal. Times: 01:03 04:12
Quant Type: ISTD

	COMPOUND	RRF / AMOUNT	RF10	CCAL RRF10	MIN RRF	%D / %DRIFT	MAX %D / %DRIFT	CURVE TYPE	
	1 Dichlorodifluoromethane	0.56178	0.54856	0.54856	0.010	2.35379	25.00000	Averaged	
	2 Chloromethane	0.25846	0.24058	0.24058	0.100	6.91980	25.00000	Averaged	
	3 Vinyl chloride	0.30306	0.29342	0.29342	0.010	3.17939	20.00000	Averaged	
	4 Bromomethane	10.40777	10.00000	0.25389	0.010	-4.07775	25.00000	Linear	
	5 Chloroethane	0.19849	0.19521	0.19521	0.010	1.65178	25.00000	Averaged	
	6 Trichlorofluoromethane	0.70821	0.65375	0.65375	0.010	7.69061	25.00000	Averaged	
	7 Acrolein	0.00277	0.00267	0.00267	0.001	3.49417	50.00000	Averaged	
	8 1,1-Dichloroethene	0.34860	0.33105	0.33105	0.010	5.03428	20.00000	Averaged	
	9 Trichlorotrifluoroethane	0.62178	0.61637	0.61637	0.010	0.86890	25.00000	Averaged	
	10 Acetone	0.01768	0.01751	0.01751	0.010	0.97800	50.00000	Averaged	
	12 Carbon Disulfide	1.08796	0.97272	0.97272	0.010	10.59231	50.00000	Averaged	
	13 Acetonitrile	0.00403	0.00348	0.00348	0.010	13.64136	50.00000	Averaged	<-
	14 Methylene chloride	0.26819	0.25115	0.25115	0.010	6.35439	25.00000	Averaged	
	15 Acrylonitrile	0.01247	0.01217	0.01217	0.010	2.38988	50.00000	Averaged	
	17 trans-1,2-Dichloroethene	0.38662	0.38320	0.38320	0.010	0.88388	25.00000	Averaged	
	18 Methyl-tert-Butyl Ether	0.23934	0.22761	0.22761	0.010	4.90007	25.00000	Averaged	
	21 1,1-Dichloroethane	0.63032	0.60963	0.60963	0.100	3.28208	25.00000	Averaged	
	22 Vinyl Acetate	0.09111	0.07664	0.07664	0.010	15.87596	50.00000	Averaged	
	27 2,2-Dichloropropane	0.56107	0.55119	0.55119	0.010	1.76090	25.00000	Averaged	
	26 cis-1,2-Dichloroethene	0.32530	0.33070	0.33070	0.010	-1.66138	25.00000	Averaged	
	28 2-Butanone	0.02133	0.01666	0.01666	0.010	21.89598	50.00000	Averaged	
	29 Propionitrile	0.00353	0.00349	0.00349	0.010	1.34156	50.00000	Averaged	<-
	30 Bromochloromethane	0.13282	0.13717	0.13717	0.010	-3.27280	25.00000	Averaged	
	31 Tetrahydrofuran	0.01284	0.01229	0.01229	0.010	4.28371	25.00000	Averaged	
	32 Chloroform	0.67739	0.67669	0.67669	0.010	0.10367	20.00000	Averaged	
$	33 Dibromofluoromethane	0.50513	0.50328	0.50328	0.010	0.36720	25.00000	Averaged	
	35 1,1,1-Trichloroethane	0.67800	0.65160	0.65160	0.010	3.89408	25.00000	Averaged	
	37 1,1-Dichloropropene	0.61267	0.57582	0.57582	0.010	6.01531	25.00000	Averaged	
	38 Carbon tetrachloride	0.60852	0.56106	0.56106	0.010	7.79913	25.00000	Averaged	
$	39 1,2-Dichloroethane-d4	0.16231	0.15520	0.15520	0.010	4.38300	25.00000	Averaged	
	40 Benzene	0.92161	0.88617	0.88617	0.010	3.84500	25.00000	Averaged	
	41 1,2-Dichloroethane	0.17841	0.17635	0.17635	0.010	1.15337	25.00000	Averaged	
	46 Trichloroethene	0.46811	0.45876	0.45876	0.010	1.99793	25.00000	Averaged	
	49 1,2-Dichloropropane	0.26329	0.26861	0.26861	0.010	-2.02030	20.00000	Averaged	
	51 Dibromomethane	0.15087	0.15544	0.15544	0.010	-3.03131	25.00000	Averaged	
	52 Bromodichloromethane	0.48062	0.49505	0.49505	0.010	-3.00110	25.00000	Averaged	

CONTINUING CALIBRATION COMPOUNDS

Instrument ID: gc13.i
Lab File ID: 3c1017.d
Analysis Type: WATER
Lab Sample ID: VSTD010
Method: /var/chem/gc13.i/101802.b/hydr3w.m

Injection Date: 18-OCT-2002 08:19
Init. Cal. Date(s): 09-OCT-2002 18-OCT-2002
Init. Cal. Times: 01:03 04:12
Quant Type: ISTD

	COMPOUND	RRF / AMOUNT	RF10	CCAL RRF10	MIN RRF	%D / %DRIFT	MAX %D / %DRIFT	CURVE TYPE
	56 2-Chloroethylvinylether	0.04719	0.04546	0.04546	0.010	3.66493	25.00000	Averaged
	57 cis-1,3-Dichloropropene	0.35118	0.36223	0.36223	0.010	-3.14488	25.00000	Averaged
	58 4-Methyl-2-pentanone	0.05638	0.04753	0.04753	0.010	15.68973	50.00000	Averaged
$	60 Toluene-d8	0.88400	0.89680	0.89680	0.010	-1.44730	25.00000	Averaged
	62 Toluene	9.88100	10.00000	0.60931	0.010	1.18997	20.00000	Linear
	63 trans-1,3-Dichloropropene	0.22272	0.23250	0.23250	0.010	-4.39171	25.00000	Averaged
	64 1,1,2-Trichloroethane	0.12911	0.13763	0.13763	0.010	-6.60241	25.00000	Averaged
	65 1,3-Dichloropropane	0.32475	0.34115	0.34115	0.010	-5.05224	25.00000	Averaged
	66 Tetrachloroethene	0.79002	0.78952	0.78952	0.010	0.06293	25.00000	Averaged
	67 2-Hexanone	0.04918	0.03736	0.03736	0.010	24.02263	50.00000	Averaged
	69 Dibromochloromethane	0.41518	0.44149	0.44149	0.010	-6.33647	25.00000	Averaged
	70 1,2-Dibromoethane	0.17613	0.18706	0.18706	0.010	-6.20662	25.00000	Averaged
	71 1-Chlorohexane	0.52830	0.52226	0.52226	0.010	1.14384	25.00000	Averaged
	72 Chlorobenzene	0.98323	1.01837	1.01837	0.300	-3.57418	25.00000	Averaged
	73 1,1,1,2-Tetrachloroethane	0.48194	0.50779	0.50779	0.010	-5.36268	25.00000	Averaged
	74 Ethylbenzene	0.52025	0.53375	0.53375	0.010	-2.59605	20.00000	Averaged
	75 p,m-Xylene	1.43762	1.46823	1.46823	0.010	-2.12930	25.00000	Averaged
M	77 1,2-Dichloroethene (total)	0.35596	0.35695	0.35695	0.010	-0.27914	25.00000	Averaged
	78 o-Xylene	1.31381	1.35062	1.35062	0.010	-2.80176	25.00000	Averaged
	79 Styrene	0.84104	0.91004	0.91004	0.010	-8.20461	25.00000	Averaged
	80 Bromoform	0.20355	0.22597	0.22597	0.100	-11.01394	25.00000	Averaged
	81 Isopropylbenzene	3.38045	3.38829	3.38829	0.010	-0.23205	25.00000	Averaged
$	82 p-Bromofluorobenzene	0.70610	0.72322	0.72322	0.010	-2.42485	25.00000	Averaged
	83 1,1,2,2-Tetrachloroethane	0.41264	0.43197	0.43197	0.300	-4.68397	25.00000	Averaged
	84 Bromobenzene	0.81645	0.85720	0.85720	0.010	-4.99194	25.00000	Averaged
	85 1,2,3-Trichloropropane	0.08772	0.09149	0.09149	0.010	-4.29380	25.00000	Averaged
	86 n-Propylbenzene	4.26490	4.20759	4.20759	0.010	1.34354	25.00000	Averaged
	87 2-Chlorotoluene	3.01077	2.98657	2.98657	0.010	0.80387	25.00000	Averaged
	88 1,3,5-Trimethylbenzene	2.54751	2.61229	2.61229	0.010	-2.54317	25.00000	Averaged
	89 4-Chlorotoluene	2.94200	3.02366	3.02366	0.010	-2.77565	25.00000	Averaged
	92 tert-Butylbenzene	2.95820	2.98126	2.98126	0.010	-0.77960	25.00000	Averaged
	93 1,2,4-Trimethylbenzene	2.40871	2.46613	2.46613	0.010	-2.38388	25.00000	Averaged
	94 sec-Butylbenzene	4.15921	4.17269	4.17269	0.010	-0.32413	25.00000	Averaged
	95 1,3-Dichlorobenzene	1.55533	1.57882	1.57882	0.010	-1.51011	25.00000	Averaged
	96 p-Isopropyltoluene	3.22249	3.26814	3.26814	0.010	-1.41647	25.00000	Averaged

CONTINUING CALIBRATION COMPOUNDS

Instrument ID: gc13.i
Lab File ID: 3c1017.d
Analysis Type: WATER
Lab Sample ID: VSTD010
Method: /var/chem/gc13.i/101802.b/hydr3w.m

Injection Date: 18-OCT-2002 08:19
Init. Cal. Date(s): 09-OCT-2002 18-OCT-2002
Init. Cal. Times: 01:03 04:12
Quant Type: ISTD

COMPOUND	RRF / AMOUNT	RF10	CCAL RRF10	MIN RRF	%D / %DRIFT	MAX %D / %DRIFT	CURVE TYPE
98 1,4-Dichlorobenzene	1.71550	1.77446	1.77446	0.010	-3.43665	25.00000	Averaged
99 n-Butylbenzene	3.38841	3.41990	3.41990	0.010	-0.92945	25.00000	Averaged
101 1,2-Dichlorobenzene	1.19886	1.24386	1.24386	0.010	-3.75421	25.00000	Averaged
102 1,2-Dibromo-3-Chloropropane	0.06900	0.07251	0.07251	0.010	-5.09657	25.00000	Averaged
104 1,2,4-Trichlorobenzene	0.78450	0.80761	0.80761	0.010	-2.94610	25.00000	Averaged
105 Hexachlorobutadiene	1.04401	1.05231	1.05231	0.010	-0.79476	25.00000	Averaged
106 Naphthalene	0.46186	0.48093	0.48093	0.010	-4.12837	25.00000	Averaged
107 1,2,3-Trichlorobenzene	0.55649	0.57018	0.57018	0.010	-2.46004	25.00000	Averaged
M 108 Xylene (total)	1.31381	1.35062	1.35062	0.010	-2.80176	25.00000	Averaged

Average %D / Drift Results.

Calculated Average %D/Drift = 4.22211
Maximum Average %D/Drift = 15.00000
* Passed Average %D/Drift Test.

VOLATILE REPORT SW846 METHOD 8260B WATERS

Data file : /var/chem/gcl3.i/101802.b/3c1017.d
Lab Smp Id: VSTD010 Client Smp ID: VSTD010
Inj Date : 18-OCT-2002 08:19
Operator : DCT Inst ID: gcl3.i
Smp Info : CV V02J18DAA
Misc Info : VSTD010,1,7
Comment : HP 5971/ 5890 GC TEKMAR 3000/2016
Method : /var/chem/gcl3.i/101802.b/hydr3w.m
Meth Date : 21-Oct-2002 14:16 petruszj Quant Type: ISTD
Cal Date : 18-OCT-2002 02:22 Cal File: 3i1017i.d
Als bottle: 7 Continuing Calibration Sample
Dil Factor: 1.00000
Integrator: HP RTE Compound Sublist: ICAL1.sub
Target Version: 3.50
Processing Host: manatee

Concentration Formula: Amt * DF * Uf * 1/Vo * CpndVariable

Name	Value	Description
DF	1.00000	Dilution Factor
Uf	25.00000	ng unit correction factor
Vo	25.00000	Sample Volume purged (mL)
nd Variable		Local Compound Variable

Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RESPONSE	AMOUNTS CAL-AMT (ug/L)	ON-COL (ug/L)
1 Dichlorodifluoromethane	85	2.010	2.010	(0.308)	1061832	10.0000	9.765
2 Chloromethane	50	2.228	2.228	(0.342)	465677	10.0000	9.308
3 Vinyl chloride	62	2.337	2.337	(0.358)	567967	10.0000	9.682
4 Bromomethane	94	2.709	2.709	(0.415)	491442	10.0000	10.408
5 Chloroethane	64	2.827	2.827	(0.434)	377863	10.0000	9.835
6 Trichlorofluoromethane	101	3.144	3.144	(0.482)	1265436	10.0000	9.231
7 Acrolein	56	3.571	3.571	(0.548)	413405	800.000	772.05
8 1,1-Dichloroethene	96	3.716	3.716	(0.570)	640800	10.0000	9.496
9 Trichlorotrifluoroethane	101	3.725	3.725	(0.571)	1193097	10.0000	9.913
10 Acetone	43	3.734	3.734	(0.573)	33885	10.0000	9.902
12 Carbon Disulfide	76	3.970	3.970	(0.609)	1882867	10.0000	8.941
13 Acetonitrile	41	4.052	4.052	(0.621)	107700	160.000	138.17
14 Methylene chloride	84	4.252	4.252	(0.652)	486135	10.0000	9.364
16 Acrylonitrile	53	4.515	4.515	(0.692)	376900	160.000	156.18
17 trans-1,2-Dichloroethene	96	4.588	4.588	(0.704)	741748	10.0000	9.912

	Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RESPONSE	AMOUNTS CAL-AMT (ug/L)	ON-COL (ug/L)
	18 Methyl-tert-Butyl Ether	73	4.588	4.588	(0.704)	440581	10.0000	9.510
	21 1,1-Dichloroethane	63	5.087	5.087	(0.780)	1180051	10.0000	9.672
	22 Vinyl Acetate	43	5.159	5.159	(0.791)	148354	10.0000	8.412
	27 2,2-Dichloropropane	77	5.822	5.822	(0.893)	1066914	10.0000	9.824
	26 cis-1,2-Dichloroethene	96	5.813	5.813	(0.891)	640135	10.0000	10.166
	28 2-Butanone	43	5.822	5.822	(0.893)	32250	10.0000	7.810(M)
	29 Propionitrile	54	5.885	5.885	(0.788)	115091	160.000	157.85
	30 Bromochloromethane	128	6.121	6.121	(0.939)	265518	10.0000	10.327
	31 Tetrahydrofuran	42	6.176	6.176	(0.947)	237949	100.000	95.716
	32 Chloroform	83	6.221	6.221	(0.954)	1309841	10.0000	9.990
S	33 Dibromofluoromethane	113	6.430	6.430	(0.986)	974179	10.0000	9.963
	35 1,1,1-Trichloroethane	97	6.475	6.475	(0.993)	1261279	10.0000	9.610
	37 1,1-Dichloropropene	75	6.693	6.693	(1.026)	1114596	10.0000	9.398
	38 Carbon tetrachloride	117	6.702	6.702	(0.898)	1157793	10.0000	9.220
S	39 1,2-Dichloroethane-d4	65	6.866	6.866	(0.920)	320267	10.0000	9.562
	40 Benzene	78	6.965	6.965	(0.933)	1828685	10.0000	9.616
	41 1,2-Dichloroethane	62	6.956	6.956	(0.932)	363917	10.0000	9.885
*	42 Pentafluorobenzene	168	6.521	6.521	(1.000)	1935670	10.0000	
	46 Trichloroethene	130	7.809	7.809	(1.046)	946684	10.0000	9.800
*	48 1,4-Difluorobenzene	114	7.465	7.465	(1.000)	2063579	10.0000	
	49 1,2-Dichloropropane	63	8.091	8.091	(1.084)	554292	10.0000	10.202
	51 Dibromomethane	93	8.236	8.236	(1.103)	320764	10.0000	10.303
	52 Bromodichloromethane	83	8.445	8.445	(1.131)	1021568	10.0000	10.300
	56 2-Chloroethylvinylether	63	8.871	8.871	(1.188)	93818	10.0000	9.634
	57 cis-1,3-Dichloropropene	75	9.053	9.053	(1.213)	747482	10.0000	10.314
	58 4-Methyl-2-pentanone	43	9.261	9.261	(1.241)	98083	10.0000	8.431
S	60 Toluene-d8	98	9.425	9.425	(1.263)	1850610	10.0000	10.145
	62 Toluene	92	9.516	9.516	(1.275)	1257356	10.0000	9.881
	63 trans-1,3-Dichloropropene	75	9.806	9.806	(1.314)	479783	10.0000	10.439
	64 1,1,2-Trichloroethane	97	10.051	10.051	(1.541)	266408	10.0000	10.660
	65 1,3-Dichloropropane	76	10.278	10.278	(0.901)	457036	10.0000	10.505
	66 Tetrachloroethene	166	10.278	10.278	(0.901)	1057706	10.0000	9.994
	67 2-Hexanone	43	10.414	10.414	(0.913)	50056	10.0000	7.598
	69 Dibromochloromethane	129	10.596	10.596	(0.928)	591453	10.0000	10.634
	70 1,2-Dibromoethane	107	10.750	10.750	(1.440)	386007	10.0000	10.621
	71 1-Chlorohexane	91	11.431	11.431	(1.753)	1010915	10.0000	9.886
	72 Chlorobenzene	112	11.449	11.449	(1.003)	1364294	10.0000	10.357
	73 1,1,1,2-Tetrachloroethane	131	11.567	11.567	(1.014)	680273	10.0000	10.536
	74 Ethylbenzene	106	11.621	11.621	(1.018)	715059	10.0000	10.260
	75 p,m-Xylene	91	11.784	11.784	(1.033)	3933906	20.0000	20.426
*	76 Chlorobenzene-d5	117	11.412	11.412	(1.000)	1339678	10.0000	
M	77 1,2-Dichloroethene (total)	96				1381883	20.0000	20.056
	78 o-Xylene	91	12.347	12.347	(1.082)	1809390	10.0000	10.280
	79 Styrene	104	12.365	12.365	(1.083)	1219166	10.0000	10.820
	80 Bromoform	173	12.610	12.610	(1.105)	302731	10.0000	11.101
	81 Isopropylbenzene	105	12.883	12.883	(0.872)	2562052	10.0000	10.023
S	82 p-Bromofluorobenzene	95	13.091	13.091	(1.147)	968882	10.0000	10.242

Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RESPONSE	AMOUNTS CAL-AMT (ug/L)	AMOUNTS ON-COL (ug/L)
83 1,1,2,2-Tetrachloroethane	83	13.291	13.291	(0.900)	326632	10.0000	10.468
84 Bromobenzene	156	13.300	13.300	(0.900)	648172	10.0000	10.499
85 1,2,3-Trichloropropane	110	13.346	13.346	(0.904)	69180	10.0000	10.429(M)
86 n-Propylbenzene	91	13.473	13.473	(0.912)	3181561	10.0000	9.866
87 2-Chlorotoluene	91	13.581	13.581	(0.920)	2258288	10.0000	9.920
88 1,3,5-Trimethylbenzene	105	13.736	13.736	(0.930)	1975281	10.0000	10.254
89 4-Chlorotoluene	91	13.745	13.745	(0.931)	2286335	10.0000	10.278
92 tert-Butylbenzene	119	14.208	14.208	(0.962)	2254274	10.0000	10.078
93 1,2,4-Trimethylbenzene	105	14.280	14.280	(0.967)	1864759	10.0000	10.238
94 sec-Butylbenzene	105	14.534	14.534	(0.984)	3155174	10.0000	10.032
95 1,3-Dichlorobenzene	146	14.680	14.680	(0.994)	1193822	10.0000	10.151
96 p-Isopropyltoluene	119	14.752	14.752	(0.999)	2471195	10.0000	10.142
98 1,4-Dichlorobenzene	146	14.807	14.807	(1.002)	1341752	10.0000	10.344
99 n-Butylbenzene	91	15.351	15.351	(1.039)	2585952	10.0000	10.093
* 100 1,4-Dichlorobenzene-d4	152	14.770	14.770	(1.000)	756148	10.0000	
101 1,2-Dichlorobenzene	146	15.351	15.351	(1.039)	940546	10.0000	10.375
102 1,2-Dibromo-3-Chloropropane	75	16.449	16.449	(1.114)	54832	10.0000	10.510
104 1,2,4-Trichlorobenzene	180	17.502	17.502	(1.185)	610672	10.0000	10.295
105 Hexachlorobutadiene	225	17.720	17.720	(1.200)	795702	10.0000	10.079
106 Naphthalene	128	17.784	17.784	(1.204)	363651	10.0000	10.413
107 1,2,3-Trichlorobenzene	180	18.056	18.056	(1.222)	431137	10.0000	10.246
M 108 Xylene (total)	91				5743296	10.0000	32.631

Flag Legend

M - Compound response manually integrated.

Surrogate Spike Recovery Default Limits

Surrogate Compound	Water	Low Soil
Toluene-d_8	88-110	81-117
4-Bromofluorobenzene	86-115	74-121
1,2-Dichloroethane-d_4	80-120	80-120
Dibromofluoromethane	86-118	80-120

Note: Above are Surrogate Spike Recovery Default Limits from 8260B. These limits are for guidance only, not intended as set limits. In-house generated statistical limits or QAPP limits will be used whenever possible. See Table 1 for in-house generated statistical limits.

LCS / MS Recovery Default Limits

MS Compound	Water	Soil/Sediment
1,1-Dichloroethene	61-145	59-172
Trichloroethene	71-120	62-137
Chlorobenzene	75-130	60-133
Toluene	76-125	59-139
Benzene	76-127	66-142

Internal standard areas must be within -50% to 100% of the EICP for the corresponding continuing calibration standards. Internal standard retention times must not deviate by 30%.

Attachment 3.

Example: GC/MS Volatiles/CAR Logbook; Tune Form; Sample Tracking Sheet , Maintenance Logbook

STL Chicago
GC/MS Volatile Analysis Logbook

Instrument ID# 16

CHI-22-20-049/A-05/02

Analysis Date / Time	File Name	Sample Number	Sample ID	Sparge No.	Sample Wt. / Vol.	Instr. Dil.	Int. Std. No.	pH < 2	Comments (MUST include SRN's)	Analyst Initials

Analyst Signature/Date:_____ Reviewer Signature/Date:_____ Page No.

Instrume... ID# 16

STL Chicag
Corrective Action/Qualification Report GC/MS VOA

Page No _____
CHI-22-20-049/A-05/02

Analytical Methods
___SW846 8260/A/B
___40CFR 624
___OLM04.2

Tune Name:_____'02
___EPA 524.2 __Other_____
___OLM03.2
___OLC02.1

ISTD/RT report
Initial calibration / Continuing Calibration IS#_____
(For method 524 include all points in ICAL)

Data File Name: _____

	IS 1	RT1	IS2	RT2	IS3	RT3	IS4	RT4
1								
2								
3								
4								

Tune Criteria
Description of Situation:_____
Action Taken:_____
Demonstration of Control:_____

Initial Calibration Cirteria
Description of Situation:_____
Action Taken:_____
Demonstration of Control_____

Continuing Calibration Criteria
Description of Situation:_____
Action Taken:_____
Demonstration of Control:_____

Internal Standards (continuing cal to continuing cal)
Description of situation:_____
Action Taken:_____
Demonstration of Control:_____

Method Blank
Description of situation:_____
Action Taken:_____
Demonstration of Control:_____

LCS
Description of Situation:_____
Action Taken:_____
Demonstration of Control:_____

Qualification of Data
Data Affected (Client/Sample #)_____
Qualification:_____

Associated samples reanalyzed: Yes No (see below)
Explanation for no reanalysis/data MUST be qualified and narrated:_____

Analyst Signature/date_____/_____

Reviewer Signature/date_____/_____

Tune Name: _____ STD CC: _____ Labnet ID: _____ Method: _____ Tune Batch: _____

Tune Time: _____ CC: _____ Labnet ID: _____ Method: _____ Tune Batch: _____

INST: _____ LCS: _____

Sample ID:	File:	Act	H T	p H	T S	S S	Misc. Info	Prep Method	Prep Batch	Analytical Batch

Exception Reports ☐

rpjah

Job Analysis History

10/21/2002

V2

Surrogate Reagent...:

Method Code....: 8260B Volatile Organics
Job Number.....:
Project Number.:
Customer Job ID..:

Holding Time.....: 14 Day Holding Time
Customer.....:
Proj. Cat..: INDUSTRIAL PM...:

Job Report Type...: l2qfmdl
Contact.:
Hardcopy Due Date.: 10/21/2002 Fax Due Date.: 10/11/2002

Sample #	QC	Client Sample ID	Matrix	HT Date	TAT Date	File Name	Dil	Tune name	Action	Analst	Prep Batch	Comments
1	N	A90210BH01-01	SOIL	10/21/2002	10/21/2002							
2	N	A90210BH01-02	SOIL	10/21/2002	10/21/2002							
3	N	A90210BH01-GW	WATER	10/21/2002	10/21/2002							
13	N	A90210TB1	WATER	10/21/2002	10/21/2002							

Date of Maintenance:_____ Entry No.:_____

Analyst:_____

Description:_____

Follow-Up._____

Analyst:_____ Date:_____

Date of Maintenance:_____ Entry No.:_____

Analyst:_____

Description:_____

Follow-Up:_____

Analyst:_____ Date:_____

Date of Maintenance:_____ Entry No.:_____

Analyst:_____

Description:_____

Follow-Up:_____

Analyst:_____ Date:_____

Reviewer Signature:_____ Date:_____

Attachment 4.

Evaluation and Acceptance Criteria Table

GCMS Calibration – Evaluation and Acceptance Criteria

Prepare standards	• The concentrations must cover the range of quantitation for all analytes • The lowest point of the calibration curve must be at, or below, the reporting limit	
Run calibration standards	• All analytes must contain at a minimum 5 calibration points for Linear regressions, linear curves, or average response factors • Analytes using second order fits must have a minimum of 6 calibration points on a curve • Analytes using 3rd order curves must have a minimum of 7 calibration points	• Calibration levels deemed to be statistical or visual outliers shall be dropped from the curve and replaced by a similar concentration standard. The standard shall be dropped in its entirety, not on a per analyte basis
Calculate "grand mean RSD" of all compounds	• The "grand mean RSD" is calculated before attempting to fit compounds to any calibration curves only because it is easier to do at this time. The "grand mean RSD" acceptance is only to be used as a last resort in determining whether a compound's calibration is acceptable. • Calibrations for compounds which occur on different dates (i.e. appix compounds analyzed at different dates than the HSL compounds), the "grand mean RSD" is calculated separately for each curve.	• If no %RSD for any given compound is above 15%, the "grand mean RSD will be less than 15%.
Evaluation each compound for linear fit, second order fit or 3rd order fit	• Having determined that the calibration meets minimum requirements, the laboratory will evaluate each compound to determine the best calibration fit using statistical and visual evaluation of the curve. • Using "priori" knowledge some compounds ranges may be shortened (i.e. not as low a reporting limit or not as high a range)	• Citing priori knowledge the laboratory may decide to "keep" calibrations for several compounds despite exceeding the statistical threshold allowed by the method. The compounds that fall in this category are known poor performers as indicated by the method or as indicated from historical performance data (e.g. Appendix IX compounds). These compounds will be listed in the OP as possible trouble analytes. Quantitation for these compounds may be biased and should be used only with caution.
Determine the best calibration approach for each compound	• RRF • Linear • 2nd order • Grand Mean RSD	• Even when the "grand mean RSD" indicates minimum acceptance has been met, the analyst must use discretion for quantification because some compounds may be biased. This approach must be used with caution.

Attachment 5.

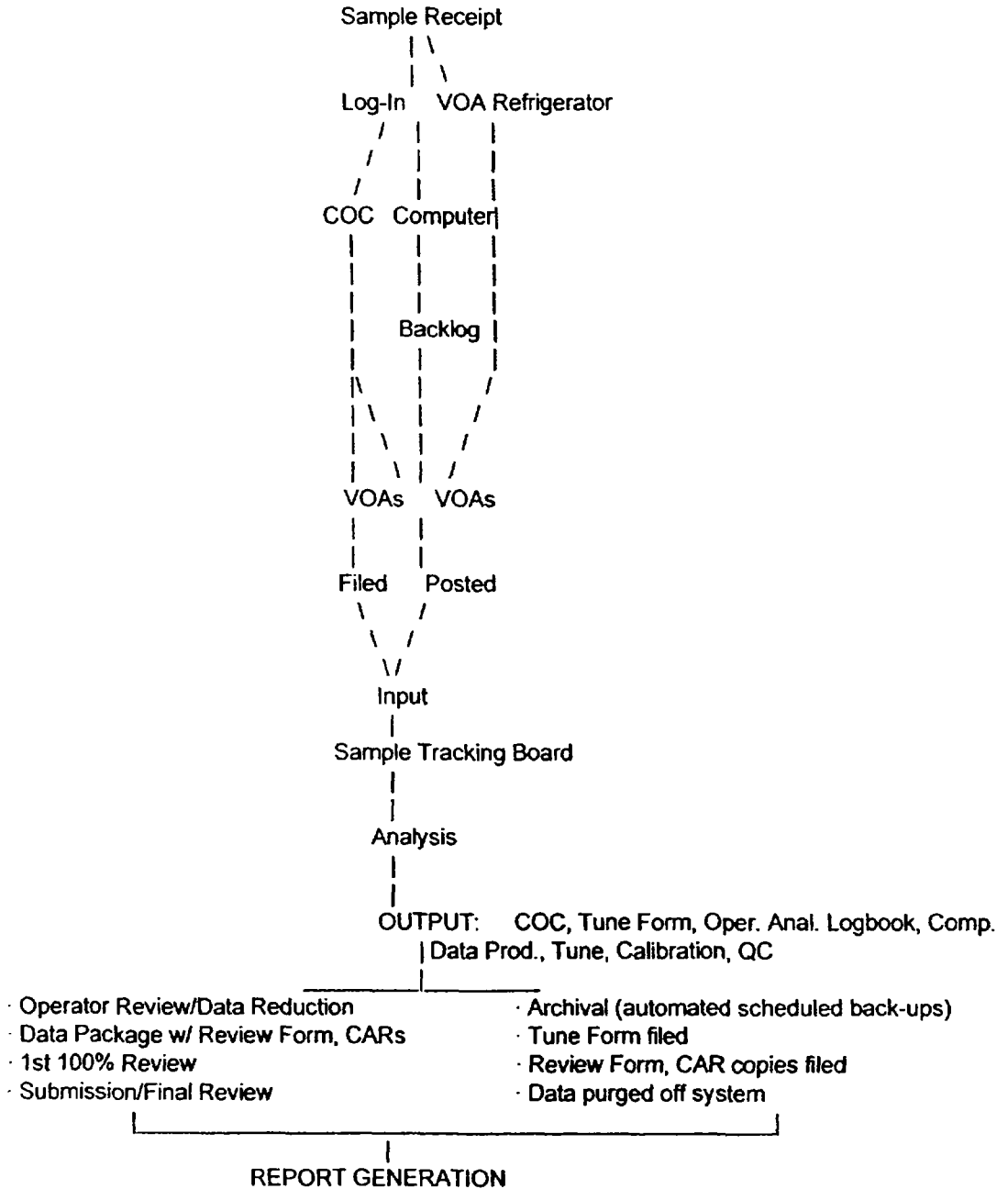
Example: Analysis and Sample Tracking Flowcharts

ANALYSIS SCHEME FLOWCHART

(Terms defined in the Section 9)

```
                PFTBA
                  |
                  |
                  |
                 BFB  (Form 5)
                /  \  Every 12 hours
               /    \
              /      \
Initial Calibration———Continuing Calibration
  (Form 6)              (Form 7)
                      Every 12 hours
                          |
                          |
                          \|/
                        Analysis
                          |
                          |
                          \|/
                 Computer Data Production/Reduction
                          |
                          |
                          \|/
                 Operator Data Review/Reduction
                      (Form 1,2,3,4,5)
                          |
                          |
                          \|/
                 Final Review/Data Submission
                          |
                          |
                          \|/
                      Report Generation
```

Sample Tracking Flowchart (for EACH unique Job)



Attachment 6.

Example: Data Review Form

STL Chicago

GCMS DATA REVIEW CHECKLIST

Site Name:_____ Primary Reviewer:_____ Review Date:_____

JOB Number: _____ Secondary Reviewer:_____ Review Date:_____

. of Samples/Matrix: a) _____ WATER b) _____ SOIL c) _____ SPLP / TCLP d) _____ Other (_____)

Method: a) VOA _____ 5030_____ Encores: 5035–High _____ 5035-Low_____ b) BNA _____

Report Type: a) MDL U b) RL U c) Breach d) P1 / P2 ("QCORG" printed QC must match PM selected Report Type)

TASK	PRI REV	SEC REV	COMMENTS
LAB CHRON: 1) Matches Big Board (Job Analysis History)			
2) Matches Raw Data (Form 4 / 5)			
3) Note Sample dilutions and list reason. a) High Sample Conc. b) Interference present IF original and re-run are to be reported in LabNet Re-log Samples (Indicate data type used) Re-Analyzed (RE) Re-Extracted (RA) Dilution (DL)			Smp # Original Dilution Comments BNA Only: Final Volume Adjustment _____
4) Sample Hold Times Met (SDR written: Yes No)			
5) Proper Prep Links Created S-F6: Routine Preps; 5035PL; 5035PH S-F9: TCLP; SPLP ; 5035 Archon Purge & Trap			
Incomplete JOB Status Report reveals No Outstanding Data			
PROJ. REQ. MET: 1) Sample Detection Limit Met			
2) Reported J values meet reporting criteria			
3) Method Blank Detection Limits Met (MB<1/2 RL for LCG)			
4) Project Specific Compounds of Concern : Yes No			
LabNet Report matches Quant Report: Sample weights / Volumes / % Moisture / Factors verified			
Manual Integration documentation / verification complete			
FORM 2: Surrogate Recoveries Within Limits Statistical Limits _____ Method Limits _____ Project Limits _____ (S-F10 used to Clone By Project) AFCEE___; LCG___; QAPP___ Directed Note to PM: Yes / No			Smp # Original Re-analysis Comments
FORM 3: MS/MSD Recoveries Acceptable Statistical Limits _____ Method Limits _____ Project Limits _____ (S-F10 used to Clone By Project) AFCEE___; LCG___; QAPP___ Directed Note to PM: Yes / No			Smp # _____ MS MSD
FORM 3: LCS Recoveries Acceptable (LCD if no MS/MSD) Statistical Limits _____ Method Limits _____ Project Limits _____ (S-F10 used to Clone By Project) AFCEE___; LCG___; QAPP___ Directed Note to PM. Yes / No			Batch # _____ Batch # _____ Batch # _____ Batch # _____ Batch # _____ Batch # _____

TASK	PRI REV	SEC REV	COMMENTS
FORM 5: Tuning Criteria Met			
FORM 6: Initial Calibration Criteria Met			
ICAL Spike Required: Yes No Control Limit applied: _____			
FORM 7: Daily Calibration (CCV) Criteria Met			
MRL Check Required: Yes No (LCG Requirement – Before and after Sample analysis) Control Limit Applied: _____			Before: After: Batch # _____ Batch # _____ Batch # _____ Batch # _____ Batch # _____
FORM 8: Internal Standards Criteria Met Default – Internal Standards checked against the continuing calibration LCG - Internal Standards checked against the mid-point of the ICAL **Form 8 MUST BE verified for correct areas present: YES NO** **It is critical that the ICAL1 be processed last. The last ICAL processed is held in the method which is what appears on the target IS report.** Directed Note to PM: Yes / No			Smp # Original Re-analysis Comments
LabNet Batch Status Report Displays Data at RPT / RVWD Status	RPT	RVWD	
RAW DATA: 1) Raw Data Verified/Complete			
2) Raw Data Matches Forms			
3) 5035 Prep Log page present / verified			
4) Quant Report Matches Spectra			
5) Manual integration reports (befores and afters) present (when required by client) and reason correctly documented and approved. Manual Integration Summary Printed: Yes No			File ID:
NARRATIVE: 1) Holding Times			
2) Method References			
3) % Recoveries / RPD's			
4) Analytical Difficulties/Typos/CAR's Directed Note to PM: Yes / No			
Manual Calculation of On Column result: Response Factor (Smp) x Concentration of IS IS Response Factor (Smp) Cmpd. RRF (Cont.Calib)			Sample : _____ Compound: _____

Additional Comments:

STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURE

SOP No.	Revision No.	Date	Page
UME-6010B	04	10/25/02	1 of 25

TITLE: **Metals Analysis**
Trace Inductively Coupled Argon Plasma by SW-846 6010B
(Simultaneous Operation)

Updated by:	Signature:	Date:
Paul F. Kolarczyk Senior Analyst	Paul F. Kolarczyk	10/17/2002

Approved by:	Signature:	Date:
Mani S. Iyer Section Manager, Metals Dept.	Mani S Iyer	10/17/02
David L. Kaczka Env. Health & Safety Coor.	DLKK	10-21-02
Terese A. Preston Quality Manager	Terese A. Preston	10-21-02

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ISSUED TO : **Gloria Chojnacki, S.E.H.**
Re: Ashland NSP/Lakefront Site QAPP

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the guidelines for determining metal concentrations by Trace Inductively Coupled Argon Plasma (ICAP) Emission Spectrometry - Simultaneous Operation. This SOP was written using U.S. EPA SW-846 "Test Methods for Evaluating Solid Waste", Third Edition, Method 6010B as a reference.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Instrument Detection Limits

Instrument Detection Limits (IDLs) are performed on a quarterly basis for each element and for each instrument (as specified in CLP). These limits are used to gauge instrument sensitivity and when routinely evaluated, instrument performance without the introduction of method variance can be determined. (Note: The annual MDL may be used in lieu of one of the semi-annual IDL sets, providing required reporting limits are achieved).

1.1.3 Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory maintains reporting limits that are higher than the MDL. Wherever possible, reporting is limited to values ~3-5x the respective MDL to ensure confidence in the value reported.

Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement. Refer to Table 1 for element wavelength and reporting limits.

1.1.4 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM).

1.2 Summary of Method

ICAP is a technique for the analysis of soluble or digested samples for metal concentrations using atomic emission spectrometry. All matrices, including water, TCLP extracts, wastes, soils, sludges and sediments, require digestion prior to analysis. The instrument is capable of analyzing simultaneously 31 different elements on a sample.

2.0 INTERFERENCES

Spectral, Physical and Chemical Interferences are the three main interferences that are commonly present on the ICAP.

2.1 Spectral Interferences

Mainly caused by continuous background wavelength, stray light from a high concentration element or overlap of a spectral line from another element. The ICAP can correct for the first two types of interferences by using background correction adjacent to the wavelength. Spectral overlap can be corrected by monitoring the interfering wavelength and computer correcting the results for the false concentration. The values used to correct are known as Inter-element Correction Factors or IEC's.

2.2 Physical Interferences

Usually associated with the sample uptake and nebulization processes. These interferences can usually be eliminated by using a peristaltic pump which assures a constant sample uptake rate. If a sample is extremely viscous or contains a very high dissolved solids concentration, a dilution of the sample may be required to assure a constant and smooth nebulization rate.

2.3 Chemical Interferences

Normally not significant on the ICAP. These interferences include ionization effects and molecular compound formation. Chemical interferences are highly dependent on the sample matrix type and the element.

Trace ICP can have some ionization effects caused by torch positioning. To eliminate these effects, Cesium is added to the internal standard solution (100 mLs / 1 Liter).

Most interferences can be corrected by ensuring a constant sample uptake rate and by using the correcting abilities of the computer. If severe interferences are suspected, an alternate method such as Graphite Furnace Atomic Absorption (GFAA) can be used or to verify the ICAP results.

3.0 SAFETY

- Employees will adhere to the practices and policies in the STL Corporate Safety Manual (CSM) and will read the MSDSs for the materials used in this method before handling or using the material.
- If contact occurs with a standard containing Hydrofluoric Acid, flush with water and apply Calcium Gluconate Gel (located in standards cabinet) immediately. ***Seek medical attention.***
- The ICP torch puts out harmful ultraviolet radiation. The torch should never be looked at directly without proper eye protection (i.e. lens tinted for the wavelength of the torch.)
- Parts of the instrument can be extremely hot. Care should be taken if the instrument needs to be adjusted internally.
- People with pacemakers should not be near the ICP due to the radio frequency generator.
- Proper ventilation is required due to sample fumes and extreme heat generation (RF generator and plasma) and plasma emissions. People with medical conditions that may respond to ozone emissions should exercise caution.

4.0 EQUIPMENT AND SUPPLIES

4.1 Instrumentation

3 - Thermo Jarrell Ash ICAP 61E Trace Analyzer. These instruments are simultaneous ICAP's which currently have 31 analytical wavelengths. Additional wavelengths may be added as required.

The instruments are operated via desktop computers and Thermo Jarrell Ash software (Version 6.2). They also come equipped with a peristaltic pump for sample uptake and an autosampler.

4.2 Supplies

- Volumetric Flasks (Class A): 100 mLs; 1000 mLs
- Eppendorf Pipettes, varying volumes

5.0 REAGENTS AND STANDARDS

5.1 Reagents

- Milli-Q Water
- *Concentrated Nitric Acid (HNO_3) - InstraPure
- *Concentrated Hydrochloric Acid (HCl) - InstraPure

*Purchased from a vendor.

5.2 Standards and QC Solutions

All stock standards and QC solutions are purchased from an outside supplier in aqueous form. Two types of standards are used: single element and custom mixed standards. Single element standards are available for most elements at a 1,000 mg/L concentration. The shelf life of all purchased solutions are as stated by the manufacturer and are listed in LabNet (LIMS).

5.2.1 Calibration Standards

Prepared with Milli-Q water that has been acidified with 1% HNO_3 and 5% HCl. The calibration standards are prepared daily as follows:

1. **Calibration Blank**

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Repipette 10 mLs conc. HNO_3 and 50 mLs conc. HCl into the flask. Dilute to volume with Milli-Q water and mix thoroughly.

2. **Calibration Standards** (Refer to Appendix A for element concentrations)

S1: Add ~50 mLs of Milli-Q water to a 100 mL Class A volumetric flask. Repipette 1 mL conc. HNO_3 and 5 mLs conc. HCl into the flask. Using Eppendorf pipettes, add 1.0 mL each of RFW-ICPT-STD-1B, RFW-ICPT-STD-1C, and RFW-ICPT-STD-1D. Dilute to volume with Milli-Q water and mix thoroughly.

S1A: Add ~50 mLs of Milli-Q water to a 100 mL Class A volumetric flask. Repipette 1 mL conc. HNO_3 and 5 mLs conc. HCl into the flask. Using Eppendorf pipettes, add 0.4 mLs each RFW-ICPT-STD-1B, RFW-ICPT-STD-1C, and RFW-ICPT-STD-1D. Dilute to volume with Milli-Q water and mix thoroughly.

S1B: Add ~50 mLs of Milli-Q water to a 100 mL Class A volumetric flask. Repipette 1 mL conc. HNO_3 and 5 mLs conc. HCl into the flask. Using Eppendorf pipettes,

add 0.5 mLs each of RFW-ICPT-STD-1B, RFW-ICPT-STD-1C, and RFW-ICPT-STD-1D. Dilute to volume with Milli-Q water and mix thoroughly.

S2: Add ~50 mLs of Milli-Q water to a 100 mL Class A volumetric flask. Re-pipette 1 mL conc. HNO_3 and 5 mLs conc. HCl into the flask. Using Eppendorf pipettes, add 1.0 mL each of RFW-ICPT-STD-2A, RFW-ICPT-STD-2B, and RFW-ICPT-STD-3. Dilute to volume with Milli-Q water and mix thoroughly.

S2A: Add ~50 mLs of Milli-Q water to a 100 mL Class A volumetric flask. Re-pipette 1 mL conc. HNO_3 and 5 mLs conc. HCl into the flask. Using Eppendorf pipettes, add 0.4 mLs each of RFW-ICPT-STD-2A, RFW-ICPT-STD-2B, and RFW-ICPT-STD-3. Dilute to volume with Milli-Q water and mix thoroughly.

S2B: Add ~50 mLs of Milli-Q water to a 100 mL Class A volumetric flask. Re-pipette 1 mL conc. HNO_3 and 5 mLs conc. HCl into the flask. Using Eppendorf pipettes, add 0.5 mLs of RFW-ICPT-STD-2A, RFW-ICPT-STD-2B, and RFW-ICPT-STD-3. Dilute to volume with Milli-Q water and mix thoroughly.

5.2.2 QC Solutions (Refer to Appendix B for element concentrations.)

Prepared with Milli-Q water that has been acidified with 1% HNO_3 and 5% HCl. All QC Solutions are recorded in the intermediate standard traceability logbook. The QC Solutions are prepared as follows:

1. **Initial Calibration Verification (ICV)**

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add 10 mLs conc. HNO_3 and 50 mLs conc. HCl. Add 8 mLs each of CCV Soln. A, CCV Soln. A1, CCV Soln. B and the following:

- 1.84 mLs of 10,000 ug/mL Ca
- 1.6 mLs of 10,000 ug/mL Na, Fe
- 1.68 mLs of 10,000 ug/mL Mg
- 3.6 mLs of 10,000 ug/mL K, Al

Dilute to volume with Milli-Q water and mix thoroughly.

2. **Continuing Calibration Verification (CCV)**

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add 10 mLs conc. HNO_3 and 50 mLs conc. HCl. Add 10 mLs each of CCV Soln. A, CCV Soln. A1, CCV Soln. B and the following:

- 2.3 mLs of 10,000 ug/mL Ca
- 2.0 mLs of 10,000 ug/mL Na, Fe
- 2.1 mLs of 10,000 ug/mL Mg
- 4.5 mLs of 10,000 ug/mL K, Al

Dilute to volume with Milli-Q water and mix thoroughly.

3. **CRI [Contract Required Detection Limit (CRDL) Standard for ICAP]**

(Refer to Appendix B for element concentrations.)

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add 10 mLs conc. HNO_3 and 50 mLs conc. HCl to the flask. Add the following:

- 20 uL each of 10,000 ug/mL Fe
- 40 uL of 10,000 ug/mL Al
- 100 uL of CRI-CRA-1
- 200 uL each of 1000 ug/mL B, Bi, Li, Mo, Si, Sn, Sr, Ti, CRI-CRA-2, CRI-CRA-3
- 400 uL of 1000 ug/mL Ba
- 1 mL each of 10,000 ug/mL Ca, K, Mg, Na

Dilute to volume with Milli-Q water and mix thoroughly.

4. **Interferent Check Standard (ICSA)**

(Refer to Appendix B for element concentrations.)

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add 10 mLs conc. HNO_3 and 50 mLs conc. HCl. Add 100 mLs of CLP Interferent A Solution. Dilute to volume with Milli-Q water and mix the solution thoroughly.

5. **Interferent Check Standard (ICSAB)**

(Refer to Appendix B for element concentrations.)

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Add 10 mLs conc. HNO_3 and 50 mLs HCl. Add 100 mLs of CLP Interferent A Solution, 10 mLs of CLPP-ICS-B4. Bring up to volume with Milli-Q water and mix thoroughly.

6.0 CALIBRATION (NON-DAILY)

6.1 Linear Range Analysis Standard (LRS)

LRS calibration is performed quarterly that covers the anticipated range of measurement. This is used to verify linearity and document the upper limit of the calibration range for each element. At least one of the calibration standards will be at or near the reporting limit. The calibration curve generated must have a correlation coefficient of ≥ 0.995 in order to consider the responses linear over that range. All samples found to be above the ICAP linear range are diluted and re-analyzed until the concentration falls within the instruments linear range.

6.2 Inter-Element Correction (IEC)

Correction factors for spectral interference due to Al, Ca, Fe, and Mg will be determined at least annually for all wavelengths used for each analyte reported or any time the ICAP is adjusted in any way that may affect the IECs. Correction factors for spectral interferences other than Al, Ca, Fe, and Mg are recommended and are performed as needed and documented with the instrument records.

7.0 PROCEDURE

7.1 Quality Control Checks

The following section summarize the quality control (QC) samples associated with ICAP analysis.

QC Sample	Frequency	Control Limit [1]
Method Blank (MB)	1 per 20 samples	≤ Reporting Limit
Lab Control Sample (LCS) [2]	1 per 20 samples	80 – 120 %
Matrix Spike (MS) [3]	1 per 20 samples	75 – 125 %
MS Duplicate (MSD) [3]	1 per 20 samples	75 – 125 %; 20 RPD
Duplicates (MD) [4]	1 per 20 samples	20 RPD
Serial Dilution (5x) [5]	1 per 20 samples	± 10% of the original result

[1] Refer to Section 8 for additional details.
[2] LCS Duplicate (LCD) is performed only when requested by the client or project.
[3] If sample concentration is ≤ 4X spike level, 75-125%; if sample concentration is > 4X spike level, no control range. If TCLP matrix spike is < 50%, Standard Addition must be performed.
[4] If ≥ 5X reporting limit, 20 RPD; if < 5X reporting limit ± reporting limit; if < reporting limit no control range.
[5] If the analyte concentration is >10X the MDL, results should agree within ±10% of the original sample result.

7.2 Sample Preservation and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Holding Time[1]	Preservation	Reference
Waters	180 days	HNO_3, pH < 2; Cool 4 ± 2°C	40 CFR Part 136.3
Soils	180 days	Cool 4 ± 2°C	N/A

[1] Inclusive of digestion and analysis.

7.3 Sample Preparation

The most commonly used digestion procedures are SW-846 Methods 3010A (waters) and 3050B (soils). Refer to USP-3000 for details on sample digestion. The samples are received in the metals laboratory as 25, 50 or 100 mL final volumes.

7.4 Calibration / Standardization

7.4.1 Instrument Set Up

Set up the instrument with the proper operating conditions as provided by TJA. The instrument must be allowed to become thermally stable (usually requiring ~1-hour) prior to profiling and calibration. The instrument is profiled using a 1 ppm Arsenic standard (S1) by aspiration and selecting the automatic profile feature from the TJA software. The peak position reading should be within +/- 0.1. If the reading is acceptable, record the peak area in the logbook & rinse. If the reading is > +/- 0.1, set the micrometer to the adjusted vernier position given by the instrument and profile again to verify. Record the peak area in the logbook and rinse. The instrument is now ready to calibrate.

7.4.2 Standardization

Before any instrument is used as a measurement device, the instrument response to known reference materials must be determined. All sample measurements must be made within the linear range of the instrument.

The instrument is standardized using a calibration blank and 3 calibration standards, which consist of 6 multi-element solutions. The results are given in intensities. Minimum requirement is a blank and a standard.

Standard	Frequency	Control Limit
Calibration Curve	Initially	Corr. Coeff. ≥ 0.995
High Standards (S1, S2)	After the Calibration Curve	± 5% of the Known Conc.
Initial Cal. Verif. (ICV)	After the Calibration Curve	± 10% of the Known Conc.
Initial. Cal. Blank (ICB)	After the ICV	≤ Reporting Limit
CRI	Daily, every 8 hrs. thereafter	None Required
ICSA / ICSB	Daily, every 8 hrs. thereafter	± 20% of the Known Conc.
Cont. Cal. Verif. (CCV)	Every 10 reading; End of each run	± 10% of the Known Conc.
Cont. Cal. Blank (CCB)	Every 10 readings; End of each run	≤ Reporting Limit

7.5 Preventive Maintenance

The required preventive maintenance is listed in the preventive maintenance logbooks which are kept at the instruments. All maintenance is recorded in these logbooks along with the date and the signature of the analyst performing the maintenance. The instruments are under a full service contract with the manufacturer for all major repairs.

7.5.1 Daily Maintenance

Includes changing the pump tubing for consistent sample uptake and a visible check of the waste container to make sure that it doesn't overflow.

7.5.2 Weekly Maintenance

Includes checking the air filters on the back of the instrument for excessive dust buildup, and checking the tip of the torch for excessive buildup of material.

7.5.3 Monthly Maintenance

Includes cleaning and checking the water re-circulator for proper fluid level, cleaning the spray chamber.

7.6 Sample Analysis

7.6.1 Analytical Run

After the instrument is standardized (Section 7.4.2), an analytical run is initiated. The first run of the day would proceed as follows:

- S1,S2 Reanalysis of calibration standard as a sample
- ICV Initial Calibration Verification
- ICB Initial Calibration Blank

- CRI Spiked Blank Sample
- ICSA Interferent Check Standard A
- ICSB Interferent Check Standard B
- CCV Continuing Calibration Verification
- CCB Continuing Calibration Blank
- MB Method Blank
- LCS Laboratory Control Sample
- Sample 1
- Sample 1 Matrix Duplicate (MD)
- Sample 1 Matrix Spike (MS)
- Sample 1 Matrix Spike Duplicate (MSD)
- Sample 1 Serial Dilution (L)
- Sample 2
- •
- •
- Sample X (10)
- CCV Continuing Calibration Verification
- CCB Continuing Calibration Blank

If the CCV and CCB results are acceptable, the run may continue without restandardization. If any of the post-run QC is out of control, or close to being out of control, the instrument is restandardized before analyzing the next batch. Any samples with elements associated with an out of control CCV or CCB will be reanalyzed.

7.7 Documentation

7.7.1 Instrument Run-Log

The analysis of samples and standards is documented within the instrument run log and supported by the instrument print-out. The runlog must be completed for each days analysis. An example of a runlog page appears in Appendix C.

7.7.2 Traceability of Standards

Custom made and single element stock standard solution which are traceable to NIST or EPA are purchased. Upon receipt, each standard is entered into LabNet and is issued a unique source ID#. The manufacturer, lot #, date received, expiration date, date of verification and the initials of the recording analyst are also entered.

7.7.3 Data Review

Analytical data goes through a 200% review cycle. The analyst and a trained data reviewer perform the reviews according to the criteria established on the data review checklist (Refer to Appendix D). Upon the first 100% review, the checklist is initialed and

dated as reviewed. The package, with its review sheet, comments and any Corrective Action Reports (CARs) are submitted to the section manager, unit supervisor or peer reviewer for a second review. Once again, the checklist is initialed and dated by the second reviewer. The completed data review form remains on file with the original data.

8.0 QUALITY CONTROL

8.1 QC Summary

NOTE: The following laboratory acceptance criteria are set at default control limits. Statistical limits are generated on an annual basis from cumulative LCS data and can be implemented when specified by the client, contract, or QAP.

8.1.1 Method Blank (MB)

At least one MB and one LCS will be included in each digestion batch of 20 samples. Regardless of the matrix being processed, the LCS and MB will be in an aqueous media. The MBs are analyzed to determine if contaminants are being introduced into the sample via the sample preparation procedures.

8.1.2 Laboratory Control Sample (LCS)

The LCS is analyzed to determine the accuracy of the digestion process.

Accuracy will be measured by the percent recovery (%R) of the LCS. The recovery must be within ±20% of the known concentration. If the LCS results are outside these control limits, all samples in the preparation set must be redigested and reanalyzed. Refer to Appendix E for element concentrations.

8.1.3 Matrix Duplicate (MD)

A duplicate sample will be prepared at a frequency of 5% (1 in 20 samples). A 20 RPD is set as the acceptance limits.

8.1.4 Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

The MS / MSD will be prepared at a frequency of 5% (1 in 20 samples). The recovery must be within 75 - 125%. (Exception allowed if the sample concentration exceeds 4 times the spike added concentration.)

TCLP - If the MS recovery is <50% and the concentration does not exceed the regulatory limit or the sample concentration is within 20% of the regulation level, the Method of Standard Addition (MSA) is required. Three aliquots of the sample are spiked at 50%,

100% and 150% of the sample concentration or, if the sample concentration is < RL, the MSA is at 50%, 100% and 150% of the MS level. The data is subjected to linear regression whereas the concentration of the unknown is the x-intercept and the correlation coefficient value must be ≥ 0.995.

8.1.5 Serial Dilution

A Serial Dilution (5X) will be prepared from the digestate at a frequency of 5% (1 in 20 samples). If the concentration is >10 times the MDL, results should agree within +/- 10% of the original results.

8.2 Corrective Action

When an out of control situation occurs, the analysts must use his/her best analytical judgment and available resources to determine the corrective action to be taken. The out of control situation may be caused by more than one variable. The analyst should seek the assistance of his/her section manager, supervisor, QA personnel, or other experienced staff if he/she are uncertain of the cause of the out of control situation. The test must not be resumed until the source of the problem and an in-control status is attained. All samples associated with the out of control situation should be reanalyzed. Out of control data must never be released without approval of the section manager, supervisor, or QA personnel.

Listed below are steps that must be taken when an out of control situation occurs:

- demonstrate that all the problems creating the out of control situation were addressed;
- document the problem and the action which was taken to correct the problem on a CAR;
- document on the CAR that an in control has been achieved; and
- receive approval (signature) of the section manager, supervisor, or QA personnel prior to the release of any analytical data associated with the problem.

Suggested actions to specific out of control situations:

8.2.1 Calibration Curve

- reanalyze the standard curve;
- prepare a new stock and/or working standards;
- check the reagents/solutions and prepare fresh if necessary.

8.2.2 Initial Calibration Verification (ICV)

- repeat the ICV to verify proper preparation;
- prepare a new ICV from original stock;
- recalibrate with a new standard curve;
- prepare a new stock and/or working standards;

- check the reagents/solutions and prepare fresh if necessary.

8.2.3 Initial Calibration Blank (ICB)

- prepare a new ICB to verify proper preparation;
- verify that the instrument base-line is stable and perform necessary maintenance, cleaning, etc.. to achieve stability;
- determine the source of contamination by process of elimination, carryover from a previous analysis or reagent contamination and correct the problem;
- check the reagents/solutions and prepare fresh if necessary;
- correct for any contamination and reanalyze the ICB and any associated samples.

8.2.4 Laboratory Control Standards (LCS)

If the LCS is low:

- reanalyze the LCS and all samples in the set for the failed analyte(s) to confirm that it is out of control.
- If continued out of control, redigest and reanalyze the set.
- Write a CAR.

If the LCS is high:

- reanalyze the LCS and all samples in the set for the failed analyte(s) to confirm that it is out of control.
- check for contamination of reagents, LCS stock solution, or in the preparation area;
- correct for contamination, redigest and re-analyze the set;
- Write a CAR.

8.2.5 Laboratory Control Standard Duplicate (LCD)

- Performed on a project-by-project basis and project-specific corrective actions will be applied.

8.2.6 Method Blank (MB)

- reanalyze the MB to verify that it is beyond the reporting limit;
- determine the source of contamination;
- determine if a high value is due to contamination;
- check for contamination of reagents or in the preparation area;
- correct for contamination, reanalyze the set;
- in the extreme case where all samples in the set are at least 10x > the MB or < RL, reanalysis will not be required; however, a CAR will be written and approved by the supervisor or section manager

8.2.7 Matrix Duplicate (MD)

- a CAR will be written and approved by the supervisor or section manager.

8.2.8 Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

- a CAR will be written and approved by the supervisor or section manager.

8.2.9 Serial Dilution (L)

- prepare a new serial dilution to verify proper preparation;
- a CAR will be written and approved by the supervisor or section manager.

8.2.10 Continuing Calibration Verification (CCV)

- repeat the CCV to verify proper preparation;
- prepare a new CCV from the original stock;
- check for instrument base-line drift or a change in one or more of the reagents;
- check the reagents/solutions and prepare fresh if necessary;
- recalibrate with a new standard curve and repeat all samples since the previous in control CCV;
- never dispose of any samples until you are sure that all QC are within the control limits.

8.2.11 Continuing Calibration Blank (CCB)

- check reagents/solutions to verify proper preparation and prepare fresh if necessary;
- verify that the instrument base-line is stable and/or perform necessary maintenance, cleaning, etc., to achieve stability;
- correct for any contamination (carryover from a previous analysis or reagent contamination) and reanalyze the CCB and any associated samples;
- never dispose of any samples until you are sure that all QC are within the control limits.

8.2.12 Additional Corrective Actions

1. If any of the ICV, ICB, ISA, ISB, CCV or CCB results are out of control for any element, the instrument is restandardized and the samples associated with the out of control elements are reanalyzed.

2. If the MB or LCS are out of control for any element, the samples are redigested. An exception is if the sample concentrations are $\geq$ 10X the MB contamination or < RL. In this case, the results are reported as is.

3. If any of the MD or MS/MSD results are out of control, the client is notified of the poor results via a case narrative that is sent with the data report.

4. CARs are completed by the analyst performing the analysis. The forms are then reviewed and signed by the supervisor or section manager. The signed forms are filed with the original data and a copy is kept on file in the Metals Department.

9.0 DATA ANALYSIS AND CALCULATIONS

The sample results are stored in a data file on the desktop computer. The data is transferred over to LabNet and edited there. This system helps to eliminate transcription errors, since data is not entered by hand.

9.1 Accuracy

9.1.1 ICV / CCV, LCS

$$\% \text{ Recovery} = \frac{\text{observed concentration}}{\text{actual concentration}} \times 100$$

9.1.2 MS / MSD

$$\% \text{ Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

9.2 Precision

9.2.1 Matrix Duplicate (MD)

$$\text{RPD} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

9.3 Concentration

$$\text{mg/kg or L} = \frac{C \times V \times D}{W}$$

Where:
C = sample concentration in extract (ppm)
V = Volume of extract (mL)
D = Dilution Factor
W = Weight/Volume of sample aliquot extracted (grams or mLs)

9.4 Dry Weight Reporting

$$= \frac{\text{Final Result}}{\text{Total Solids}} \times 100$$

NOTE: All dry weight corrections are made in LabNet at the time the final report is prepared.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

- Waste from this procedure will enter the "Corrosive Wastewater" wastestream.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1.0, 7.0 and 8.0.

12.0 REFERENCES

Refer to Section 1.0.

13.0 ATTACHMENTS

Table 1: Element and Reporting Limits
Appendix A: Standard Stock Solutions
Appendix B: Stock QC Solutions
Appendix C: Example: Analysis Run Log
Appendix D: Example: Data Review Form
Appendix E: Known Digested Quality Control

Historical File:
Revision 00: 02/11/98
Revision 01: 01/29/99
Revision 02: 03/20/00
Revision 03: 06/29/01
Revision 04: 09/13/02

Reasons for Revision; Revision 04

- Annual Review – No Changes.
- Updated the Health & Safety (3.0) and Waste Disposal (10.0) sections.

U:\QC\SOP\ME\6010B.DOC

Table 1.

Element and Reporting Limits

Element	ICAP 61E (ICP3) Wavelength (nm)	ICAP 61E (ICP4) Wavelength (nm)	ICAP 61E (ICP5) Wavelength (nm)	Reporting Limits[1]	
				Waters (ug/L)	Soils (mg/kg)
Al	308.2	308.2	308.2	200	20
Sb	206.8	206.8	206.8	20	2
As	189.0	189.0	189.0	10	1
Ba	493.4	493.4	493.4	10	1
Be	313.0	313.0	313.0	4	0.4
Bi	223.0	223.0	N/A	50	5
B	249.6	249.6	249.6	50	5
Ca	317.9	317.9	317.9	100	10
Cd	226.5	226.5	226.5	2	0.2
Cr	267.7	267.7	267.7	10	1
Co	228.6	228.6	228.6	5	0.5
Cu	324.7	324.7	324.7	10	1
Fe	271.4	271.4	271.4	50	5
Pb	220.3	220.3	220.3	5	0.5
Mg	279.0	279.0	279.0	100	10
Mn	257.6	257.6	257.6	10	1.0
Mo	202.0	202.0	202.0	10	1
Ni	231.6	231.6	231.6	10	1
P	214.9	178.2	178.2	50	5
K	766.4	766.4 / 404.7	766.4	500 / 10,000	50 / 1,000
Se	196.0	196.0	196.0	5	0.5
Si	288.1	288.1	288.1	200	20
Ag	328.0	328.0	328.0	5	0.5
Na	330.2	330.2	330.2 / 588.9	1,000	100
Sr	421.5	NA	421.5	5	0.5
Tl	190.8	190.8	190.8	10	1
Sn	189.9	189.9	189.9	20	2
Ti	334.9	337.2	334.9	5	0.5
V	292.4	292.4	292.4	5	0.5
Y[2]	371.0	371.0	371.0	N/A	N/A
Zn	213.8	206.2	206.2	10	1

[1]These are routine Trace ICAP reporting limits (RL). Lower RLs are available and can be used per client request. RLs will vary depending on sample size/volume, dilution factors, dry weight reporting for soils, and changes in MDLs.

[2]Y is used as an internal standard and is introduced continuously to all samples (including standards and QC samples) via the peristaltic pump at an approximate concentration of 5 ppm.

Appendix A.

Standard Stock Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	S1A	S1B	S1	S2A	S2B	S2
Inorganic Ventures	RFW-ICPT-STD-1B	Sb	100	0.4	0.5	1			
		Mo	100	0.4	0.5	1			
		Si	100	0.4	0.5	1			
		Sn	100	0.4	0.5	1			
		Ti	100	0.4	0.5	1			
Inorganic Ventures	RFW-ICPT-STD-1C	Al	1000	4	5	10			
		Fe	1000	4	5	10			
		K	1000	4	5	10			
		Na	1000	4	5	10			
		Li	800	2	4	8			
		Mg	800	2	4	8			
		Ca	400	1.6	2	4			
Inorganic Ventures	RFW-ICPT-STD-1D	As	100	0.4	0.5	1			
		Ba	100	0.4	0.5	1			
		Be	100	0.4	0.5	1			
		Bi	100	0.4	0.5	1			
		B	100	0.4	0.5	1			
		Cd	100	0.4	0.5	1			
		Cr	100	0.4	0.5	1			
		Cu	100	0.4	0.5	1			
		Pb	100	0.4	0.5	1			
		Ni	100	0.4	0.5	1			
		Se	100	0.4	0.5	1			
		Ag	100	0.4	0.5	1			
		Sr	100	0.4	0.5	1			
		Tl	100	0.4	0.5	1			
		Zn	100	0.4	0.5	1			
Inorganic Ventures	RFW-ICPT-STD-2A	Al	10,000				40	50	100
		K	10,000				40	50	100
Inorganic Ventures	RFW-ICPT-STD-2B	Ca	5000				20	25	50
		Fe	5000				20	25	50
		Mg	5000				20	25	50
		Na	5000				20	25	50
Inorganic Ventures	RFW-ICPT-STD-3	Pb	2000				8	10	20
		Mn	1000				4	5	10
		V	1000				4	5	10

Appendix B.

Stock QC Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	ICV (mg/L)	CCV (mg/L)
High Purity	CCV Solution A	As	50	0.4	0.5
		B	50	0.4	0.5
		Ba	50	0.4	0.5
		Be	50	0.4	0.5
		Bi	50	0.4	0.5
		Cd	50	0.4	0.5
		Co	50	0.4	0.5
		Cr	50	0.4	0.5
		Cu	50	0.4	0.5
		Ni	50	0.4	0.5
		Pb	50	0.4	0.5
		Se	50	0.4	0.5
		Fe	500	20	25
		Mn	500	4	5
		V	500	4	5
		Tl	50	0.4	0.5
		Zn	50	0.4	0.5
		Sr	50	0.4	0.5
High Purity	CCV Solution A2	Ca	200	20	25
		Li	400	---	---
		Na	500	20	25
		Al	500	40	50
		Mg	400	20	25
		K	500	40	50
High Purity	CCV Solution B	Ag	50	0.4	0.5
		Sb	50	0.4	0.5
		Mo	50	0.4	0.5
		Si	50	0.4	0.5
		Sn	50	0.4	0.5
		Ti	50	0.4	0.5
Ultra	Single Elements	Al	10,000	40	50
		Ca	10,000	20	25
	* spiked on top	Fe	10,000	20	25
	of custom mixes.	Na	10,000	20	25
		K	10,000	40	50
		Mg	10,000	20	25

Appendix B.
(continued)
Stock QC Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	CRI Conc. (mg/L)
Inorganic Ventures	CRI-CRA-1	Be	100	0.01
		Cr	200	0.02
		Co	1000	0.10
		Cu	500	0.05
		Mn	300	0.03
		Ni	800	0.08
		Ag	200	0.02
		V	1000	0.10
		Zn	400	0.04
Inorganic Ventures	CRI-CRA-2	Sb	600	0.12
Inorganic Ventures	CRI-CRA-3	As	100	0.02
		Cd	50	0.01
		Pb	30	0.006
		Se	50	0.01
		Tl	100	0.02
Inorganic Ventures	Calcium	Ca	10,000	10
	Potassium	K	10,000	10
	Magnesium	Mg	10,000	10
	Sodium	Na	10,000	10
	Iron	Fe	10,000	0.2
	Aluminum	Al	10,000	0.4
	Barium	Ba	1,000	0.4
	Boron	B	1,000	0.2
	Bismuth	Bi	1,000	0.2
	Molybdenum	Mo	1,000	0.2
	Silicon	Si	1,000	0.2
	Tin	Sn	1,000	0.2
	Strontium	Sr	1,000	0.2
	Titanium	Ti	1,000	0.2

Appendix B.
(continued)
Stock QC Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	ICSA Conc. (mg/L)
Inorganic Ventures	CLP Interferents "A" Solution	Al	5000	500
		Ca	5000	500
		Mg	5000	500
		Fe	2000	200
				ICSB Conc. (mg/L)
Inorganic Ventures	CLP Interferent A Solution	Al	5000	500
		Ca	5000	500
		Mg	5000	500
		Fe	2000	200
Inorganic Ventures	CLPP-ICS-B4	Cd	100	1
		Ni	100	1
		Zn	100	1
		Sb	60	0.6
		Ba	50	0.5
		Be	50	0.5
		Co	50	0.5
		Cr	50	0.5
		Cu	50	0.5
		Mn	50	0.5
		V	50	0.5
		Ag	20	0.2
		As,Tl	10	0.1
		Pb,Se	5	0.05

Appendix C.

Example: Analysis Runlog

STL Chicago

TJA Trace ICAP (61E) Analysis Log – ICP5

Page No._____

Date	Initials	File Name	Dig. Set	Int. Std	Sample Nos.	Parameters	Comments
				As = Y =			
				As = Y =			
				As = Y =			
				As = Y =			
				As = Y =			
				As = Y =			
				As = Y =			
				As = Y =			
				As = Y =			

Reviewed by:_____ Date:_____

CHI-22-14-062/A/11/01

Appendix D.

Example: Data Review Checklist

STL Chicago
ICAP Metals Data Review Checklist

Instrument ID: ICP 3 ICP 4 ICP 5 **Filename:**_____

Analyst Initial(s):_____ **LabNet Batch No.:**_____

Copies: _____ _____

****

QC Type: a. CLP b. Standard c. TCLP d. Drinking Waters e. Solubles

I. Calibration:

Analyst	Reviewer	
		1. Verification of standard traceability and expiration (daily).
		2. Calibration is clearly documented:
		a. Instrument is calibrated using a Blank and three Calibration Standards. The correlation coefficient must be ≥0.995.
		b. Reanalysis of the top calibration standard as a sample. Control limits are 95 - 105%. (Run once daily prior to sample analysis).
		3. Calibration Verification: (10% Frequency):
		a. ICV/CCV: **Std./CLP** – Recovery 90-110% **EPA 200.7 (ICV)** – Recovery 95-105%
		b. ICB/CCB: **Std. QC:** < RL; **CLP QC:** < CRDL; **SW-846 QC:** < 3x IDL.
		4. **CLP QC:** An Initial & Final for each sample analysis run:
		a. CRI - 2x CRDL; No Limit Set
		b. ISA/ISAB - 80-120% Recovery
		5. **Std. QC:** Analyzed at the beginning of the day and every 8 hours thereafter:
		a. CRI: 2x CRDL; No Limit Set
		b. ISA/ISAB: 80-120% Recovery
		Refer to Run #:_____

Note: **CLP QC** requires the use of the IDL for calculating % Recoveries and Reporting Limits.
Standard QC requires the use of the RL for calculating % Recoveries and Reporting Limits.

II. Sample Analysis:

Analyst	Reviewer	
		1. Each Prep Batch consists of a maximum of 20 samples of a similar matrix:
		a. Prep Batches must be clearly identified
		b. 1 Prep Blank **CLP** - < CRDL; **Std. QC** - < RL **TCLP** - < TCLP Reporting Limit
		c. 1 LCS **Std./CLP** - 80-120% Rec.; **EPA 200.7** - 85-115% Rec.
		d. 1 Duplicate **Std.** - RPD or RSD limits are 20%; ***Unless*** the sample conc. is <5x RL then ± RL applies; for CLP ± CRDL applies. **EPA 200.7** - 10% Frequency
		e. 1 Matrix Spike **Std./CLP** - 75-125% Rec.; ***Unless*** the sample conc. exceeds the spike conc. by 4x; **EPA 200.7** - 70-130% Rec.; 10% Frequency
		f. Analytical MS **TCLP** - >50% (MSA performed if <50% recovery)
		g. Serial Dilution 1 per 20 samples; 10% Difference Limit
		h. A post-digestion spike (PMS) must be performed for CLP and 200.7 if the above limits are not met, (CLP - except for Ag, Na, Ca, K, and Mg for waters and soils, and Al and Fe for soils only).
		i. Turbidity Checked: **EPA 200.7 Drinking Water**

STL Chicago
ICAP Metals Data Review Checklist

II. Sample Analysis (continued):

Analyst	Reviewer	
		2. A Corrective Action Report (CAR) must be written for any out of control situations, clearly stating the problem and action to be taken:
		a. CAR included with original data run
		b. CAR with corrective action results included with the corrective action run.

III. Data Documentation

Analyst	Reviewer	
		1. Raw Data:
		a. Unused data is clearly identified.
		b. All crossed out data is initialed and dated.
		c. Out of control QC is clearly identified.
		d. Any data that has a tick (S, I, H or L) is commented on with appropriate action taken.
		e. The first page of the run must have the filename; instrument; and analyst's signature

		2. Run Log:
		a. Unused data is clearly identified.
		b. All cross outs are initialed and dated.
		c. Analyst's Signature is required.

		3. LabNet:
		a. Worksheet and data pages are printed.
		b. Unused data is clearly identified.
		c. All cross-outs are initialed and dated.
		d. First page must have the filename, instrument identification; analyst signature.
		e. Samples needing copying are clearly marked.
		f. Label Sample ID with the LabNet Batch their in.

III. Miscellaneous

Analyst	Reviewer	
		1. Is Sample Prep Linked?
		2. Is TCLP Linked? (Shift F9 from the start page)
		3. Did all dilutions carry over for MD, MS, MSD (where applicable)?
		4. Did all prep and analysis matrices match up?

Comments:

_____

_____

_____

Analyst Signature: _____ Date:

Reviewer Signature: _____ Date:

Appendix E.

Known Digested QC Values (mg/L)

Element	LCS/Spike	TCLP Spike
Al	2	-
Sb	0.5	-
As	0.1	5
Ba	2	100
Be	0.05	-
Bi	0.5	-
B	1	-
Cd	0.05	1
Ca	10	-
Cr	0.2	5
Co	0.5	-
Cu	0.25	0.25
Fe	1	-
Pb	0.10	5
Mg	10	-
Mn	0.5	-
Mo	1	-
Ni	0.5	0.5
P	0.5	-
K	10	-
Se	0.10	1
Si	5	-
Ag	0.05	1
Na	10	-
Sr	1	-
Tl	0.10	-
Sn	1	-
Ti	1	-
V	0.5	-
Zn	0.5	-

Default Control Limits
LCS: 80 - 120%
Spike: 75 - 125%
TCLP Spike: >50%

STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURE

SOP No.	Revision No.	Date	Page
UME-245.1	08	09/20/02	1 of 27

TITLE: **Metals Analysis**
Mercury by EPA Methods 245.1/245.5; SW-846 7470A/7471A; and U.S. EPA CLP Document No. ILM04.0

Updated by:	Signature:	Date:
George Klee Mercury Analyst		9/18/02

Approved by:	Signature:	Date:
Mani S. Iyer Section Manager, Metals Dept.		9/24/02
David L. Kaczka Env. Health & Safety Coor.		9/16/02
Terese A. Preston Quality Manager		9/16/02

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Re: Ashland/NSP Lakefront Site QAPP

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the digestion and analytical procedure for the determination of the mercury concentration in aqueous and non-aqueous media. This SOP was written using EPA 600/4-79-020 Methods 245.1 and 245.5; SW-846, 3rd Edition, Methods 7470A/7471A; and U.S. EPA CLP Document No. ILM04.0 as references.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Instrument Detection Limits

Instrument Detection Limits (IDLs) are performed quarterly for each element by the metals laboratory for each instrument as specified in CLP. These limits are used to gauge instrument sensitivity and when routinely evaluated, instrument performance without the introduction of method variance can be determined.

NOTE: The annual MDL may be used in lieu of one of the semi-annual IDL sets, providing required reporting limits are achieved.

1.1.3 Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory maintains reporting limits that are higher than the MDL. Wherever possible, reporting is limited to values approximately

3-5x the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement.

Matrix	Reporting Limit [1]	CRDL [2]
Water	0.2 ug/L	0.2 ug/L
Soil	0.033 mg/kg	0.1 mg/kg

[1] Reporting Limit is used for EPA Method 245.1 and SW-846 7470A/7471A. Reporting Limits may vary depending on sample volume/size, dilution factors, and changes in the MDL.
[2] CRDL (Contract Required Detection Limit) is used for U.S. EPA CLP ILM04.0.

1.1.4 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM, Revision 02).

1.2 Summary of Method

This flameless cold vapor AA procedure is a physical method based on the absorption of radiation at 253.7 nm by mercury vapor. The mercury is reduced to the elemental state and swept from solution and passed through a cell of a double beam AA. Absorbance is a function of mercury concentration.

2.0 INTERFERENCES

- Chloride, sulfide and certain volatile organic materials.

3.0 SAFETY

- Employees will adhere to the practices and policies in the STL Corporate Safety Manual (CSM) and will read the MSDSs for the materials used in this method before handling or using the material.
- As always, general laboratory safety practices should always be followed
- The standards contains potentially harmful levels of mercury. Care should be taken to avoid contact with the stock solutions. Wash hands well if contacted.

4.0 EQUIPMENT AND SUPPLIES

- 2 – Leeman Labs Model PS200 Automated Mercury Analyzer
- Class A volumetric glassware
- Eppendorf pipettes

5.0 REAGENTS AND STANDARDS

5.1 Reagents

5.1.1 Miscellaneous Reagents

- Hydrochloric Acid [HCl], Concentrated
- Nitric Acid [HNO_3], Concentrated
- Sulfuric Acid [H_2SO_4], Concentrated
- Deionized (DI) Water, Type II

5.1.2 Sodium Chloride-Hydroxylamine Hydrochloride Solution

Dissolve 240 g of sodium chloride and 240 g of hydroxylamine hydrochloride in sufficient DI water to make 2-liters of solution.

- Life of Reagent: 1 Year
- Storage Requirements: None

5.1.3 Stannous Chloride Solution

Dissolve 100 g of stannous chloride in 10% hydrochloric acid to make 1-liter of solution.

- Life of Reagent: 1 Month
- Storage Requirements: None

5.1.4 Potassium Permanganate, 5%

Dissolve 175 g of potassium permanganate into 3.5-liters of DI water.

- Life of Reagent: 1 Year
- Storage Requirements: None

5.1.5 Potassium Persulfate, 5%

Dissolve 175 g of potassium persulfate into 3,500 mLs of DI water.

- Life of Reagent: 1 Year
- Storage Requirements: None

5.2 Standards All standards are prepared in Class A volumetric flasks.

5.2.1 Standard Stock Solution I; 1,000 ppm

A 1,000 ppm concentrated mercury standard is purchased from an outside supplier.

- Life of Standard: 1 Year
- Storage Requirements: None

5.2.2 Working Standard Solution I; 100 ppb

To a 1.0 L volumetric flask filled with ~800 mLs DI water, transfer 100 uLs of Stock Solution I to the flask using a 100 uL Eppendorf pipette. Add 2.5 mLs conc. nitric acid as a preservative. Dilute to volume with DI Water. Invert and mix to insure complete mixture.

*For use in spiking Matrix Spikes, CRAs & the Standard Curve.

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.2.1 Working Standard Solution IA; 25 ppb

To a 100 mL volumetric flask filled with ~80 mLs DI water, transfer 25 uLs of Working Standard Solution I (Item 5.2.2) to the flask using an Eppendorf pipette. Dilute to volume with DI Water. Invert and mix to insure complete mixture.

*For use in spiking Matrix Spikes, CRAs & the Standard Curve in the **Hot Block Digester**

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.3 Standard Stock Solution II; 1,000 ppm

Purchased from an outside supplier as a 1,000 ppm solution and is from an alternate source than that of Standard Stock Solution I (Rgt. 5.2.1).

- Life of Standard: 1 Year
- Storage Requirements: None

5.2.4 Working Standard Solution II; 200 ppb

To a 1.0 L volumetric flask filled with ~800 mLs DI water, add 2.5 mLs concentrated nitric acid (as a preservative) and 200 uLs of Standard Stock Solution II to the flask (using a 200 uL Eppendorf pipette). Dilute to volume with DI water and invert several times to mix.

*For use in spiking the ICV/CCV and LCS.

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.4.1 Working Standard Solution IIA; 50 ppb

To a 100 mL volumetric flask filled with ~80 mLs DI water, add 25 uLs of Working Standard Solution II (Item 5.2.4) to the flask using an Eppendorf pipette. Dilute to volume with DI Water. Invert and mix to insure complete mixture.

*For use in spiking the ICV/CCV and LCS in the **Hot Block Digester**

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.5 Working Standards for Mercury in Water

Standard (ug/L)	mLs of Working Soln. I or IA	Final Volume (mLs) Water Bath	Final Volume (mLs) Hot Block
Blank	0.0	100	25
0.2	0.2	100	25
0.5	0.5	100	25
1.0	1.0	100	25
3.0	3.0	100	25
5.0	5.0	100	25
CRA (0.2 ug/L)	0.2	100	25
Matrix Spike (1.0 ug/L)	1.0	100	25

Standard (ug/L)	mLs of Working Soln. II or IIA	Final Volume (mLs) Water Bath	Final Volume (mLs) Hot Block
Init. Cal. Verif. (ICV) (2.0 ug/L)	1.0	100	25
Cont. Cal. Verif. (CCV) (1.0 ug/L)	0.5	100	25
Lab Control Sample (LCS) (2.0 ug/L)	1.0	100	25

CLP Standard (ug/L)	mLs of Working Soln. II or IIA	Final Volume (mLs) Water Bath	Final Volume (mLs) Hot Block
Init. Cal. Verif (ICV) (2.0 ug/L)	1.0	100	25
Cont. Cal. Verif. (CCV) (1.0 ug/L)	0.5	100	25

NOTE: ILM04.0 requires the ICV and CCV to be at different levels.

6.0 CALIBRATION (NON-DAILY)

All calibration procedures are performed on a daily basis. Refer to Section 7.4 for details.

7.0 PROCEDURE

7.1 Quality Control Checks

The following Quality Control samples are performed with each batch of samples. Refer to Section 8.0 for additional details.

QC Sample	Frequency[1]	Control Limits
Method Blank (MB)	1 in 20 samples	• < Reporting Limit (EPA / SW-846) • < CRDL (CLP)
LCS	1 in 20 samples	• 80-120% Recovery (EPA / SW-846 / CLP) • 85-115% Recovery (EPA 245.1 Only)
Matrix Duplicate (MD)[2]	1 in 20 samples	• 20 RPD unless the sample conc. is <5x RL, then ± RL. (EPA / SW-846) • 20 RPD unless the sample conc. is <5x CRDL, then ± CRDL. (CLP)
Matrix Spike (MS) MS Duplicate (MSD)[2]	1 in 20 samples	• 75 – 125% Recovery unless the sample concentration > spike level by 4x (EPA / SW-846 / CLP) • 85 – 115% Recovery (EPA 245.1) • > 50% Recovery; if <50% Recovery, Method of Standard Additions (MSA) is required (TCLP)

[1] Drinking waters by EPA 245.1 and CLP analyses are analyzed at a frequency of 1 in 10 samples.
[2] The sample selection for MS/MSD or MS/MD, where appropriate, are rotated among client samples so that various matrix problems may be noted and/or addressed. MD's are performed only when requested by the client/project/contract. The MS/MSD are the routinely performed matrix QC indicators.

7.2 Sample Preservation and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client request. Listed below are the holding times and preservations for the referenced programs.

Program	Preservation [1]	Holding Time [2]
SDWA	pH < 2, Cool 4 ± 2°C	28 days VTS [3]
CWA	pH < 2, Cool 4 ± 2°C	28 days VTS
RCRA	pH < 2, Cool 4 ± 2°C	28 days VTS
CLP	pH < 2, Cool 4 ± 2°C	26 days VTSR [4]

[1] Waters are preserved with nitric acid at pH <2; Soils are preserved at Cool 4 ± 2°C.
[2] Holding times include digestion and analysis.
[3] VTS: Verified Time of Sampling.
[4] VTSR: Verified Time of Sample Receipt.

7.3 Sample Preparation

7.3.1 Mercury Water Digestion Procedure - EPA Method 245.1 / CLP ILM04.0

Item	Full Scale (Water Bath)	Hot Block
Sample Volume	100 mLs	25 mLs
Reaction Vessel	BOD Bottle, 300 mLs	Sample Vials, 50 mLs
Sulfuric Acid (conc.)	5 mLs	1.25 mLs
Nitric Acid (conc.)	2.5 mLs	0.625 mLs
Potassium Permanganate, 5% Sol. (W/V)	15 mLs	3.75 mLs
Potassium Persulfate, 5% Sol. (W/V)	8 mLs	2 mLs
Preparation	2 hrs. @ 90 - 95°C, Cool	2 hrs. @ 90 - 95°C, Cool
Hydroxylamine Addition	6 mLs	1.5 mLs
Total Volume	136.5 mLs	34.125 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.3.2 Mercury Water Digestion Procedure - SW-846 Method 7470A

Item	Full Scale (Water Bath)	Hot Block
Sample Volume	100 mLs	25 mLs
Reaction Vessel	BOD Bottle, 300 mLs	Sample Vials, 50 mLs
Sulfuric Acid (conc.)	5 mLs	1.25 mLs
Nitric Acid (conc.)	2.5 mLs	0.625 mLs
Potassium Permanganate,	15 mLs	3.75 mLs

Item	Full Scale (Water Bath)	Hot Block
5% Sol. (W/V)		
Potassium Persulfate, 5% Sol. (W/V)	8 mLs	2 mLs
Preparation	2 hrs. @ 90-95°C, Cool	2 hrs. @ 90 - 95°C, Cool
Hydroxylamine Addition	6 mLs	1.5 mLs
Total Volume	136.5 mLs	34.125 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.3.3 Mercury Soil Digestion Procedure - SW-846 Method 7471A

NOTE: Three aliquots of soils (~0.2 g) are combined and digested as one sample.

Item	Full Scale (Water Bath)
Sample Weight	~ 0.6 – 0.7 grams
Reaction Vessel	BOD Bottle, 300 mLs
DI Water, Type II	5 mLs
Aqua Regia [3:1 HCl (conc.) to HNO_3 conc.)]	5 mLs
Preparation	2 min. @ 90-95°C, Cool
DI Water, Type II	50 mLs
Potassium Permanganate, 5% Sol. (W/V)	15 mLs
Preparation	30 min. @90-95°C, Cool
Hydroxylamine Addition	6 mLs
Total Volume	Dilute to 100 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.3.4 Mercury Soil Digestion Procedure - EPA Method 245.5 / CLP ILM04.0

Item	Full Scale (Water Bath)
Sample weight	0.2 - 0.3 grams
Reaction Vessel	BOD bottle, 300 mLs

Item	Full Scale (Water Bath)
Sulfuric Acid (conc.)	5 mLs
Nitric Acid (conc.)	2.5 mLs
Preparation	2 min. @ 90 -95°C, Cool
DI Water, Type II	50 mLs
Potassium Permanganate, 5% Sol. (W/V)	15 mLs
Potassium Persulfate, 5% Sol. (W/V)	8 mLs
Preparation	30 min. @ 90 - 95°, Cool
Hydroxylamine Addition	6 mLs
Total Volume	Dilute to 100 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.4 Calibration / Standardization

Before the instrument is used as a measurement device, the instrument response to known reference materials must be determined. All sample measurements must be made within this linear range of the instrument.

Standard	Frequency	Control Limit
Calibration Curve	Initially	Corr. Coeff. ≥ 0.995
ICV	After the Calibration Curve	• 90 –110% Recovery (SW-846 / CLP) • 95 – 105% Recovery (EPA)
ICB	After the ICV	• < Reporting Limit (EPA / SW-846) • < CRDL (CLP)
CRA	After ICB	• No established limits.
CCV	Every 10 readings; end of each run	• 90 – 110% Recovery (EPA / CLP) • 80 – 120% Recovery (SW-846)
CCB	Every 10 readings; End of each run	• < Reporting Limit (EPA / SW-846) • < CRDL (CLP)

7.4.1 Calibrating the System

The instrument must be calibrated before samples are analyzed.

To perform a standard EPA (Method 7470) calibration, press the F2 macro key and "Macro:" prompt appears at the top of the, type "CLP3 STOP" and press enter. The calibration routine will begin running. It is assumed that the five standards (0, 0.2, 0.5, 1.0, 3.0, and 5.0 ppb) have been loaded as standards 1 through 6. After the standards

run, the check standards will run automatically. CLP3 STOP will accept the calibration. "Macro:" RUNSTD will run standards only.

NOTE: If running ILM04.0 samples, choose "CLP3 STOP" to run ICV from Check Std. 2 (2 ppb) and all CCV's from Check Std. 3 (1 ppb).

To perform a calibration other than a standard EPA procedure, press the STD F6 action key. The Standard screen appears and a "Run standard: 1 2 3 4 5 6 " message is displayed at the bottom of the screen. Enter the number of the standard to be run (1-6) and press enter. A "from replicate: 1 to: _ "message will then be displayed at the bottom of the screen. Enter the first number in the "from replicate:" field and last number in the "to:" field. Press ENTER. The system will run the standards.

NOTE: To stop a procedure at any time, press the Stop F10 action key.

The results of the calibration are automatically stored. To review the results, select CALIBRATION from the Main Menu and then select LINE CALIBRATION to generate a display.

Below are some guidelines for determining whether the results are acceptable:

- Do the %RSD's look acceptable for various concentrations?
- Is the correlation coefficient larger than 0.995?

If the calibration results are acceptable, type A and press ENTER. A "New calibration coefficients stored" message will be displayed at the bottom of the screen and the samples can now begin to be analyzed..

7.4.2 Check Standards

This option allows for the verification that the calibration has not drifted. To check standard concentrations:

- From the Main Menu, select CALIBRATION and then select CHECK STANDARDS. The check standard screen will appear.
- Type 1 for a check standard blank. Enter, in units specified on the standards page, the range of acceptance.
- Type 2 for check standards cup 2. Type the concentration and Enter. Type the percent acceptance and Enter.
- Repeat this for up to seven check standards.
- From Main Menu, select AUTOSAMPLES, then select SETUP and then check Enter the C1 frequency (e.g., 5/EPA protocol)
- Halt: Enter Y if the instrument should halt after an unacceptable check standard. Enter N for an alert only. Macros can be written to automatically recalibrate and rerun samples if check standards fall outside specifications.

7.5 Preventive Maintenance

The instrument requires some routine daily maintenance as well as some scheduled and non-scheduled periodic maintenance. All maintenance will be recorded in the instruments maintenance logbook. The following maintenance schedule lists the various maintenance procedures and when they should be performed. Each of these procedures is described in the following sections.

7.5.1 Maintenance Schedule

Equipment	Schedule
Drying Tube	Must be changed daily.
Pump Tubing	Weekly, or as needed.
Lamp	Replace as needed (avg. 4 mos. - 1 yr.).
Optical Cell	Clean as needed (typically monthly).
Liquid Gas Separator	Replace every 1-3 yrs., as needed.
Internal Tubing	Should not require replacement under normal circumstances.

7.5.2 Packing and Changing the Drying Tube

Under normal use, the drying tube must be changed each morning before analyzing samples. (The drying tube is located on the front panel on the left side of the instrument) Several tubes can be packed at one time and stored in an airtight container for a ready supply.

To pack a tube, plug one end with quartz wool, pour in magnesium perchlorate to fill tube, and plug the other end with quartz wool.

To change a tube, slightly loosen the nuts that hold the tube in at either end and slide the used tube out of the fittings. Slide a fresh tube into the fittings and tighten the fittings with your fingers to make a gas-tight seal.

To clean a tube, remove the quartz wool and the magnesium perchlorate. Either dispose of as a solid waste or dissolve in water and dispose of as a liquid waste. Clean the tube with ordinary laboratory glassware cleaner and dry thoroughly.

7.5.3 Replacing and Conditioning Pump Tubing

Pump Tubing should be replaced weekly or when it shows signs of wear. There are four pump tubes: two for drainage, one for sample, and one for reductant. Each tube is fed through a pump cassette which then clamps onto the pump head. Slide a tube through the plastic clips at the bottom of a cassette until the plastic tab is secure. Hold the tube taut, slide the loaded cassette onto the pump head, and lock the clamp up. Repeat for the remaining tubes, then connect the tubes ends.

For optimal performance, run DI water through new tubes for one hour to exercise them before using them for running samples. To do this, select INSTRUMENT from the Main Menu and then select OPERATION.

The INSTRUMENT:OPERATION screen will appear. Set the Pump Rate flow to the standard rate for 5 mL/min (Type R and M and 5 Enter). Wait for one hour and then connect the tubing to the appropriate fluids.

NOTE: This procedure only needs to be done once, when the tubes are new and unused.

7.5.4 Replacing the Lamp

The mercury lamp has a life of about 2000 hours, between four months and a year of use. The lamp needs to be replaced if the relative absorbance of a standard has changed significantly while the optical cell is clean. If the lamp is suspected, it is faster to replace the lamp and recalibrate than to clean the optical cell.

NOTE: Before installation, clean the new lamp quartz with methanol and wipe it dry. Do not get finger prints on the lamp and do not face the printing on the lamp toward the optical cell.

- Turn off the lamp (press the blue button on the front of the instrument).
- Remove the front panel of the instrument (lift up and out).
- Remove the optical assembly.
- Remove the two screws on the lamp housing and take off the lamp cover.
- Twist the lamp 90° and slide it straight out.
- Insert the new lamp and rotate it 90° in the reverse direction to secure it in place. Make sure that the lettering on the lamp will be facing to the left of the instrument when it has been reinstalled. If it is not, remove the lamp and reinsert it correctly.
- Replace the optical assembly.

7.5.5 Cleaning the Optical Cell

If the relative absorbance of standards differs significantly from that of previous calibrations, the optical cell (located inside the front panel) may be dirty and must be cleaned:

- Turn the lamp and the power off and remove the front panel by lifting it up and out.
- Remove the optics clamps, disconnect the detector, and rotate and lift out the assembly. Disconnect the gas lines.
- Remove the six screws holding the lamp spacer and the detector spacer onto the optical cell.

- Inspect the two ends with the lenses. If the external surface of the lenses appear to be the only contaminant, then clean. To clean use methanol. Install if no other cleaning is necessary.
- Disassemble the optical cell (using the allen wrench provided on the inside of the front cover) by removing (in order) the screws, lens, and gasket at each end.
- Carefully clean the inside of the cell with laboratory glassware cleaner, taking care not to scratch the inside surfaces. Rinse thoroughly, first with water and then with DI water. Dry the cell in the oven (free of contaminants) for one hour at approximately 40 - 50°C.
- Clean the lenses with laboratory glassware cleaner and rinse thoroughly with hot tap water. Flush lightly with methanol and dry by air or vacuum oven (maximum 50°C).
- Replace the gaskets (this is recommended although not required unless the gasket shows signs of wear) and reassemble the optical cell. Cleaning of the gaskets should only be done with DI water.

7.5.6 Replacing the Liquid Gas Separator

- The liquid gas separator (transparent block on the chemical panel) should only need to be replaced once every one to three years, depending on the amount of use it receives.
- To replace the separator, shut off the gas and liquid flow and flush the tubing with DI Water for safety purposes. Disconnect the four lines and remove the two screws. Remove the unit from the system, screw on a new one, reconnect the four lines, and turn the gas and liquid flow back on.

7.5.7 Replacing Internal Tubing

Internal gas and Teflon tubes should last indefinitely and should not need to be replaced. Periodically inspect all tubing for restrictions or blockages. If tubing should need to be replaced, do so one piece at time to avoid any confusion while making connections.

7.6 Sample Analysis

7.6.1 Preparing the System

The following procedures must be performed each morning before warming up the system:

- Press the F10 macro key to stop any currently running macro.
- Change the drying tube. Refer to maintenance, Section 7.5 for instructions.
- Release the clamps and check the pump tubing for wear. Under normal use, the tubes will need to be replaced once a week. To replace the tubing, refer to maintenance, Section 7.5 for instructions.
- Check the reductant volume and refresh, if needed.
- Clean the rinse tank using standard lab cleaning practices, add fresh rinse.

- If the lamp has been off then turn on the lamp power and allow the lamp to warm up for at least 45 minutes.
- If the system is shut off, power up all components and perform COLDSTRT macro.
- Start up the system.

7.6.2 Start-up Procedures

The start-up routine used will depend on the current state of the system. If it is in Overnite mode, use the Warmstart macro (Section 7.6.3). If the system has been completely powered down, run the Coldstart macro instead (Section 7.6.4).

7.6.3 Warm Start

- The Warmstart macro is used to prepare the instrument for operation if it is being started up from a short-term (overnight) shutdown.
- To run the Warmstart macro, press the F2 macro key on the keyboard. Type WARMSTRT and press ENTER. The system will wait for several minutes and then turn on the pump and the gas flow to protocol speed. When the system is stable, a beep will sound and an "Operation Complete" message will appear on the screen. The instrument is now ready for operation.

7.6.4 Cold Start

- The Coldstart macro procedure is used to prepare the instrument for operation if the system has been shut down for an extended period of time. This procedure turns on the liquid and the gas flow and then waits until the system thermally equilibrates before beeping to indicate that it is ready to run. Perform an aperture test and make any necessary adjustments to the aperture before analyzing samples.
- To run the Coldstart macro, press the F2 macro key on the keyboard, type COLDSTRT and press ENTER. The Coldstart procedure takes approximately 2 1/2 hours. Do not attempt to operate the instrument before this procedure is complete, or its performance will be significantly impaired.
- When a beep has sounded and an "Operation Complete" message is visible on the screen, indicating the completion of the Coldstart procedure, check the apertures on the optical cell and make any necessary adjustments; this procedure is documented in Section 2.10, steps 1 and 2 of the operator's manual. When the aperture adjustments are completed, the instrument is ready for operation.

7.6.5 Software Setup

- In order to run samples, enter all necessary information regarding the protocol, sample ID's, calibration values, and autosampler parameters into the software. This information is entered into a series of screens which are accessed from the Main Menu. (Display the Main Menu at any time by pressing the F1 key)
- Perform each of the following steps in sequence to set up the software. When these steps have been completed, the instrument will be able to run samples automatically.

NOTE: The steps below comprise the basic daily software setup sequence. The software also contains numerous advanced functions. Refer to the PS Series Reference Guide for a detailed description of the many other keys and functions available for use with this system.

7.6.6 Name the Protocol

Protocols are operational determinations (parameters) for running calibrations and samples. Name the desired protocol to instruct the instrument what its normal operational values will be for running the next batch of samples.

- From the Main Menu, select PROTOCOL and then select GET. The Protocol screen will appear a "Get protocol name:" message will be displayed at the bottom of the screen.
- Type the protocol name and press ENTER. This creates a protocol file.
- Press the F1 key to return to the Main Menu.

7.6.7 Name the Folder

Once the protocol has been named, create a folder to hold all data generated from each sequence of operation.

- From the Main Menu, select DATA OUTPUT and then select Open folder. The Folder maintenance screen appears and an "Enter folder name:" message will be displayed at the bottom of the screen.
- Type a folder name and press ENTER. The folder is created.
- Press the F1 key to return to the Main Menu.

7.6.8 Verify Values and Integration Times

Check to make sure that all values and integration times are correct for running the samples:

- From the Main Menu, select PROTOCOL, then select SET Values. The Set Values screen appears.
- For normal operation, enter the following values (as illustrated below):

Number of Integrations:	1
Uptake time	10
Weight	N
Dilution	N
Percent Recovery	N

- Press F1 to return to the Main Menu.

7.6.9 Enter values for on/offs, times, and gains

- From the Main Menu, select PROTOCOL, then select ON/OFFS, TIMES, GAINS. The on/offs, times, gains screen appears and an "Enter integration time:" message is displayed at the bottom of the screen.
- Type the desired integration time from between 1 and 30 seconds (the typically selected value is 10 seconds) and press ENTER.
- Press the F1 key to return to the Main Menu.

7.6.10 Enter the Calibration Standard Concentrations:

- From the Main Menu, in sequence, select CALIBRATION, STANDARDS, and then UNITS. The Units screen appears an "Enter units:" prompt is displayed at the bottom of the screen.
- Type the desired unit of measurement (e.g., ppb) and press ENTER. The entry will appear in the Units column above.
- Using the hot key, select each standard on the screen (S1-S6) and enter the appropriate calibration standard concentration (e.g., S1-.00000, S2-.20000, S3-.50000, S4-1.0000, S5-3.0000, S6-5.0000)
- Press the F1 key to return to the Main Menu.

NOTE: Do not be concerned with the UI (Update Intercept) and US (Update Slope) columns at this time. If more information is required in these fields, refer to the PS Series Reference Guide.

7.6.11 Reset the Calibration Intensity Data

- From the Main Menu, select CALIBRATION, RESET, and NEW CALIBRATION RESET. The Reset screen appears at the bottom of the screen.
- To erase any calibration data that may have already been done with this protocol, enter Y and press ENTER. An "All Data Reset" message will appear when the process is complete. (To escape this procedure, enter N instead.)
- Press the F1 key to return to the Main Menu.

7.6.12 Set the Autosampler Rinse Time

- From the Main Menu, select AUTOSAMPLER, SETUP, and RINSE TIME (seconds). The Setup screen appears and an "Enter rinse time:" message is displayed at the bottom of the screen.
- Type the desired value in seconds (typically 50) and press ENTER.
- Press the F1 key to return to the Main Menu.

7.6.13 Set up the Racks

- From the Main Menu, select AUTOSAMPLER and then RACK ENTRY. The Rack screen appears and an "Enter rack name:" message is displayed at the bottom of the screen.
- Type a rack name (either new or existing) and press ENTER. (If a new name is entered, a prompt will appear to ask if you want to create a new rack: answer Y.)

- Fill the sample cups to be used to within 1/4" from the top (to allow for two runs). Using the autosampler layout in as a guide, load each sample cup into the rack and enter the sample ID into the appropriate (cup) position on the rack entry screen.

NOTE: For details on the INSERT key, rack calculation options, and advanced editing options, refer to the PS Series Reference Guide.

- It is important to remember that the instrument can run two complete racks unattended.
- Press the F1 key to return to the Main Menu.

7.6.14 Define start-to finish sample sequence

- From the Main Menu, select AUTOSAMPLER and then SETUP. Type the rack number to be run (1 or 2). The prompt "Enter rack name" is displayed at the bottom of the screen.
- Type the rack name and press ENTER. The Setup screen for that rack will appear and a "Begin cup:" prompt will be displayed at the bottom of the screen.
- Enter the number (cup position) of the first cup to be sampled and press ENTER. An "End cup:" prompt will now be displayed at the bottom of the screen.
- Enter the number of the last cup to be sampled and press ENTER.
- Press the F1 key to return to the Main Menu.
- If using a second rack, repeat steps 1-5.

7.6.15 Running Samples

NOTE: Optimum Concentration Range = 0.2 ug/L - 5 ug/L

- Press the F8 macro key. The Autosamples setup menu appears and a "Press F8 again to run sample" message will be displayed at the bottom of the screen.
- Press the F8 A Macro key again. The instrument will run the samples, print the results, and store the data in the folder that was created.
- When all samples have been run, the system will beep and the word "Idle" will appear in the State field at the top of the screen. At this time, repeat the above steps to run more samples or shut down the instrument. Refer to Section 7.6.16 for shutdown procedures.

NOTE: Each sample takes ~2 minutes to run: a full tray (88 samples) will take ~2 1/2 hours to complete. As operation is fully automatic, laboratory personnel need not be present while samples are running.

7.6.16 Shutdown Procedures

There are two methods for shutting down the instrument. Under routine operation, when the system is used daily, only the lamp is shut off (system power remains on) and the

Overnite routine is used to put the unit into a "sleep mode". If the system is to be completely turned off and not used for an extended period of time , or if it is to be shipped or moved, use the long-term Shutdown routine instead. These two methods are described below. For weekends or periods of "sleep" greater than 24 hours it is recommended to turn off the mercury lamp using the blue button.

NOTE: Before shutting down the instrument, the system must have beeped to indicate completion of the last procedure, and the word "Idle" should appear in the "State field in the top left of the displayed screen.

7.6.17 Short-Term (Overnite Macro)

Press the F2 macro key, type OVERNITE, and press ENTER. Turn off power to the lamp if the instrument will not be used for longer than 24 hours. In overnite mode, the pump and gas flow will turn on every few minutes, run for a few seconds and then stop. This cycle exercises the tubes so they don't get flat spots and fatigue, and the gas flow keeps the optical cell dry.

SUGGESTION: If macros are used to automate the run procedures, call the Overnite procedure at the end (CM....) so that the system will shut down automatically when the last procedure is finished.

7.6.18 Long-Term (Shutdown Macro)

The Shutdown macro procedure is designed to flush out all lines with DI water to get rid of any chemical residues.

- Lift the sample tip and remove the rinse tray. Rinse and fill it with DI water and replace the tray. Lower the sample tip into the cleaned tray.
- Remove the reductant bottle cap and line and carefully place the tip of the line in the rinse tank (rest the cap on the corner of the tray).
- Turn off the lamp.
- Press the F2 macro button. Type SHUTDOWN and press ENTER. When a "beep" is heard and the word "Idle" appears in the State field at the top left of the screen (wait several minutes), release all pump clamps.
- Remove the front cover of the instrument and remove the optical cell (refer to Section 7.5). Disconnect the two gas lines on the left side of the cell and leave them hanging. Replace the optical cell and the front cover.

NOTE: The next time the system is started up, remember to re-open the front cover, remove the optical cell and reconnect the gas lines.

- Shut off power to the computer, monitor, printer, and finally the instrument itself.

7.7 Documentation

7.7.1 Instrument Run-Log

The analysis of samples and standards is documented within the instrument run log (Attachment 1) and supported by the instrument print-out. The runlog must be completed for each days analysis.

7.7.2 Traceability of Standards

Custom made and single element stock standard solution which are traceable to NIST or EPA are purchased. On receipt, each standard is recorded in LabNet (LIMS) and is issued a unique source ID#. The manufacturer, lot #, date received, expiration date, date of verification and the initials of the recording analyst are entered into the system.

7.7.3 Data Review

Analytical data goes through a 200% review cycle. The analyst and a trained data reviewer perform the reviews according to the criteria established on the data review checklist (Attachment 2). Upon the first 100% review, the checklist is initialed and dated as reviewed. The package, with its review sheet, comments and any corrective action reports (CARs) is submitted to the supervisor, section manager, or peer reviewer for a second review. Once again, the checklist is initialed and dated by the second reviewer. The completed checklist remains on file with the original data.

8.0 QUALITY CONTROL

8.1 QC Summary

The laboratory generates annual statistically generated control limits and these can be used when requested by the client, contract or QAPP. These limits are based on the successive analysis of LCSs.

8.1.1 Calibration curve must be composed of a minimum of a blank and 5-standards. A least square fit linear calibration curve must have a minimum correlation coefficient of 0.995, which must be reported with the raw data.

8.1.2 ICV and ICB will be performed at the beginning of an analytical sequence. The ICV must not vary more than a) 10% for SW-846 & CLP methods or b) 5% for EPA Methods from its true value and must be prepared from a different source than the calibration curve standards.

Calibration verification will be performed with a CCV and CCB every 10 samples and at the end of the analysis. The CCV must not vary more than a) 20% for SW-846 methods

or b) 10% for EPA & CLP methods from its true value and must be prepared from a different source than the calibration curve standards. The CCB must be < Reporting Limit (EPA / SW-846) / CRDL (CLP).

8.1.3 Dilute samples if they are more concentrated than the highest standard or if they fall on the plateau of a calibration curve (dilute with a digested blank containing all reagents, or repeat the analysis using a smaller sample volume).

8.1.4 A minimum of one MB must be analyzed per sample batch to determine if contamination has occurred

8.1.5 An LCS will be included with each batch of 10 (drinking waters and EPA 245.1) or 20 (SW-846 or CLP) samples. The analyzed result must not vary more than 20% from the true value. For EPA Method 245.1, the LCS acceptance limits are 85-115%.

8.1.6 Matrix spike and duplicate samples are analyzed with each batch of 10 (drinking waters and EPA 245.1) or 20 (SW-846 or CLP) samples.

8.2 Corrective Actions

When an out of control situation occurs, the analysts must use his/her best analytical judgment and available resources to determine the corrective action to be taken. The out of control situation may be caused by more than one variable. The analyst should seek the assistance of his/her immediate supervisor, section manager, QA personnel, or other experienced staff if he/she is uncertain of the cause of the out of control situation. The test must not be resumed until the source of the problem and an in-control status is attained. All samples associated with the out of control situation should be reanalyzed. Out of control data must never be released without approval of the supervisor, section manager, QA personnel or the laboratory manager.

Listed below are steps that must be taken when an out of control situation occurs:

- demonstrate that all the problems creating the out of control situation were addressed
- document the problem and the action which was taken to correct the problem on a CAR
- document on the CAR that an in control has been achieved and receive approval (signature) of the supervisor, section manager, QA personnel, or the laboratory manager prior to the release of any analytical data associated with the problem.

8.2.1 Calibration Curve

- reanalyze the standard curve;
- prepare new stock and/or working standards;
- check reagents/solutions and prepare fresh if necessary.

8.2.2 Initial Calibration Verification (ICV)

- repeat ICV to verify proper preparation;
- prepare new ICV from original stock;
- recalibrate with a new standard curve;
- prepare new stock and/or working standards;
- check reagents/solutions and prepare fresh if necessary.

8.2.3 Initial Calibration Blank (ICB)

- prepare new ICB to verify proper preparation;
- verify that the instrument base-line is stable and perform necessary maintenance, cleaning, etc.. to achieve stability;
- determine the source of contamination by the process of elimination, carryover from a previous analysis or reagent contamination and correct the problem;
- check reagents/solutions and prepare fresh if necessary;
- correct for any contamination and reanalyze ICB and any associated samples.

8.2.4 Laboratory Control Sample (LCS)

If LCS is low:

- reanalyze LCS to verify that it is out of control;
- determine the source of error within the preparation procedure, repeat the sample set, write a CAR.

If the LCS is high:

- reanalyze LCS to verify that it is out of control;
- determine the source of error within the preparation procedure, repeat the sample set;
- determine if the high result is due to contamination;
- check for contamination of reagents, LCS stock solution, or preparation area;
- correct for contamination, reanalyze.

8.2.5 Method Blank (MB)

- reanalyze MB to verify that it is beyond the reporting limit;
- determine the source of contamination;
- determine if the high result is due to contamination;
- check for contamination of reagents or preparation area;
- correct for contamination, reanalyze set;
- in the extreme case where all samples in the set are at least 10X > the MB, reanalysis will not be required. However, a CAR and approval will be necessary.

8.2.6 Matrix Duplicate (MD)

- the sample must be reprocessed and reanalyzed;
- if the reanalysis results in data that is still out of the control limit, then the sample will be ticked with a "*";

- regardless of the outcome of the reanalysis, a CAR will be written and approved by the Section Manager.

8.2.7 Matrix Spike (MS)

- the sample must be reprocessed and reanalyzed;
- if the reanalysis results in data that is still out of the control limit, then the sample will be ticked with a "N";
- regardless of the outcome of the reanalysis, a CAR will be written and approved by the Section Manager.

8.2.8 Continuing Calibration Verification (CCV)

- repeat CCV to verify proper preparation;
- prepare new CCV from original stock;
- check for instrument base-line drift or a change in one or more of the reagents;
- check reagents/solutions and prepare fresh if necessary;
- recalibrate with a new standard curve and repeat all samples since the previous in control CCV;
- never dispose of any samples until you are sure that all QC, especially the CCV, are within the control limits.

8.2.9 Continuing Calibration Blank (CCB)

- prepare new CCB to verify proper preparation;
- verify that the instrument base-line is stable and/or perform necessary maintenance, cleaning, etc.. to achieve stability;
- determine the source of contamination by the process of elimination, carryover from a previous analysis or reagent contamination and correct the problem,
- check reagents/solutions and prepare fresh if necessary;
- correct for any contamination and reanalyze CCB and any associated samples;
- never dispose of any samples until you are sure that all QC, especially the CCB are within the control limits.

8.2.10 Summary

- If any of the ICV, ICB, CCV or CCB results are out of control for any element, the instrument is restandardized and the samples associated with the out of control elements are reanalyzed.
- If the MB or LCS are out of control for any element, the samples are redigested. An exception is if the sample concentrations are $\geq$ 10X the MB contamination, the results are reported as is.
- If any of the MD or MS results are out of control, a reanalysis is performed if there is sufficient sample. If there is insufficient sample, or the reanalysis is still out of control, the client is notified of the poor results via a case narrative that is sent with the data report.
- CARs are available for out-of-control MB, LCS, MS and MD problems. These forms are completed by the analyst performing the analysis. The forms are then reviewed

and signed by the supervisor or section manager. The signed forms are kept on file within the laboratory department and are used to prepare the case narrative (if applicable).

9.0 DATA ANALYSIS AND CALCULATIONS

Perform a linear regression or quadratic fit analysis of the calibration standard results. Compare sample results to the curve to determine the mercury concentration.

9.1 Water ug/L Hg = ug/L x Dilution Factor (Where L = Final digestate volume)

9.2 Soil $$\text{mg/kg Hg} = \frac{(\text{ug/L}) \times L \times \text{Dilution Factor}}{\text{wt(g)} \times \text{fraction solids}}$$

(Where L = Final digestate volume)

NOTE: All dry weight corrections are made in LabNet at the time the final report is prepared.

9.3 Accuracy $$\%R = \frac{(A_T - A_O)}{A_F} \times 100$$

Where:
A_T = Total amount recovered in fortified sample
A_O = Amount recovered in unfortified sample
A_F = Amount added to sample

9.4 Precision $$RPD = \frac{|C_1 - C_2|}{(C_1+C_2)/2} \times 100$$

Where:
C_1 = First measurement value
C_2 = Second measurement value

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

- Waste from this process goes into the " Corrosive Wastewater" wastestream.
- Single component standards should not be mixed into the waste streams unless approved by the Waste Coordinator. All standards with Hazardous constituents will be turned in to the waste technician for disposal.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0.

13.0 ATTACHMENTS

Attachment 1: Example: Analysis Instrument Runlog
Attachment 2: Example: Data Review Checklist

Historical File:

Revision 00: 10/03/90
Revision 01: 08/09/91
Revision 02: 03/19/93
Revision 03: 10/18/95
Revision 04: 01/24/97
Revision 05: 03/31/99
Revision 06: 03/16/00
Revision 07: 05/23/01
Revision 08: 09/06/02

Reasons for Change, Revision 08:

- Updated the Health & Safety (3.0) and Waste Disposal (10.0) sections.
- Section 7.1: Amended statement regarding MS/MSD and MS/MD.

U:\QC\SOP\ME\2451.DOC

Attachment 1:

Example: Analysis Runlog

STL Chicago
Mercury Digestion Log / Analytical Run Log

Page No.:_____
Book #:_____
LabNet File:_____

Circle Method:
a: Water: EPA 245.1 / SW-846 7470A
b: Soil/Solid: EPA 245.5 / SW-846 7471A
c: Water/Soil/Solid: U.S. EPA SOW ILM04.0
d. Other: _____

Instrument: Leeman Labs PS200 (HG4)
Wavelength: 253.7 nm
Optical Cell Length: 20.5 cm

Standard/Matrix Spike Source ID#:_____ ICV/CCV/LCS Source ID#:_____ Equip. ID#:_____
Water Bath Temp.: Initial:_____°C Final:_____°C Control Limits: 90°C to 95°C H_2SO_4 Lot #:_____
Thermometer ID:_____ Correction Factor:_____°C HNO_3 Lot #:_____ HCl Lot #:_____

Repipettor Volume Check:
☐ HNO_3, 2.5 mL ☐ H_2SO_4, 5.0 mL ☐ $KMnO_4$, 15 mL ☐ $K_2S_2O_8$, 4.0 mL ☐ $NH_2OH \cdot HCl$, 6.0 mL

Comments:_____

AS Pos. #	Sample # / QC ID	Sample Size (mls or g per final vol [1])	% Solids	Anal. Dil.	Comments

QC2 ICV/CCV:_____ 100 / 25 mLs _____
QC1 ICB/CCB:_____ 100 / 25 mLs _____

QC2 CCV:_____ 100 / 25 mLs _____
QC1 CCB:_____ 100 / 25 mLs _____

[1] Water bath digestion requires 100 mL final volume; Hot block digestion requires a 25 mL final volume.

Preparation Signature:_____ Date:_____ Time In:_____ Time Out:_____

Analyst Signature:_____ Date Analyzed:_____ Date LIMS'd:_____

Reviewer Signature:_____ Date:_____

Attachment 2.

Example: Data Review Checklist

STL Chicago
Mercury Data Review Checklist: Automated CV (PS 200)

Instrument ID: HG3 HG4 (circle one) **LabNet Batch No.:**_____

Analyst Initial(s):_____ **Date:** _____

Copies: _____ _____
_____ _____
_____ _____
_____ _____
_____ _____

****

QC Type: a. CLP b. Standard c. TCLP d. Drinking Waters e. Solubles

I. Calibration:

Analyst Reviewer

1. Calibration is clearly documented.
   a. c.c.: 0.995 to 1.000
   ___ ___ b. y-intercept: **Std. QC**: < RL; **CLP QC**: < CRDL

2. Calibration Verification
   CLP QC: Every 10 Sample Bottles
   Std. QC: Every 20 Sample Bottles
   TCLP QC: Every 20 Sample Bottles
   Drinking Waters: Every 10 Sample Bottles
   a. ICV/CCV **Std./SW-846:** ± 10% (ICV); ± 20% (CCV);
   CLP: ± 10% (ICV); ± 10% (CCV)
   ___ ___ **EPA 245.1/245.5:** ± 5% (ICV); ± 10% (CCV)
   b. ICB/CCB **Std. QC**: < RL; **CLP QC**: < CRDL

3. CRA
   ___ ___ **CLP QC**: At CRDL; Analyzed each Calibration; No Limit; **Std. QC**: At CRDL; Analyzed Daily; ± RL

II. Sample Analysis:

Analyst Reviewer

1. Each Preparation Batch:
   ___ ___ a. Must be clearly identified
   ___ ___ b. Contains a maximum of 20 samples
   ___ ___ c. 1 Prep Blank: **CLP:** < CRDL; **Std. QC:** < RL
   ___ ___ d. 1 LCS: **Std./CLP:** 80-120% Rec. **EPA 245.1:** 85-115% Rec.
   e. 1 Matrix Spike: **Std./CLP:** 75-125% Rec.; ***Unless*** the sample conc. exceeds the spike conc. by factor 4x. **TCLP:** > 50% Rec.; If <50%, MSA analysis is required
   ___ ___ **245.1:** 85-115% Rec.
   f. 1 Matrix Duplicate: **Std.:** RPD/RSD limits are 20% ***Unless*** the sample conc. is <5x RL then ± RL
   CLP: RPD or RSD limits are 20%; ***Unless*** the sample conc. is <5x CRDL then
   ___ ___ ± CRDL applies.
   ___ ___ g. % TS for samples to be reported on a Dry Wt.

III. Data Documentation

Analyst Reviewer

1. The instrument and current conditions must be clearly documented. The Temperature of the Water Bath must be 95°C.
   ___ ___
2. **All** Percent Recoveries and RPD's need to be documented in the raw data.
   ___ ___
3. If the CCB/PB and/or CCV/LCS are outside of the control limits, **a CAR must be written** and the Section Manager or Unit Leader must be notified that redigestion is required.
   ___ ___

III. Data Documentation (continued)

Analyst Reviewer

4. Matrix Spike outside the control limits:
   a. **CLP QC**: No corrective action required, the sample is ticked appropriately.
   b. **Std. QC**: **A CAR must be written** and the Section Manager or Unit Leader must make the decision as to whether re-digestion is required.
   c. If MSA is performed; check the calculation.
5. Sample Duplicate outside the control limits:
   ___ ___ a. **CLP QC**: Normally no corrective action required, and the result is ticked appropriately.
   ___ ___ b. **Std. QC**: **A CAR must be written** and the Section Manager or Unit Leader must make the decision as to whether redigestion is required.
6. The sample data and QC is recorded in the databook in the order in which they were analyzed. **All** unused data is clearly identified.
   ___ ___
7. Standard Traceability is correctly documented.
   ___ ___
8. Data Report accurately reflects the documentation in the Databook and the LIMS Spreadsheet.
   ___ ___
9. The analyst's full signature is required on the following:
   ___ ___ a. Instrument Data Report
   ___ ___ b. Databook
   ___ ___ c. Data Review Checklist
   ___ ___ d. Print out LabNet Pages, Raw Data, QC, and RunLog
   ___ ___ e. Samples needing copying are clearly marked
10. All unused portions of the data page are Z'd out.
    ___ ___
11. Proper Corrective Action Documentation for any out of control situation is clearly identified.
    ___ ___

IV. Miscellaneous

Analyst Reviewer

___ ___ 1. Is Sample Prep Linked?
___ ___ 2. Is TCLP Linked? (Shift F9 from the start page)
___ ___ 3. Did all dilutions carry over for MD, MS, MSD (where applicable)?
___ ___ 4. Did all prep and analysis matrices match up?

Comments:_____

Analyst Signature: _____ Date:

Reviewer Signature:_____ Date:

STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURE

SOP No.	Revision No.	Date	Page
UMB-8270	11	03/01/02	1 of 60

TITLE: **Gas Chromatography / Mass Spectrometry - Semi-Volatiles SW-846 Method 8270**

Updated by:	Signature:	Date
Gary L. Rynkar Section Manager, GC/MS Dept.	Gary L. Rynkar	2/22/2

Approved by:	Signature:	Date
Gary L. Rynkar Section Manager, GC/MS Dept.	Gary L. Rynkar	2/22/2
David L. Kaczka Env. Health & Safety Coor.	D L Kaczka	2/25/02
Terese A. Preston Quality Manager	Terese A. Preston	2/25/02

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COPY # : **Uncontrolled**

ISSUED TO : **Gloria Chojnacki, S.E.H.**
Re: Ashland/NSP Lakefront Site
QAPP

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the guidelines for the analysis of semi-volatile base/neutral and acid (BNA) compounds by Gas Chromatography/Mass Spectrometry (GC/MS). This SOP was written using the following methods: SW-846 3rd Edition, Methods 8270A, 8270C and 8000B as references.

On occasion, clients may request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP) and authorized via laboratory signature approval; and amended to the data packages case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory endeavors to keep reporting limits approximately 3-5x the respective MDL to ensure confidence in the value reported.

Reporting limits [a.k.a., Practical Quantitation Limits (PQLs)] are assessed annually based on MDL performance. If the MDL does not meet the routine laboratory reporting limit or the method specified limit, it is repeated, or the laboratory reporting limit is reassessed. Table 1 defines the laboratory's reporting limits for each compound that can be routinely analyzed by this method according to each matrix.

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM, Revision 01).

1.2 Summary of Methods

This method is appropriate for the analysis of BNA's in wastewaters, soils, sediments, solids, sludges, wastes, and oils. Concentrated extracts are transferred to crimp-top vials, internal standard solution added, with subsequent analysis on the GC/MSD. The method finds applicability for most BNA compounds that are soluble in dichloromethane (DCM) and chromatograph well on a fused-silica capillary column. Table 2 lists those compounds with their characteristic ions. The approximate retention times were generated by a specific GC/MS system.

The following exceptions are noted: Benzidine is subject to loss during solvent concentration and chromatographs poorly. Hexachlorocyclopentadiene is subject to decomposition in the inlet, chemical reaction in acetone and photochemical decomposition. N-nitrosodimethylamine can be difficult to separate from the solvent front. N-nitrosodiphenylamine decomposes in the injection port and cannot be separated from diphenylamine. Other qualitative procedures are listed in Method 625 for these compounds.

Those samples suspected of high background levels are screened by a GC/MS prior to analysis. Initial dilutions are determined from this screen.

Instrument calibration occurs prior to analysis and every 12 hours of run-time. Instrument maintenance is performed as needed, on a daily, monthly or yearly basis, as the specific action requires.

2.0 INTERFERENCES

External interference's can be caused by contaminants from sample containers, preparative glassware and reagents, inlet liners, syringes and columns and manifest themselves in discrete peaks and/or elevated baselines. "Soap" peaks and phthalates are the most common external interferences encountered. Proper glassware preparation, sample handling, and instrument maintenance should reduce the contamination from these sources. A laboratory reagent blank is analyzed with each batch to demonstrate the absence of these contaminants.

Rinsing the syringes well, both the syringe used for sample prep and sample injection, prior to and after use, for each sample or standard is critical. Assigning separate functions to the syringes prevents cross-contamination (introduction of compounds from one sample to a sample not originally containing those compounds). Replacing the rinse and DCM dilution containers often is also necessary.

Carryover is another source of contamination. After analysis of highly concentrated samples or background containing samples, a DCM blank should be run, or at a

minimum, the oven temperature should be raised to 290°C and solvent flushed through the system.

Internal or matrix interference's can be co-extracted from the sample during preparation. These can appear as large distinct peaks and/or elevated baselines. Occasionally, matrix interferences manifest themselves as low/high recoveries of spike compounds. Matrix interferences vary from sample to sample. Unless specifically requested by the client, clean-up procedures are not performed to remove heavy background or interferences.

3.0 SAFETY

- Employees will adhere to the practices and policies in the STL Corporate Safety Manual (CSM) and will read the MSDS' for the materials used in this method before handling or using the material.
- As always, general laboratory safety practices should always be followed.
- ALL samples should be handled with care due to the uncertainty of the properties and contents involved.
- Special care needs to be taken with the solvents used in this method: Methylene Chloride, Methanol and Acetone.
- Interior parts of GC's can be very hot. Care should be taken during maintenance.

4.0 EQUIPMENT AND SUPPLIES

4.1 GC/MSD

A temperature-programmable gas chromatograph is equipped with a splitless injection port and accessories (syringes, gases, and columns). The column used is a DB5MS, 30mx0.25mm ID or equivalent bonded-phase silicone coated fused-silica capillary column, with 0.25um film thickness. Interfaced with a mass-selective detector capable of scanning from 35 to 500 amu every second or less using 70 volts electron energy in the Electron Ionization (EI) mode. The system must be able to produce an acceptable mass spectrum of decafluorotriphenylphosphate (DFTPP) when 50ng is injected on the column.

4.2 Data System

The analytical system is interfaced with a data system capable of continuing acquisition and storage of mass spectral data. The software allows plotting of specific masses versus time or scan numbers (Extracted Ion Current Profile -EICP) and integration of that abundance. The system also contains the latest NBS Library.

4.3 Accessories

- 10 uL, 25 uL, 500 uL, 1000 uL gas-tight syringes.
- amber and clear vials (1.5 mL and 4.5 mL)
- Teflon/silicone septa

- crimp-top and screw-top vial caps

4.4 Current Hardware/Software

- 4 - 5890 Series II Plus Gas Chromatographs with Electronic Pressure Control (EPC), Hewlett-Packard (HP)
- 2 - 5890 Series II Gas Chromatograph with Electronic Pressure Control (EPC), Hewlett-Packard (HP)
- 5 - 5972 Mass Selective Detectors, Hewlett-Packard
- 1 - 5970 Mass Selective Detector, Hewlett-Packard
- 6 - 7673 Autosamplers and Accessories, Hewlett-Packard
- 6 - Hewlett-Packard ChemStations B.02.04 software and peripheral hardware
- 1 - Hewlett-Packard Chemserver with Target 3.5.

5.0 REAGENTS AND STANDARDS

All neat standards or stock solutions received are entered into the laboratory's LIMS (LabNet). A standard label is printed from LabNet and affixed to the bottle or ampule. All standards are then stored at -10°C to -20°C until needed. All glassware and syringes needed to prepare reagents and standards must be cleaned, dried and rinsed well with the solvent to be used (methanol and DCM).

All information concerning standard preparation must be entered into LabNet. The labels contain the following information: Standard ID, solution description (content, weights, concentrations, date prepared, expiration date and analyst). All neat standards (referenced by standard type and date in LabNet) used in preparations are noted and cross-referenced here, providing a standard tracking mechanism. The expiration date of any prepared standard cannot exceed the expiration date assigned for any neat standard that is a component in the prepared standard mixture.

5.1 Surrogate Spiking Solution

The surrogate spiking solution is obtained from NSI Environmental Solutions (Catalog #C-316) as a prepared solution in 25 mL amber glass Teflon-lined screw-capped bottles. The surrogate spike is prepared by NSI using EPA certified standards (NSI Catalog #'s C-161 and C-162) diluted to the following concentrations:

Compound	Concentration (ug/mL)
p-Terphenyl-d_{14}	100
Nitrobenzene-d_5	100
2-Fluorobiphenyl	100
Phenol-d_5	150
2-Fluorophenol	150
2,4,6-Tribromophenol	150

- Life of Standard: 6 months from date of transfer of standard or less as indicated by expiration date from manufacturer.
- Storage Requirements: Store at -10 to -20°C. All bottles are labeled with a LabNet ID Number.

The Surrogate Spike Solution is spiked in all samples, all matrix spike/matrix spike duplicate (MS/MSD) samples, all method blanks (MBs), and all laboratory control samples (LCSs) at a volume of 0.5 mLs prior to extraction. This results in a spiking level of 75 ug for the Acid surrogate compounds and 50 ug for the Base/Neutral surrogate compounds.

5.2 Matrix Spiking Solutions

The WORKING full list matrix spike solution is a mix purchased from NSI Environmental Solutions (TCL BNA LCS spike - Catalog #C - 408) as a prepared solution in 25 mL amber glass Teflon-lined screw-capped bottles. The full list matrix spike is prepared by NSI at the following concentrations:

TCL BNA LCS Spike Compounds (100 ug/mL)

Acenaphthene	2-methylphenol (o-Cresol)	Hexachlorocylcopentadiene
Acenaphthylene	4-methylphenol (p-Cresol)	Hexachloroethane
Anthracene	Dibenz(a,h,)anthracene	Indeno(1,2,3-c,d)pyrene
Aniline	Dibenzofuran	Isophorone
Benzidine	1,2-Diphenylhydrazine	2-Methylnaphthalene
Benzyl Alcohol	1,2-Dichlorobenzene	Naphthalene
Benzo(a)anthracene	1,3-Dichlorobenzene	2-Nitroaniline
Benzo(b)fluoranthene	1,4-Dichlorobenzene	3-Nitroaniline
Benzo(k)fluoranthene	3,3'-Dichlorobenzidine	4-Nitroaniline
Benzo(g,h,i)perylene	2,4-Dichlorophenol	Nitrobenzene
Benzo(a)pyrene	2,4-Dimethylphenol	2-Nitrophenol
Benzoic acid	4,6-Dinitro-2-methylphenol	4-Nitrophenol
4-Bromophenylphenylether	2,4-Dinitrophenol	N-Nitrosodimethylamine
Butylbenzylphthalate	2,4-Dinitrotoluene	N-Nitrosodiphenylamine
Carbazole	2,6-Dinitrotoluene	N-Nitrosodi-n-propylamine
4-Chloroaniline	Diethylphthalate	Pentachlorophenol
Chrysene	Dimethylphthalate	Phenanthrene
bis(2-Chloroethoxy)methane	Di-n-butylphthalate	Phenol
bis(2-Chloroethyl)ether	Di-n-octylphthalate	Pyrene
2,2'-oxybis(1-Chloropropane)	bis(2-Ethylhexyl)phthalate	Pyridine
4-Chloro-3-methylphenol	Fluoranthene	1,2,4-Trichlorobenzene
2-Chloronaphthalene	Fluorene Hexachlorobenzene	2,4,5-Trichlorophenol
2-Chlorophenol	Hexachlorobutadiene	2,4,6-Trichlorophenol
4-Chlorophenylphenylether		

- Life of Standard: 6 months from date of transfer of standard or less as indicated by expiration date from manufacturer
- Storage Requirements: Store at -10 to -20°C. All bottles are labeled with a LabNet ID Number.

All MS/MSDs and LCSs are spiked with 1.0 mL of the TCL BNA LCS Spike Solution prior to extraction, resulting in a spike level of 100 ug for all compounds listed in the above table.

The extraction department is responsible for the ordering and tracking of all BNA surrogate and matrix spike solutions.

5.3 DFTPP / Pentachlorophenol (PCP) / Benzidine Stocks

The DFTPP stock is purchased from NSI (Catalog #1010H) at 2000 ug/mL, PCP stock is purchased from NSI (Catalog #0062) at 5000 ug/mL, Benzidine stock is purchased through NSI, (Catalog #1213) at 2000 ug/mL and DDT stock is purchased through NSI (Catalog #550477) at 1000 ug/mL. All stocks are transferred to amber-glass, screw-topped, Teflon lined vials; assigned a LabNet ID Number; and documented in LabNet. Stock standards are stored at -10° to -20°C. An expiration date is assigned for 1 year from date of transfer or less as indicated by the manufacturer.

5.3.1 DFTPP / PCP / Benzidine / DDT Parent Solution

125 uL of DFTPP stock + 125 uL PCP stock + 250 uL Benzidine stock + 250 uL DDT stock are brought to 1000 uL final volume with DCM. This results in a parent solution of DFTPP/PCP/DDT at 250 ug/mL and Benzidine at 500 ug/mL. This is stored in a 1.5 mL labeled amber, screw top; vial with Teflon lined septum, at -10 to -20°C until needed. All preparation information is recorded in LabNet and assigned a LabNet ID Number. An expiration date is assigned for 6 months from date of preparation or less as indicated by the manufacturer.

5.3.2 The DFTPP / PCP / Benzidine / DDT Working Solution

100 uLs of the DFTPP/PCP/Benzidine/DDT Parent Solution are added to 900 uLs of DCM, resulting in a concentration of 50 ng/2uL DFTPP/PCP/DDT and 100 ng/2uL Benzidine. This is stored in a 1.5 mL labeled amber, crimp-top, autosampler vial, at -10 to -20°C until needed. All preparation information is recorded in LabNet and assigned a LabNet ID Number. An expiration date is assigned for 6 months from date of preparation or less as indicated by the manufacturer. Alternately, DFTPP can be spiked at the same concentration in the calibration verification solution.

5.4 Internal Standard Solution

This solution is obtained as a mixture from NSI, (Catalog #C-394)

Internal Standards (2,000 ug/mL)	
1,4-Dichlorobenzene- d_4	Phenanthrene- d_{10}
Naphthalene- d_8	Chrysene-d_{12}
Acenaphthene- d_{10}	Perylene- d_{12}

Once the ampule is opened, the entire contents are transferred to a 1.5-mL amber gas-tight conical vial and labeled appropriately. All preparation procedures are recorded in LabNet. Unopened ampules can be kept for the period indicated by the manufacturer, and are stored at -10° to -20°C until needed.

- Life of Standard: 6 months from date transferred or less as indicated by the expiration date from the manufacturer.
- Storage Requirements: Store -10 to -20°C. All vials are labeled with a LabNet ID Number.

Refer to Table 3 for a listing of Internal Standards and corresponding ions assigned for quantitation.

5.5 Initial Calibration Standards

5.5.1 Hazardous Substance List (HSL) Stock Standards

The HSL parent stock solution is purchased through NSI (Catalog #C-510) at a concentration of 200 ug/mL at a 5.0 mL volume in sealed ampules. The standard is labeled with a LabNet ID Number and is stored at -10° to -20°C and can be kept for one year from the date of transfer or less as indicated by the manufacturer.

BNA Parent Calibration Standard (200 ug/mL)

Acenaphthene	Dibenzofuran	2-Nitroaniline
Acenaphthylene	1,2-Diphenylhydrazine	3-Nitroaniline
Anthracene	1,2-Dichlorobenzene	4-Nitroaniline
Aniline	1,3-Dichlorobenzene	Nitrobenzene
Benzidine	1,4-Dichlorobenzene	2-Nitrophenol
Benzyl Alcohol	3,3'-Dichlorobenzidine	4-Nitrophenol
Benzo(a)anthracene	2,4-Dichlorophenol	N-Nitrosodimethylamine
Benzo(b)fluoranthene	2,4-Dimethylphenol	N-Nitrosodiphenylamine
Benzo(k)fluoranthene	4,6-Dinitro-2-methylphenol	N-Nitrosodi-n-propylamine
Benzo(g,h,i)perylene	2,4-Dinitrophenol	Pentachlorophenol
Benzo(a)pyrene	2,4-Dinitrotoluene	Phenanthrene
Benzoic acid	2,6-Dinitrotoluene	Phenol
4-Bromophenylphenylether	Diethylphthalate	Pyrene
Butylbenzylphthalate	Dimethylphthalate	Pyridine
Carbazole	Di-n-butylphthalate	1,2,4-Trichlorobenzene
4-Chloroaniline	Di-n-octylphthalate	2,4,5-Trichlorophenol

Chrysene	bis(2-Ethylhexyl)phthalate	2,4,6-Trichlorophenol
bis(2-Chloroethoxy)methane	Fluoranthene	
bis(2-Chloroethyl)ether	Fluorene Hexachlorobenzene	Surrogates
2,2'-oxybis(1-Chloropropane)	Hexachlorobutadiene	1,2-Dichlorobenzene-d_4
4-Chloro-3-methylphenol	Hexachlorocylcopentadiene	2-Fluorobiphenyl
2-Chloronaphthalene	Hexachloroethane	Nitrobenzene-d_5
2-Chlorophenol	Indeno(1,2,3-c,d)pyrene	p-Terphenyl-d_{14}
4-Chlorophenylphenylether	Isophorone	2-Chlorophenol-d_4
2-methylphenol (O-Cresol)	2-Methylnaphthalene	2-Fluorophenol
4-methylphenol (P-Cresol)	Naphthalene	Phenol-d_5
Dibenz(a,h,)anthracene		2,4,6-Tribromophenol

An additional Benzidine standard is purchased through NSI (Catalog #1213) at 2000 ug/mL in sealed ampules. The standard is labeled appropriately and given a LabNet ID Number and stored at -10° to -20°C and may be kept for one year from the date of transfer or less as indicated by the expiration date from the manufacturer.

5.5.2 Appendix IX Stock Standards

The Appendix IX stock standard (Catalog #C-426), the Custom Appendix IX Mix 1 stock standard (Catalog #Q-1214A), the Custom Appendix IX Mix 2 stock standard (Catalog #Q-1214B), the Aramite stock standard (Catalog #W-922), the Hexachlorophene stock standard (Catalog #W-323), the p-Phenylenediamine (Catalog #Q-1584), a,a-Dimethylphenylamine (Catalog #P-023 from Cerilliant) and the 1,4-Dioxane stock standard (Catalog #Q-1585) are purchased from NSI in 1.5 mL sealed amber-glass ampules. The standard is labeled with a LabNet ID Number and is stored at -10° to -20°C and can be kept for one year from the date of receipt or less as indicated by the manufacturer.

Each mixture contains the following compounds and concentrations:

Appendix IX Stock Standard (Catalog #C-426) at 2,000 ug/mL	
Acetophenone	Diallate
Isosafrole	Methapyrilene
1,4-Naphthoquinone	4-Nitroquinoline-n-oxide
Phenacetin	2-Picoline
Pronamide	Safrole

Custom Appendix IX Mix 1 (Catalog #Q-1214A) at 2,000 ug/mL	
Methyl Methanesulfonate	Ethyl Methanesulfonate
2,6-Dichlorophenol	Hexachloropropene
1,2,4,5-Tetrachlorobenzene	meta-Dinitrobenzene
Pentachlorobenzene	2,3,4,6-Tetrachlorophenol
Sym-Trinitrobenzene	2-sec-Butyl-4,6-dinitrophenol
Pentachloronitrobenzene	Chlorobenzilate
7,12-dimethylbenz(a)anthracene	3-Methylcholanthrene

Custom Appendix IX Mix 2 (Catalog #Q-1214B) at 2,000 ug/mL	
N-Nitrosomethylethylamine	N-Nitrosodiethylamine
N-Nitrosopyrrolidine	N-Nitrosomorpholine
o-Toluidine	N-Nitrsospiperidine
N-Nitroso-di-n-butylamine	1-Naphthylamine
2-Naphthylamine	Diphenylamine
5-Nitro-o-toluidine	4-Aminobiphenyl
p-Dimethylaminoazobenzene	3,3'-Dimethylbenzidine
2-Acetylaminofluorene	

Single Component Stock Standards	
Compound	**Concentration (ug/mL)**
Aramite	2,000
Hexachlorophene	5,000
p-Phenylenediamine	5,000
1,4-Dioxane	5,000
a,a-Dimethylphenylamine	1,000

5.6 8-Point Initial Calibration Standards

Two separate initial calibrations are prepared; one for HSL and one for Appendix IX.

5.6.1 HSL 8-Point Initial Calibration Standards

Remove the BNA parent calibration standard and the Benzidine standard as identified in Section 5.5.1 from storage. Allow the standards to come to room temperature. Transfer the stock BNA parent calibration standard to a 3.5-mL amber-glass, Teflon-lined, screw-capped vial. Transfer the stock Benzidine standard to a 1.5-mL amber-glass, Teflon-

lined, screw-capped vial. Record the transfer in LabNet and obtain a LabNet ID Number for each standard. Store the unused standard at -10° to -20°C.

Locate and rinse WELL with DCM, a 10 uL, 25 uL, 100 uL, 500 uL, and 1000 uL syringe.

The preparation information for the Working 8-Point HSL Standards are entered into LabNet and each standard is given a LabNet ID Number. Prepare the Working Standards as follows:

Cal. Std.	BNA Parent (200 ug/mL)	Benzidine (2000 ug/mL)	DCM	Int. Standard (2000 ug/mL)
160 ng/2uL	400 uL	210 uL	Bring to 1.0 mL	*10 uL
120 ng/2uL	300 uL	170 uL	Bring to 1.0 mL	*10 uL
80 ng/2uL	200 uL	105 uL	Bring to 1.0 mL	*10 uL
60 ng/2uL	150 uL	85 uL	Bring to 1.0 mL	*10 uL
50 ng/2uL	125 uL	75 uL	Bring to 1.0 mL	*10 uL
40 ng/2uL	100 uL	40 uL	Bring to 1.0 mL	*10 uL
20 ng/2uL	50 uL	15 uL	Bring to 1.0 mL	*10 uL
10 ng/2uL	25 uL	10 uL	Bring to 1.0 mL	*10 uL

* Add internal standard **after** the standard has been brought up to 1.0 mL.

The calibration levels listed above are correct for all compounds except Benzidine. The calibration levels for Benzidine are as follows:

Benzidine Cal. Levels
50 ng/2uL
100 ng/2uL
200 ng/2uL
350 ng/2uL
400 ng/2uL
500 ng/2uL
800 ng/2uL
1000 ng/2uL

- Life of Standard: 6 months from date prepared or less as indicated by the expiration date from the manufacturer.
- Storage Requirements: Store in an amber crimp-top autosampler vials at -10 to -20°C.

5.6.2 Appendix IX 8-Point Initial Calibration Standards

Remove the Appendix IX stock standards as identified in Section 5.5.2 from storage. Allow the standards to come to room temperature. Transfer the Appendix IX stock

standards to 1.5 mL amber-glass, Teflon-lined, screw-capped vials. Enter the transfer information into LabNet and obtain ID Numbers for each standard. Store the Appendix IX stock standards at -10° to -20°C.

Locate and rinse WELL with DCM, a 10 uL, 25 uL, 100 uL, 500 uL, and 1000 uL syringe.

5.6.2.1 Appendix IX Parent Solution - 200 ug/mL

Stock Standard	Concentration (ug/mL)	Amount Added (uL)
a,a-Dimethylphenylamine	1000	600
Custom Appendix IX Mix 1	2000	300
Custom Appendix IX Mix 2	2000	300
Aramite	2000	300
Appendix IX Stock Standard	2000	300
1,4-Dioxane	5000	480
p-Phenylenediamene	5000	480

5.6.2.2 The Appendix IX Parent Solution is brought up to a 3.0-mL final volume with Dichloromethane. The preparation is entered into LabNet and the standard is given a LabNet ID Number. An expiration date of 6 months is assigned or less as indicated by the manufacturer and the standard is stored in a 3.5-mL amber-glass, screw-capped vial with a Teflon septum at -10 to -20°C.

5.6.2.3 The preparation information for the Working 8-Point Appendix IX Standards are entered into LabNet and each standard is given a LabNet ID Number. Prepare the Working Standards as follows:

Calibration Std.	Appendix IX Parent Std. (200 ug/mL)	Hexachlorophene Stock Std. (5000 ug/mL)	DCM	Internal Std. (2,000 ug/mL)
160 ng/2uL	400 uL	160 uL	Brought to 1.0 mL	*10 uL
120 ng/2uL	300 uL	120 uL	Brought to 1.0 mL	*10 uL
80 ng/2uL	200 uL	100 uL	Brought to 1.0 mL	*10 uL
60 ng/2uL	150 uL	90 uL	Brought to 1.0 mL	*10 uL
50 ng/2uL	125 uL	80 uL	Brought to 1.0 mL	*10 uL
40 ng/2uL	100 uL	60 uL	Brought to 1.0 mL	*10 uL
20 ng/2uL	50 uL	30 uL	Brought to 1.0 mL	*10 uL
10 ng/2uL	25 uL	15 uL	Brought to 1.0 mL	*10 uL

*Internal Standard added after each standard is brought to 1.0-mL final volume with DCM. The calibration levels listed above are correct for all compounds except the following:

1,4-Dioxane (ng/2uL)	Hexachlorophene (ng/2uL)	p-Phenylenediamine (ng/2uL)
40	150	40
80	300	80
160	600	160
200	800	200
240	900	240
320	1000	320
480	1200	480
640	1600	640

- Life of Standard: 6 months from date prepared or less as indicated by the expiration date from the manufacturer.
- Storage Requirements: Store in amber crimp-top autosampler vials at -10 to -20°C.

5.7 Calibration Verification Standards

A midpoint check HSL stock solution is purchased through NSI (Catalog #C-514FP) at a concentration of 50 ug/mL at a 1.0 mL volume in sealed ampules. The standard is labeled with a LabNet ID Number and is stored at -10° to -20°C and can be kept for one year from the date of receipt or less as indicated by the manufacturer. This is a second source calibration verification standard used for HSL initial calibration verification. Second source verification of the Appendix IX initial calibration is not performed. Alternately, a calibration verification standard is analyzed once per year at a different concentration from our normal 50 ug/mL per NELAC. This is achieved by running a calibration verification at 60 ug/mL. See 5.8.1.3 for preparation specifics.

BNA Calibration Check Standard (50 ug/mL)

Acenaphthene	Dibenzofuran	2-Nitroaniline
Acenaphthylene	1,2-Diphenylhydrazine	3-Nitroaniline
Anthracene	1,2-Dichlorobenzene	4-Nitroaniline
Aniline	1,3-Dichlorobenzene	Nitrobenzene
Benzidine	1,4-Dichlorobenzene	2-Nitrophenol
Benzyl Alcohol	3,3'-Dichlorobenzidine	4-Nitrophenol
Benzo(a)anthracene	2,4-Dichlorophenol	N-Nitrosodimethylamine
Benzo(b)fluoranthene	2,4-Dimethylphenol	N-Nitrosodiphenylamine
Benzo(k)fluoranthene	4,6-Dinitro-2-methylphenol	N-Nitrosodi-n-propylamine
Benzo(g,h,i)perylene	2,4-Dinitrophenol	Pentachlorophenol
Benzo(a)pyrene	2,4-Dinitrotoluene	Phenanthrene
Benzoic acid	2,6-Dinitrotoluene	Phenol
4-Bromophenylphenylether	Diethylphthalate	Pyrene
Butylbenzylphthalate	Dimethylphthalate	Pyridine
Carbazole	Di-n-butylphthalate	1,2,4-Trichlorobenzene
4-Chloroaniline	Di-n-octylphthalate	2,4,5-Trichlorophenol
Chrysene	bis(2-Ethylhexyl)phthalate	2,4,6-Trichlorophenol

bis(2-Chloroethoxy)methane	Fluoranthene	
bis(2-Chloroethyl)ether	Fluorene Hexachlorobenzene	Surrogates
2,2'-oxybis(1-Chloropropane)	Hexachlorobutadiene	1,2-Dichlorobenzene-d_4
4-Chloro-3-methylphenol	Hexachlorocylcopentadiene	2-Fluorobiphenyl
2-Chloronaphthalene	Hexachloroethane	Nitrobenzene-d_5
2-Chlorophenol	Indeno(1,2,3-c,d)pyrene	p-Terphenyl-d_{14}
4-Chlorophenylphenylether	Isophorone	2-Chlorophenol-d_4
2-methylphenol (O-Cresol)	2-Methylnaphthalene	2-Fluorophenol
4-methylphenol (P-Cresol)	Naphthalene	Phenol-d_5
Dibenz(a,h,)anthracene		2,4,6-Tribromophenol

5.8 Calibration Verification Standards

5.8.1 HSL Calibration Verification Standard

5.8.1.1 Remove the BNA Calibration Check Standard, the DFTPP 200 ug/mL stock standard, and the Benzidine standard (Section 5.5.1) from storage. Allow the standards to come to room temperature. Transfer the stock BNA Calibration Check Standard to a 1.5-mL amber-glass, Teflon-lined, screw-capped vial. Transfer the stock Benzidine standard to a 1.5-mL amber-glass, Teflon-lined, screw-capped vial. Enter the transfer information into LabNet and obtain LabNet ID Numbers for each standard. Store the unused standard at -10° to -20°C.

5.8.1.2 Locate and rinse WELL with DCM, a 10 uL, 25 uL, 100 uL, 500 uL, and 1000 uL syringe.

5.8.1.3 The preparation information for the HSL Calibration verification Check Standard is entered into LabNet and each standard is given a LabNet ID Number. Prepare the HSL Calibration verification Check Standard as follows:

Cal. Std.	HSL Check STD. (50 ug/mL)	Working DFTPP mix (optional) (50ug/mL)	Benzidine (2000 ug/mL)	DCM	Int. Standard (2,000 ug/mL)
50 ng/2uL	500 uL	125 uL	75 uL	Bring to 1.0 mL	*10 uL

Cal. Std.	HSL Check STD. (60 ug/mL) per NELAC	Working DFTPP mix (optional) (50ug/mL)	Benzidine (2000 ug/mL)	DCM	Int. Standard (2,000 ug/mL)
60 ng/2uL	600 uL	150 uL	90 uL	Bring to 1.0 mL	*10 uL

* Add internal standard **after** the standard has been brought up to 1.0 mL.

The calibration levels listed above are correct for all compounds except Benzidine. The calibration levels for Benzidine are 350 ng/2uL and 420 ng/2ul (for NELAC check std).

- Life of Standard: 6 months from date prepared or less as indicated by the expiration date from the manufacturer.
- Storage Requirements: Store in an amber crimp-top autosampler vials at -10 to -20°C.

5.8.2 Appendix IX Calibration Verification Standard

The Appendix IX Calibration verification Standard is prepared from the stock standards listed in Section 5.5.2. Bring the stock standards from storage and allow them to come to room temperature.

Locate and rinse WELL with DCM, a 10 uL, 25 uL, 100 uL, 500 uL, and 1000 uL syringe. The preparation information for the Appendix IX Calibration verification Check Standard is entered into LabNet and the standard is given a LabNet ID Number. Prepare the Appendix IX Calibration verification Check Standard as follows:

Calibration Std.	Appendix IX Parent Std. (200 ug/mL)	Hexachlorophene Stock Std. (5,000 ug/mL)	DCM	Internal Std. (2,000 ug/mL)
50 ng/2uL	125 uL	80 uL	Brought to 1.0 mL	*10 uL

* Internal Standard is added after the standard is brought up to 1.0 mL.

The calibration level listed above are correct for all compounds except for the following:

Compound	Calibration Std.
1,4-Dioxane	200 ng / 2 uL
Hexachlorophene	800 ng / 2 uL
p-Phenylenediamine	200 ng / 2 uL

- Life of Standard: 6 months from date prepared or less as indicated by the expiration date from the manufacturer.
- Storage Requirements: Store in an amber crimp-top autosampler vials at -10 to -20°C.

6.0 CALIBRATION

Before any instrument is used as a measuring device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample

measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration is documented.

6.1 Initial 8-Point Calibration

An initial 8-point calibration is completed:

- as needed - calibration verification cannot be met;
- after a source cleaning and/or column change;
- anytime a major repair or change has occurred with the instrument that affects calibration.

Confirm that the GC/MSD is stable and equilibrated. If possible, allow the instrument to equilibrate overnight at all operating temperatures if the source/column has been cleaned/changed.

Prior to beginning initial calibration:

- check the interface nut for security;
- check the vacuum (at 40°C its normally between 4 and 5 x 10^{-5} torr);
- check background, air/water levels and base ion by scanning for appropriate ions (44,32,28,18) and visually inspecting the spectrum scan [base ion is normally 28 (nitrogen) and good background levels are below 2000].
- check the stability of inlet helium flow generated by the Electronic Pressure Control (EPC).

A hard copy of the ion scans and background scan is set aside to be placed with the final autotune report and profile scan.

6.2 PFTBA Autotune or Manual Tune

The instrument is first tuned in one of two ways: autotune or manual tune. The ion abundances in the calibration gas (Perfluorotributylamine-PFTBA) are monitored at a temperature of 40°C and a column flow of 1.0 mL/minute. Monitoring at this temperature and flow produces the most representative cal gas scan, and therefore the best estimate of DFTPP response.

6.2.1 Set oven temperature to 40°C.

6.2.2 If an AUTOTUNE is to be done continue below. If not, continue to Section 6.2.5. An autotune is generally performed when the instrument has been down for maintenance (i.e., source cleaning or other non-routine maintenance).

6.2.3 After running an autotune, note the following:

6.2.3.1 Observe peak shape, absence of fronting, tailing, and the resolution between isotopes and mass axis for 69, 219 and 502 in the profile scan. The following is a guideline for the ratios of 69, 219, and 502, which indicate the source is operating properly.

Autotune report	
Isotope	**% of 69**
69	100 %
219	> 40 %
502	> 1 %

6.2.3.2 If the %'s do not meet these limits, the DFTPP standard will most likely not meet the required criteria. In addition, this is probably an indication that the source is not operating properly or perhaps the source is assembled incorrectly or it is dirty. Repeat the Autotune process and re-evaluate, if it still does not meet these limits refer to the MSD manual for troubleshooting suggestions.

6.2.4 If the AUTOTUNE results are consistent with the limits above, go into MANUAL TUNE and save the AUTOTUNE values into the DFTPP tune file. The DFTPP tune file is used by the methods in setting the tune values (i.e. entrance lens, ion focus, etc) to the values that were set in MANUAL TUNE. Once in MANUAL TUNE adjust the tune parameters to meet the following limits:

Manual Tune Report	
Isotope	**% of 69**
69	100%
219	30-50%
502	1-2.5%

If unable to achieve these %'s redo an AUTOTUNE, and if still unsuccessful, refer to the MSD manual for troubleshooting suggestions.

6.2.5 If an AUTOTUNE has NOT just been performed, perform a MANUAL TUNE and adjust any parameters, if need be, to meet the relative abundances listed above. Adjustment may not be necessary, and not desired, if no previous problems have been encountered in meeting tune and calibration verification criteria. Hardcopy the profile scan and store the tune in the appropriate tune file.

6.3 DFTPP Analysis

Once the instrument is tuned, a 50 ng/2uL injection of DFTPP must meet certain criteria. 2 uLs of the working DFTPP/PCP/Benzidine/DDT standard, containing 50 ng/2uL of DFTPP/PCP/DDT and 100 ng/2uL of Benzidine is analyzed by the method in Attachment

Alternately, DFTPP can be added to the calibration verification solution and run at the same time as the calibration verification run. The method outlined in Attachment 1 is an example and minor adjustments often have to be made to the method in regards to scan start/ending time.

The manner of acquiring the mass spectrum of DFTPP can be done in only two specific ways with Target software:

- Three scans (the peak apex scan and the scans immediately preceding and following the apex) are acquired and averaged. Background subtraction is done and must be accomplished using a single scan acquired no more than 20 scans prior to the elution of DFTPP. This procedure of averaging and subtracting is done automatically by the Target software and evaluated by the criteria in Table 4. If this procedure does not meet the acceptance criteria in Table 4 then the analyst will use the following procedure:
- One scan of the DFTPP peak is acquired and not subtracted and evaluated by Target software using criteria in Table 4. This procedure is done manually by the analyst. No other manner of DFTPP acquisition and evaluation can be utilized.

The abundance's of designated masses MUST meet the criteria in Table 4, prior to any further analysis. In the acceptance criteria for DFTPP, certain ions have ratio acceptance criteria that are exclusive of the upper or lower limits of their acceptance range (i.e., ion m/z 70 must be less than 2.0 % of ion m/z 69). If in the event that a ratio on the DFTPP report generated by the Target software system lists the ratio of an ion at the limit of its acceptance range (i.e., ion m/z 70 is reported at 2.0%) and the ion is not flagged as being unacceptable, then the analyst will manually calculate the ion's ratio and confirm that the ion meets the ratio acceptance criteria as specified in Table 4.

NOTE: Pentachlorophenol, DDT and Benzidine responses are used to indicate the condition of the liner and column head only, and no tailing factor is reported.

A Tune Batch Sheet (Attachment 2) is initiated and is completed for all standards and samples analyzed on the instrument in each given 12-hour period that a DFTPP analysis has been performed.

6.4 Analysis of Initial Calibration Standards

The HSL Initial Calibration and the Appendix IX Initial Calibration are usually analyzed on separate 12-hour tunes. Each calibration standard is analyzed according to the method in Attachment 3. The method outlined in Attachment 3 is an example and minor adjustments often have to be made to the method in regards to scan start/ending time. The electron multiplier (EM) voltage should remain constant corresponding to the voltage

of the DFTPP analysis. Characteristic ions and approximate retention times of the target compound are listed in Table 2.

6.4.1 Analyze an initial calibration, which consists of 8 calibration points:

BNA 8-Point Calibration
160 ng / 2uL
120 ng / 2uL
80 ng / 2uL
60 ng / 2uL
50 ng / 2uL
40 ng / 2uL
20 ng / 2uL
10 ng / 2uL

6.4.1.1 Quantitate each standard and update the calibration into the appropriate method.

6.4.1.2 Print an instrument generated Initial Calibration (Attachment 4). Review the initial calibration and confirm that all compounds are integrated correctly and that all Calibration Check Compounds (CCC) and System Performance Check Compounds (SPCC) are within control limits. (Refer to Table 5 for a listing of the SPCC and CCC compounds.) All CCC's must have % RSD (Relative Standard Deviation) <15%, and all SPCC's must have an average minimum response factor (RF) greater than 0.05. Any CCC compound with a % RSD > 15% can be used if it meets the minimum coefficient of determination in a regression curve. Section 6.4.1.3. states the process for minimum acceptability for a CCC compound. The data system calculates all RF's and %RSD and the calculation is as follows:

$$RF = \frac{A_t}{A_i} \times \frac{C_i}{C_t}$$

Where:

A_t= Area of target compound
A_c= Area of internal standard
C_i = Concentration of internal standard
C_t = Concentration of target compound

6.4.1.3 Application of Regression Curves in the Initial Calibrations (8270C)

For all compounds in the initial calibration with a %RSD >15.0%, calibration curves of area ratio versus concentration using a first or higher order regression curve of the calibration curve points will be performed. A first order linear regression or weighted linear regression will be used if it gives the highest correlation coefficient and if the y-intercept is > 0. Otherwise, a second or third order regression curve will be used.

Method 8000B/8270C specifies a minimum coefficient of determination of 0.990 (R^2=0.9801). The methods also specify a minimum of 5 calibration points for a linear (first order) model, a quadratic (second order) model requires six points, and a power (third order) model requires seven standards. The laboratory, in order to meet AFCEE requirements, will analyze a minimum number of points to satisfy both SW-846 and AFCEE. For further reference of how initial calibration curves are evaluated refer to in "GC/MS Calibration - Evaluation and Acceptance Criteria" (Attachment 6).

The recipes noted above will be modified to include the necessary calibration levels. Recipes are for guidance only and may change as needed.

6.4.2 Having met the required criteria listed in Attachment 6, initial calibration is acceptable and complete. The DFTPP tune, all standard raw data reports, and Form 6 are filed. An example of an acceptable initial calibration appears in Attachment 5. If samples are analyzed on the same 12-hour tune as the initial calibration, the calibration standard in the initial calibration corresponding to the calibration verification standard (50ng/2uL) must pass the requirements of the daily calibration as listed in Section 6.5. The samples will be quantitated using the response factors from the initial calibration for Method 8270C.

The samples analyzed by Method 8270A will be quantitated using the calibration verification.

6.4.3 Initial calibrations are generally performed on an "as needed basis" (i.e., continuing calibration standard cannot be met) or after major maintenance (i.e., source cleaning, column change) has been performed.

6.5 Calibration Verification

A calibration verification occurs every 12 hours of run-time. All DFTPP requirements must be met. After having satisfied these requirements, a daily calibration verification must be met.

6.5.1 Analyze 2 uL of the 50 ng/2 uL HSL Calibration Verification Check standard according to the method specified in Attachment 3. If the Appendix IX compounds specified in Section 5.5.2 are to be analyzed, then the 50 ng/2uL Appendix IX Calibration verification standard will also be analyzed on the same 12-hour tune according to the method specified in Attachment 3. The method outlined in Attachment 3 is an example and minor adjustments often have to be made to the method in regards to scan start/ending time. The electron multiplier (EM) voltage should remain constant according to the voltage of the DFTPP analysis.

6.5.1.1 Confirm that the average response for all analytes is within 15% (grand mean). This verifies that the calibration verification meets Method 8000B criteria. If the verification meets 8000B criteria then proceed to check for additional criteria as stated in Method 8270C in Section 6.5.1.2. If the calibration verification does NOT meet 15% (grand mean) then check the operating conditions, and if necessary perform minor instrument maintenance (Sec. 7.5.1). Inject another calibration verification standard. If the response for the analytes is still not within 15%, then a new initial calibration must be analyzed.

6.5.1.2 Confirm that all compounds are integrated correctly and that all CCC's and SPCC's have met the required criteria. For Method 8270C, all RSD's for the CCC's must have a percent difference (%D) < 20% in relation to the initial calibration or <20% drift for measured concentrations of CCC compounds that had a first or higher order initial calibration regression curve. All SPCC's must have a minimum RF greater than 0.05.

$$\% \text{ Drift} = \frac{C_i - C_c}{C_i} \times 100$$

Where:
C_i = CCC standard concentration (50 ng)
C_c = measured CCC concentration

6.5.1.3 All internal standard retention times must not have changed more than 30 seconds from the last calibration verification standard. All internal standard areas must not change by a factor of 2 (-50% to +100%) from the midpoint (50 ng / 2 uL) standard in the HSL initial calibration.

6.5.1.4 For Method 8270C, all quantitation is performed using the initial calibration.

6.5.2 If all required criteria are met. Hardcopy the standard and the relevant data. The DFTPP tune and calibration verification raw data are kept together with all the sample data acquired during the next 12-hour analysis period. If both the DFTPP and Calibration Verification Standard have met the required criteria, analysis can proceed.

6.5.3 For Method 8270A all quantitation of samples is performed using the calibration verification.

7.0 PROCEDURE

7.1 Quality Control Checks

Quality Control is accomplished through 1) daily tuning and calibration checks and 2) preparation QC traceable through individual extraction batches.

NOTE: Table 1 contains the laboratory internally-derived statistical control limits for the MS/MSDs, the LCS, and the surrogates. The limits used to assess precision and accuracy as well as the number of compounds being used for bench level control may vary with client, QAP, project, etc.. This information is transmitted to the bench via the COC, kick-off meetings, tech profiles, etc..

7.1.1 Initial Calibration

PFTBA	
DFTPP	Prior to initial calibration
Initial Cal. Stds.	Prior to samples

7.1.2 Daily Analysis

PFTBA	
DFTPP	Prior to calibration verification
Daily Cal. Stds.	Prior to samples
Samples *	

*Any given 12-hour period may contain various quality controls. Preparation QC is at a 5% frequency. Instrumental controls are outlined above and further discussed in the procedure section.

Prep QC	Frequency
MB	1 per batch [3]
LCS [1]	1 per batch
MS/MSD's [2]	1 set in batch
Surrogates	Every blank, sample and QC Sample

[1] LCS Duplicate (LCD) is performed only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract....pre-determined by the extraction department.
[2] The sample selection for MS/MSD are rotated among client samples so that various matrix problems may be noted and/or addressed. ....pre-determined by the extraction department.
[3] A batch is not to exceed 20 samples.....pre-determined by the extraction department.

Every attempt is made to run a full extraction batch or at the minimum its associated blank, within the same 12-hour period or next 12-hour period, on the same instrument, to keep the preparation QC as reflective of the entire analysis as possible. If, for TAT reasons, a portion of the batch must be analyzed quickly and far in advance of the rest of the batch, the MB may be re-analyzed with the remainder of the batch. The MS/MSD is analyzed once, with their respective client.

7.2 Sample Preservation and Storage

Sample containers, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance and/or specific contract or client requests (Refer to the BNA Extraction SOPs for Methods 3510C, 3520C, 3550B, and 3580A for more specific information). Listed below are the holding times and the references that include container and preservation requirements for compliance with SW-846. Holding times prior to extraction are:

Matrix	SW-846 (VTS)[1]	Preservation
Soil/Sediment	14 days	Cool 4 ± 2°C
Water	7 days	Cool 4 ± 2°C
Waste/Oil	14 days	Cool 4 ± 2°C

[1]VTS = verified time of sampling

All samples extracted for BNA analysis are stored in extraction batches, in 1.5 - 2.0 mL screw-capped Teflon-lined vials or appropriately sized ground-glass volumetric, at 4 ± 2°C in the dark until analysis. All extracts are analyzed within 40 days of extraction.

7.3 Sample Preparation

7.3.1 Waters - Samples Extracted by Methods 3510C / 3520C

Samples (waters, aqueous sludges) prepared by Methods 3510C/3520C, produce 1-mL extracts containing both the acid and base/neutral fractions. Dilute the extract up to the correct final volume with DCM.

Samples that are suspected to have high levels of organic contamination are screened prior to analysis. Based on the screener result, an initial dilution may be performed.

500 uLs extract + 500 uLs DCM + 10 uL Internal Standard. This leaves 500-uL extract remaining for secondary dilutions or a repreparation.

7.3.2 Soils, Sediments, Organic Sludges - Extracted by SW 3550B / 3580A

These samples prepared by one of the above reference methods, results in one 1-mL extract. Dilute the extract up to the correct final volume with DCM.

Samples that are suspected to have high levels of organic contamination are screened prior to analysis. Based on the screener result, an initial dilution may be performed

500 uLs extract + 500 uLs DCM + 10 uL Internal Standard. This leaves 500-uL extract remaining for secondary dilutions or a repreparation.

Normal waste samples have a final volume of 10 mLs and are prepared as defined above.

7.4 Calibration Standardization

Refer to Section 6.0. Instrument calibration is based on a 12-hour tune or the calibration is completed on an as-needed basis (Section 6.1).

7.5 Preventive Maintenance

Instrumental maintenance can be broken down into three categories: daily, yearly, and "as required".

7.5.1 Daily Maintenance

- Change injection port septum.
- Check and replace liner.
- Remove column nut, check graphite ferrule - replace if necessary, and trim column.
- Check detector nut and be sure it is tightened completely.
- Replace rinse DCM
- Bake out the GC at 300°C for ~30 minutes

7.5.2 Yearly Maintenance

The only scheduled yearly maintenance involves the changing of the roughpump oil. An Analytical Instrument Services representative performs this task.

7.5.3 "As Required" Maintenance

Most maintenance is performed on an "as needed" basis, is operator determined and can be categorized as GC or MSD related.

Each required maintenance may be performed for a variety of reasons. Certain trouble-flags will indicate what maintenance procedures may be required. Refer to the GC/MSD Maintenance Manual for procedures, references, and documentation of maintenance actions. All maintenance or significant occurrences are entered into the instrument maintenance logbook with a reference number. This reference number is also written into the appropriate operator's logbook on the date in question.

7.5.3.1 GC related

- Clean injection port, swab out inlet with Methanol.
- Sonicate/clean or replace gold seal, washer, and reducing nut.

- Change column. Use DB5MS, 30m-x 0.25 mm ID x 0.25um, bonded-phase silicone coated fused-silica capillary column. Condition the column as follows:
- Set oven program to: initial temp = 40° initial time = 30 min. Rate = 1°/min
  final temp = 300° final time = 60 min.

NOTE: Be sure there is flow through the column

- Check Helium flow rate to inlet and the stability of the Electronic Pressure Control (EPC); clean or replace injection port lines.
- Change gas cylinder once 500 psi is attained, change oxy-trap every other cylinder, check for leaks.
- Clean liners and store in sylon.

7.5.3.2 MS Related

- Check vacuum, and interface nut;
- Clean source and anything associated with that activity. Refer to the MSD maintenance manual for details concerning source disassembly, cleaning, and reassembly.

7.6 Sample Analysis

7.6.1 Analyze 2 uLs of sample by the method listed in Attachment 3. The method outlined in Attachment 3 is an example and minor adjustments often have to be made to the method in regards to scan start/ending time. The analysis method should remain constant corresponding to the conditions of the calibration verification standard(s).

7.6.2 After quantitation, any extract showing analytes of interest exceeding the calibration range is appropriately diluted and re-analyzed.

7.6.3 Extracts are stored after analysis at 4 ± 2°C until disposal. Extracts are kept for a period of 1 year from the date of analysis.

7.7 Documentation

7.7.1 Sample Analysis and Tracking

The preparation and analysis is recorded in the GC/MS Semi-volatile Analysis Logbook, and must be completed for each days analysis (Attachment 7). In addition to the analysis log, a Tune Tracking Form is also filled out for each day's analysis. The form will track the status of the sample once it has been analyzed. This form, or a copy of it, physically follows each sample, or batch of the same sample #'s, until final review and submission (Attachment 2). Reference to the Tune Form also appears in the Data Review Section.

7.7.2 Data Management

Although there is a substantial amount of space available to both BNA's and VOA's during busy periods, the system can fill rather quickly. As an estimate, with 16 instruments, a maximum of about 2-3 months (per instrument) can be kept on the system at one time. There is not necessarily a set definite schedule of removing data from the system. Once the data package has been removed and all data associated from that batch has been reduced, reviewed, packaged, and sent to report generation, the tune form is placed in designated location. Either by necessity or at the supervisor's discretion, these are compiled and the data then actually removed from the system. These tune forms are then filed in the office area, which is indicative of the data having been removed from the system. Once a year, these forms are compiled and boxed and stored in a general data storage area. No data is removed from the system until it has been archived on at least one full back up and a number of differential back-ups.

7.7.3 Archival of Data

Back-ups are scheduled to occur automatically through the ARCServe software. There are four types of back-ups done on the Server.

- A differential back up is done Monday through Thursday. These occur at 1:00AM each day. The differential tape must be in place by this time and is loaded the night before (usually). These tapes are over-written each week. Differential tapes are located at the server.
- The Server automatically back-up the archive database information, regardless of the tape that is in the drive. This is done in the unlikely event that ARCServe crashes and the database (the archive-logs) is deleted. Duration of this event is about three minutes and takes place immediately after the differential and full back-ups.
- Every Tuesday a full-system back up is performed. A blank archive tape is required for each Friday back up. Depending on the amount of data, more than one tape may be necessary. Full tapes are never over-written. The most current full tapes are stored down in the office area. Older tapes are in locked storage.
- Every Wednesday a system back up is performed. There are four tapes provided for this back up, and are rotated each week.

The system maintains a database, or logs, of each back-up session. Successful completion of each back up can be verified each morning by accessing the job report logs in ARCServe. This is done each morning. Any missed jobs can be re-scheduled and completed in the morning of the following day. As noted above, this database is re-archived after every normal back-up and can be retrieved at anytime necessary.

8.0 QUALITY CONTROL

8.1 QC Summary

The department will review the quality controls as follows:

8.1.1 At least one MB will be included in each extraction set (maximum of 20 samples).

8.1.2 The MBs will be examined to determine if contamination is being introduced in the laboratory. The corrective action policy for MBs is found in Section 8.2.10.

8.1.3 One LCS will be included in each extraction set (maximum of 20 samples). Two LCS samples will be extracted when insufficient sample is available for the MS/MSD.

8.1.4 When two LCS's are performed, they will be examined to determine both precision and accuracy. The corrective action policy for LCS samples is found in Section 8.2.11.

8.1.5 Accuracy will be measured by the percent recovery (%R) of the LCSs. The recovery must be in range, as determined by statistical analysis, in order to be considered acceptable. Additionally, %R will be plotted on control charts to monitor method accuracy.

8.1.6 Surrogate Compounds will be added to every sample to measure performance of the analysis. Results must agree within statistical control limits in order to be considered acceptable.

8.2 Corrective Action

There are two corrective action reports in use in the GC/MS BNA analysis: the CAR/Qualifications Report Logbook and the Sample Corrective Action Report.

8.2.1 The GC/MS BNA CAR/Qualifications Report

This logbook is specific for each GC/MS BNA instrument and is used to provide corrective action for the analysis of DFTPP, Initial Calibrations, Calibration verifications, Internal Standard Areas (continuing calibration standard to continuing calibration standard) and Qualification of Data (Attachment 7). The description of the situation, the corrective actions taken, the demonstration of control, and any data qualification are documented. The corrective action report is initiated using the Tune File Number as a reference. The logbook number and associated page numbers for the corrective action report are transcribed to the Tune Batch Sheet and the Sample Corrective Action Report. This

provides a tracking mechanism through the entire analytical process, therefore allowing for the qualification of data in the case narrative.

8.2.2 DFTPP

If in the event that upon analysis of DFTPP at 50 ng/2 uL the ion ratios do not meet the acceptance criteria listed in Table 4, the analysts must perform the following:

8.2.2.1 The description of the situation is documented in the GC/MS BNA Corrective Action (CAR)/Qualification Report Logbook, thus initiating the corrective action process.

8.2.2.2 All corrective actions taken must be documented in the CAR/Qualifications Report and may include some but not all of the following:

- confirm that the DFTPP standard solution has not degraded or has not expired
- inspect the GC and/or MS system for malfunction or problem that may suggest the need for instrument maintenance as listed in Section 7.5
- retune using PFTBA and reanalyze the DFTPP at 50 ng/2uL

8.2.2.3 Upon reanalysis of DFTPP that meets the acceptance criteria listed in Table 4, the demonstration of control must be documented in the CAR/Qualifications Report Logbook. It is the policy of the BNA lab that: **No further analysis will be performed using this method until an acceptable DFTPP analysis has been successfully performed.**

8.2.2.4 If in the event that samples must be analyzed using an out-of-control DFTPP analysis due to analysis hold time considerations or a client specified acceptance of this DFTPP due to a rush turn-around time, the qualification of data effected must be documented in the CAR/Qualifications Report Logbook and addressed in the case narrative.

8.2.3 Initial Calibration

8.2.3.1 If in the event the initial calibration does not pass acceptance criteria as specified in Section 6.4.1.2 and in Attachment 6, the analyst must perform the following:

- The description of the situation is documented in the GC/MS BNA Corrective Action (CAR)/Qualification Report Logbook, thus initiating the corrective action process.
- All corrective actions taken must be documented in the CAR/Qualifications Report and may include some but not all of the following:

- confirm that the initial calibration standard solutions have not degraded or have not expired; prepare new standards if suspect; reanalyze DFTPP and the initial calibration.
- inspect the GC and/or MS system for malfunction or problem that may suggest the need for instrument maintenance as listed in Section 7.0; perform any necessary maintenance or correct instrument problem; rerun DFTPP and initial calibration
- inspect data and rerun any or all of the initial calibration curve points

Upon performance of an initial calibration that meets the acceptance criteria listed in Section 6.4.1.2 and the table in Attachment 6, the demonstration of control must be documented in the CAR/Qualifications Report Logbook.

- If in the event that samples must be analyzed using an out-of-control initial calibration due to analysis hold time considerations or a client specified acceptance of this initial calibration due to a rush turn-around time, the qualification of data effected must be documented in the CAR/Qualifications Report Logbook and addressed in the case narrative.

8.2.4 Calibration Verification

If in the event the calibration verification does not pass acceptance criteria as specified in Section 6.5.1, the analyst must perform the following:

8.2.4.1 The description of the situation is documented in the GC/MS BNA Corrective Action (CAR)/Qualification Report Logbook, thus initiating the corrective action process.

8.2.4.2 All corrective actions taken must be documented in the CAR/Qualifications Report and may include some but not all of the following:

- When a CCV exceeds it's recommended acceptance criteria, inspect the system to determine the cause and restore original conditions. Reanalyze the standard or prepare a new standard. Document all actions / reasons in the comment section of each runlog. **Under no circumstances is a CCV to be re-injected prior to completing the aforementioned reviews; or automatically injecting 2 CCV's.**
- There are various types of instrument maintenance that should not automatically require recalibration. Examples include changing/adjusting: septa; compressed gas cylinders; syringes; moisture, hydrocarbon or oxygen traps; split seals; column fittings; inlets; or filaments. Other procedures include breaking off or changing a guard column or cleaning the inlet. Whenever such procedures are performed, the analyst must demonstrate that the results for a CCV meet the prescribed acceptance limits before analysis of any samples. Otherwise, recalibration is required.

- If the % recovery(s) are still out of control, a new calibration sequence (linearity) is required, and all samples that were injected after the last in control standard must be reanalyzed.
- Maintenance procedures that automatically require recalibration include: changing the column; changing the entrance lens, draw out lines or repeller; cleaning the MS source; changing the electron multiplier, ion source chamber or injector port. Whenever such procedures are performed, the analyst must perform a new ICAL that meets the method requirements. Changing or replacing the column will also require that the retention time windows will need to be redetermined.

8.2.4.3 Upon reanalysis of the calibration verification that meets the acceptance criteria listed in Section 6.5.1, the demonstration of control must be documented in the CAR/Qualifications Report Logbook.

8.2.4.4 If in the event that samples are analyzed using an out-of-control calibration verification due to analysis hold time considerations or a client specified acceptance of this calibration verification, the qualification of data effected must be documented in the CAR/Qualifications Report Logbook and addressed in the case narrative.

8.2.5 Internal Standard Areas/Retention Times

If in the event the internal standard areas or retention times of the calibration verification do not pass acceptance criteria as specified in Section 6.5.1, the analyst must perform the following:

8.2.5.1 The description of the situation is documented in the GC/MS BNA Corrective Action (CAR)/Qualification Report Logbook, thus initiating the corrective action process.

8.2.5.2 All corrective actions taken must be documented in the CAR/Qualifications Report and may include some but not all of the following:

- confirm that the calibration verification standard solutions have not degraded or has not expired; prepare new standards if suspect; reanalyze DFTPP and the calibration verification.
- inspect the GC and/or MS system for malfunction or problem that may suggest the need for instrument maintenance as listed in Section 7.0; perform any necessary maintenance or correct instrument problem; retune PFTBA, rerun DFTPP and reanalyze the calibration verification.

8.2.5.3 Upon performance of a calibration verification that meets the acceptance criteria listed in Section 6.5.1, the demonstration of control must be documented in the CAR/Qualifications Report Logbook.

8.2.5.4 If in the event that samples are analyzed using an out-of-control calibration verification standard due to analysis hold time considerations or a client specified acceptance of this calibration verification, the qualification of data effected must be documented in the CAR/Qualifications Report Logbook and addressed in the case narrative.

8.2.6 The Sample Corrective Action Report

The Sample Corrective Action Report (CAR) (Attachment 8), is attached to the back of every chain-of-custody and is used to provide corrective action for the analysis of samples, MS/MSDs, MBs, and LCSs. The Sample CAR is a tracking system for the decision making process in regards to corrective action for dilutions, internal standards, surrogate recoveries or any other occurrence that is identified in the aforementioned analyses. The corrective action for a set of samples is tracked using the DFTPP tune file on the Sample CAR. The decision for a corrective action on a sample are initialed and dated by the analyst. All sample analyses are tracked on this form even if there is not a corrective action required.

Out-of-control situations are identified upon initial data review/reduction immediately following sample analysis. The analyst must perform the following steps before an out-of-control situation is identified. The analyst should:

- rule out any instrument malfunction or mis-injection of the sample;
- verify that all peaks of interest are integrated completely;
- verify that all calculations are correct;
- verify concentrations of surrogates/spikes in the spiking solutions are correct;
- verify that the sample was prepared correctly and that the correct amount of ISTD was added;
- verify that the ISTD and surrogate areas are reasonable; and
- verify that if a dilution was made was it prepared correctly

8.2.7 Dilution Corrective Action Policy

Upon the identification of an out-of-control event concerning a sample needing either an alternate initial dilution or a secondary dilution, the corrective action decision is documented on the Sample CAR. The analysis of the dilution is also recorded on the Sample CAR, indicating that the dilution was successful, thus demonstrating a return to control, or that additional dilutions may be required.

An alternate initial dilution may be required if in the opinion of the analyst that in the first analysis the sample background matrix has saturated the detector. The sample would require a reanalysis at a dilution and is considered the initial analysis. The necessary

initial dilution level is documented on the Sample CAR with the initials of the analysts and the date.

A secondary dilution on a sample must be performed if the on-column quantitation of any target compound exceeds the linear range of the initial calibration curve (160-ng on-column). The necessary secondary dilution level is documented on the Sample CAR with the initials of the analyst and the date the sample on the report.

8.2.8 Internal Standard Areas / Retention Times Corrective Action Policy

The internal standard areas in any sample analysis will not vary by more than a factor of two (-50 % to +100%) from the internal standard areas in the corresponding calibration verifications standard. The internal standards in the samples will not vary in retention time by more than ± 30 seconds from the internal standard retention times in the corresponding calibration verifications standard. Upon the identification of an out-of-control event in a sample analysis (in regards to internal standard areas or retention times), the corrective action is documented on the Sample CAR with the decision whether to reanalyze the sample, initialed and dated.

8.2.8.1 The decision to reanalyze a sample is based on the following criteria:

- All samples, MS/MSDs, MB, and LCS samples will be reanalyzed due to a shift in the retention time of the internal standards.
- A secondary dilution is considered a reanalysis for a sample with internal standard areas outside of the acceptance limits. A reanalysis is not required on a secondary dilution with internal standard areas outside of acceptance limits.
- Reanalysis of MS/MSDs and LCS samples are not performed due to internal standard areas.
- If the sample and the MS/MSD on that sample exhibit similar internal standard area patterns, then the sample does not require a reanalysis.
- All CLP-like or samples that require a higher QC level as specified by the client will be reanalyzed due to out-of-control internal standard areas.
- Samples with out-of-control internal standard areas do not require a reanalysis if in the opinion of the analyst and with the approval of the Unit Leader or Section Manager the following situation(s) occur:

  - there is obvious matrix interference in the samples causing the internal standard areas to be out of control.
  - there are no target compounds detected in the sample greater than the reporting limit that uses the out-of-control internal standard for quantitation.
  - there is approval given by Unit Leader, the Section Manager, the Project Manager, or the client that a reanalysis is unnecessary.

8.2.8.2 The results of a sample reanalysis due to out-of-control internal standards are documented on the Sample CAR.

If upon reanalysis of the sample, the internal standards meet the acceptance criteria, the documentation of return to control is recorded on the Sample CAR, and the reanalysis is reported as the initial analysis.

If upon reanalysis of the samples the internal standard is still out of control, this is documented in the Sample CAR. Both the initial and reanalysis is reported on the sample. All corrective action decisions are addressed in the case narrative.

8.2.9 Surrogate Recovery Corrective Action Policy

The surrogate recovery QC limits for both water and soil matrices are found in Table 1. Upon identification of an out-of-control event in regards to surrogate recoveries, the corrective action will be documented in the Sample CAR and the decision of whether to re-extract the sample is initialed and dated by the analyst. The sample re-analysis or re-extraction/reanalysis is also documented on the Sample CAR. This provides a documentation of a return to control or situation that requires addressing in the case narrative.

8.2.9.1 The decisions regarding corrective action for out of control surrogate recoveries are made using the following policies:

- If any surrogates are outside of limits in the MB, the MB may be reanalyzed. If the surrogate recoveries are also out of control in the reanalysis, the entire extraction batch will have to be re-extracted and reanalyzed.
- LCS samples do not require re-extraction due to out-of-control surrogate recoveries nor do associated samples require re-extraction.
- MS/MSD samples do not require re-extraction due to out-of-control surrogate recoveries.
- If one surrogate in any one sample is out of limits and all surrogate recoveries are greater than 10%, then the sample does not require re-extraction. If one acid and one base-neutral is out of limits in any one sample analysis and all surrogate recoveries are greater than 10%, then the sample does not require re-extraction.
- If the sample with the out-of-control surrogates is the same sample on which the MS/MSD was performed, and the MS/MSD show the same recovery pattern, then a re-extraction on the sample is not required.

A re-analysis of the sample is suggested before continuing. If an entire batch is showing the same pattern, it may be related either to matrix or a common preparation problem or error. If re-analysis gives the same result, a common error or matrix effect is suspected and the sample(s) is/are re-extracted and re-analyzed.

8.2.9.2 The following policy applies to re-extracted/ reanalyzed samples:

- If the surrogates are within the QC limits, then an in-control situation has been demonstrated and only the second analysis is reported. The laboratory makes every attempt to re-extract samples within extraction holding times. If the re-extraction occurs beyond the hold time, then both the initial and the re-extracted results are reported on the samples.
- If the surrogates are still out of control, both the initial and re-extracted results are reported on the samples.

8.2.10 Contamination in the Method Blank

If the MB is/appears to be contaminated with target compounds then the corrective action is documented in the Sample CAR. The decisions regarding the corrective action on a contaminated method blank are made using the following course of action:

- Reanalyze the MB on another instrument (one that has demonstrated a clean blank or sample).
- If contamination appears again, re-prepare the MB from the remaining extract. Analyze the re-prepare the MB on the first instrument again.
- If the MB was found to be uncontaminated on the second instrument or after re-preparing (from the remaining extract) the source of contamination is a) in the first instrument or b) was introduced during the sample preparation just prior to analysis. Report only these results for the method blank.
- If upon repreparation/reanalysis, the MB is contaminated, the contamination was probably introduced during the extraction procedure. The level of corrective action is based on the concentration of the target compound contaminant(s) found in the MB. If the on-column amount for any target compound is greater than the reporting limit or greater than 5x the reporting limit for the phthalate ester, than the samples associated with this MB must be re-extracted.
- A situation may occur where the samples associated with a contaminated MB may not require re-extraction when the contaminating target compounds are not detected on the samples above the reporting limit which is approved by the Unit Leader or the Section Manager, the QA department, the Project Manager or the client.
- The re-extracted samples are reported as the initial analysis and the first extraction set need not be analyzed. The laboratory makes every attempt to re-extract samples within extraction holding times. If the re-extraction occurs beyond the hold time, then both the initial and the re-extracted results are reported on the samples.

8.2.11 LCS Recoveries

In-house QC limits from the analysis of the TCL BNA LCS spike (see Section 5.3) are generated yearly. Upon identification of an out-of-control event in regards to LCS

recoveries, the corrective action will be documented in the Sample CAR and the decision of whether to re-extract the associated samples is initialed and dated by the analyst. The sample reanalysis or re-extraction/reanalysis is also documented on the Sample CAR. This provides a documentation of a return to control or situation that requires addressing in the case narrative.

8.2.11.1 Only the spike recoveries of the eleven compounds found in Table 1 will be used to provide corrective action for out-of-control LCS recoveries. Certain clients require the control of the LCS recoveries using the full target compound list. If the LCS recovery is outside of the in-house QC limits, the following actions may be taken concerning reporting or re-extracting the associated samples:

- If there is a MS/MSD extracted on a sample in the same extraction set and the spike recoveries are acceptable within these samples, then the samples do not require re-extraction and the corrective action is addressed in the case narrative.
- If there was not a MS/MSD extracted in the same extraction set and the LCS/LCD recoveries are above the QC limits, then the associated samples require re-extraction only if the spike compounds are detected in the samples above the reporting limits.
- If there was a MS/MSD extracted in the same extraction set; the spike recoveries are outside of QC limits within these samples; and the LCS recovery was above the QC limits, then the associated samples require re-extraction only if the spike compounds are detected in the samples above the reporting limits.
- If the spike recoveries in the MS/MSD are outside of the QC limits and the LCS recovery was below the QC limits, then the samples associated with the LCS sample are re-extracted.
- If there was an MS/MSD extracted and the LCS recovery was below the QC limits, then the associated samples are re-extracted.
- Other situations where the LCS recovery is outside the QC limits will be evaluated on a case by case basis and the decision to re-extracted or report the associated sample will be made by the Unit Leader or Section Manager with the approval of the QA/QA department, the Project Manager or the client.
- If the recovery in the LCS sample is outside of the QC limits, the LCS may be re-prepared using the remaining extract and reanalyzed on the same instrument or another instrument. If all recoveries are acceptable in the reanalysis, then the second analysis is reported as the initial analysis, the method is considered to be within control and the associated sample do not require re-extraction.

8.2.11.2 The following policies applies to samples re-extracted/reanalyzed due to out-of-control LCS spike recoveries:

- If the re-extraction occurs within the extraction holding times, then only the second analysis on the samples is reported. The laboratory makes every attempt to re-extract samples within extraction holding times.

- If the re-extraction occurs beyond the hold time, then both the initial and the re-extracted results are reported on the samples.

All corrective action is documented on the Sample CAR with the decision whether to reanalyze the LCS or to re-extract all associated samples; initialed and dated by the analyst. The sample reanalysis is also documented on the Sample CAR.

8.2.12 Matrix Spike (MS) / MS Duplicate (MSD)

In MS/MSD analyses, the spike recoveries and RPD values (Table 1) function to illustrate and note possible matrix effects on the efficiency and completeness of analyte extraction. Out-of-control events on MS/MSD's are documented on the Sample CAR and initialed and dated by the analyst. Sample re-extraction is not performed due to out-of-control MS/MSD recoveries or RPD values; therefore, no return to control can be documented. The Sample CAR serves as a mechanism to address the out-of-control events in the case narrative. Corrective action in these situations is not used to suggest re-extraction. The corrective action decisions for out-of-control events on MS/MSD samples are driven by the acceptance/rejection of the LCS spike recovery. (Section 8.2.11).

8.2.13 Any other occurrences that require addressing in the case narrative are documented in either the CAR/Data Qualifications Report Logbook or on the Sample CAR and the corrective action is evaluated on a case by case basis.

8.2.14 Each instrument has a Maintenance Logbook. Major instrument maintenance and problem resolutions are documented in the maintenance logbook. The logbook provides for a description of the maintenance or repair performed and a corrective action for a return to control event, which is initialed and dated by the analyst.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 Computer Data Production/Reduction

The HP ChemServer and Target software produces a Total Ion Chromatogram (TIC); quant report and background subtracted spectra of target analytes. For those clients requiring it, tentatively identified compound searches are also performed. The data system will produce library search report, which includes unknown quantitation report and unknown mass spectra with the three tentatively identified compounds with the highest probability. All data for each sample is kept together. All data for all samples run during that 12-hour period remains together with the Tune Tracking Forms until operator data workup begins. At which time, all appropriate QC and the Tune Form are photocopied for each STL # batch run on that tune.

9.2 Quantitation of Target Compounds

Quantitation of the target compounds and response factors are performed by the data system, but can be accomplished as follows:

9.2.1 Water

$$\text{Concentration (ug/L)} = \frac{(A_x)(I_s)(V_t)}{(A_{is})(RF)(V_o)(V_i)}$$

Where:
A_x = area of characteristic ion for compound of interest
I_s = amount of internal standard injected (ng) (ISTD).
V_t = volume of total extract (uLs). This includes a measured final volume
A_{is} = area of characteristic ion of designated internal standard
RF = Average Response Factor from Initial Calibration
V_o = volume of water extracted (mLs)
V_i = volume of extract injected (uLs)

9.2.2 Soil, Sediment, Waste

$$\text{Concentration (ug/kg)} = \frac{(A_x)(I_s)(V_t)}{(A_{is})(RF)(V_i)(W_s)(D)}$$

All variables are the same as in the water calculation in Section 9.2.1 with the addition of the following:
W_s = weight of sample extracted or diluted (g)
D = (100 - % moisture in sample) / 100 (or 1 for wet weight basis)

A 2x dilution factor must be taken into account whenever the soil samples have undergone a GPC clean up.

9.2.3 Accuracy

$$\%R = \frac{(A_T - A_0)}{A_F} \times 100$$

Where:
A_T = Total amount recovered in fortified sample
A_0 = Amount recovered in unfortified sample
A_F = Amount added to sample

9.2.4 Precision

$$\%D = \frac{|B_1 - B_2|}{B_1} \times 100$$

$$RPD = \frac{|B_1 - B_2|}{(B_1 + B_2)/2} \times 100$$

Where:
B_1 = %Recovery MS (or LCS)
B_2 = %Recovered MSD (or LCD – when performed)

9.2.5 Quantitation by Method 8270C

9.2.5.1 The samples analyzed by Method 8270C will be quantitated using the initial calibration. For compounds that are calibrated using a linear regression curve or a power curve, the following equations are used to determine the on-column amount of a compound:

Linear Regression Curve: $y = a_0 + (1/a_1)\,x$

Power Curve: $y = e^{a0} * x^{(1/a1)}$

which is converted to: $\ln(y) = (1/a_1) * \ln(x) + a_0$

Where:
$x = Area_{UNK}/Area_{ISTD}$
$y = Amount_{UNK}/Amount_{ISTD}$

9.2.5.2 The quantitation of compounds using either a linear regression or a power curve is performed by the Target software and has been confirmed to be accurate to obtain the on-column $Amount_{UNK}$ of a target compound reported on the quantitation report. To obtain the final concentration the following equations are used:

Waters Concentration (µg/L) = $(Amount_{UNK})(V_t)/(V_o)(V_i)$

Soils Concentration (µg/L) = $(Amount_{UNK})(V_t)/(V_i)(W_s)(D)$

* The variables V_t, V_o, V_i, W_s, and D are defined in Section 9.2.1 and 9.2.2.

9.3 Quantitation of TIC's (Tentatively Identified Compounds)

Quantitation of TIC's is performed by the ChemServer system. The formulas above for waters and soils can be used with the following modifications. A_x and A_{is} should be taken from the unknown quantitation report produced by the data system. The nearest ISTD should be used. The RF is assumed 1. The concentration is therefore an estimate and is flagged as such with a 'J'. Any TIC also found in the blank of that extraction batch is flagged 'JB'. Any TIC that has been positively identified should be flagged with a 'JN'. The aldol-condensation compounds produced in the soil extraction process should be flagged with a 'JA'.

$$\text{Total ng of TIC} = \frac{\text{area of TIC x ng of its ISTD (40 ng)}}{\text{area of that ISTD}}$$

9.4 Operator Data Reduction/Review

The operator reviews the data and 1) makes judgments concerning the "realness" of those target compounds found and 2) makes judgments concerning the identification of the tentatively identified compounds and 3) modifies the output to confirm with those judgments to produce a data package reflective of those decisions. All initial data reduction/review is performed by the analyst in Target review of the Chemserver data system before any hardcopy reports are generated.

9.5 Initial Review

Operator determines that the analysis itself is acceptable. This means:

9.5.1 QC samples meet acceptable limits. See Section 8.2 for corrective action regarding sample analysis.

NOTE: Table 1 contains the laboratory's internally-derived statistical control limits for the MS/MSDs, the LCS, and the surrogates. The limits used to assess precision and accuracy as well as the number of compounds being used for bench level control may vary with client, QAP, project, etc.. *This information is transmitted to the bench via the* COC: kick-off meetings, tech profiles, etc..

- Glassware blank (MB) is clean, ALL surrogates are within control limits. A clean blank means no target compounds above the reporting limit; except for the phthalates that must be less than 5x the reporting limit.
- All surrogates in the samples are within control limits or at most one surrogate in each fraction is out. No surrogate can be <10%. All surrogates must be within control limits for all Method Blanks.
- All MS/MSD and LCS recoveries are within in-house generated control limits specified in Table 1 for the spike compounds in the HSL BNA LCS spike identified in Section 5.3.

9.5.2 The sample does not require any further dilutions or analysis at a more concentrated level. Visually confirm complete integration for any large and/or saturated target compound found. Dilutions are made to keep the target compounds in the upper half of the calibration range. MS/MSD or LCS samples are never diluted to get spiked or non-spiked analytes within the calibration range.

9.5.2.1 *The sample does not require re-analysis for any other reason* (i.e., leak, analysis past tune time, ISTD areas low, etc..)

9.5.2.2 Identification of target compounds. The following criteria are used in the positive identification of target compounds. **These are guidelines, they are not absolute.**

9.5.2.3 "elution of component at the same relative retention time as the standard component."

The elution times should compare within 0.06 min. The standard MUST be run on the same 12-hour period as the sample. If co-eluting analytes interfere with comparisons of retention times, other ions characteristic to that compound can be used to confirm relative retention times.

9.5.2.4 "correspondence of the sample component and standard component mass spectrum."

All ions present in the standard spectrum at a 10% relative intensity (most abundant ion being 100%) MUST be present in the sample.

The relative intensities of the above ions must agree within ±20%, between the standard and sample. If an ion has 50% intensity in the standard, the corresponding ion must be between 30% and 70% in the sample.

Ions >10% in the sample but not present in the standard must be considered and accounted for.

If a compound cannot be verified by the above, **but in the operator's technical judgment, the ID is correct**, it is reported as such.

9.5.2.5 Once all positive identification is made, the file is modified to reflect these decisions. All analytes at concentrations less than the reporting limit are automatically flagged with a 'J'.

9.5.2.6 Identification of TIC's

In general, up to as many as 20 non-target compounds are tentatively identified by the data system and operator. The data system provides the operator with a subtracted mass spectrum of the unknown and the mass spectra of the first three matches. Molecular formulas, molecular weights, and CAS #'s are included. The following **guidelines** are used:

9.5.2.6.1 Relative intensities of major ions in the reference spectrum should be present in the sample (ions >10%).

- Relative ions should agree within ±20%.
- Molecular ions in the reference should be in the samples.
- Review the possibility of background and/or co-eluting compounds for those ions present in the sample but not in the standard.
- If ions are present in the sample but not in the standard, review the possibility of the presence of background or co-eluting compounds.
- If ions are present in the standard but not in the sample, review the possibility that the ions were subtracted out because they are also common to the background or co-eluting compounds.
- In the event no valid interpretation can be made, the compound is called "unknown".
- Interpretation can be often narrowed down to a class of compounds, molecular formula, or weight.

9.6 Manual Integration Policy

9.6.1 In each case where the file has been edited or manual integrations have been performed the operator must identify, initial, and date the changes on the hardcopy report. The following guidelines apply:

- Manual integrations should be consistent between all files integrated.
- Manual integrations should not be performed to meet QC criteria.
- Manual integrations are automatically flagged with an 'M' on the raw data.
- Excessive manual integrations may reflect an instrumental or methodological problem that should be addressed.
- Manual integrations shall follow the STL Corporate SOP for manual integrations (#S-Q-004).

Manual integrations are most often performed for the following reasons:

- Assignment of correct peak that was mis-identified by the data system.
- Incomplete auto-integration due to high level of target compound detected.
- Incomplete auto-integration due to background interference.
- Incorrect auto-integration due to co-elution or near co-elution of compounds.
- Missed peaks.

The analysts review all integrations. Spectra and Extracted Ion Chromatography Profiles (EICP) are printed after any integration takes place for target compounds and are routinely included in the data packages. If EICP's for internal standards, surrogates and calibration standards are required to satisfy client deliverables, they can be provided, but will not be routinely added. Manual integrations may be documented in the case narrative if so required, however, references to this SOP will be used for explanations, and any further documentation beyond initials and dates will not be done.

9.7 Final Review

Once 1) the analysis is determined to be acceptable and 2) the initial review and data reduction has occurred (verifiable on the Tune Form) 3) all forms are produced using the Envision data packaging software and the package is put together 4) the results transferred to LabNet and 5) the package is put together and submitted for it's first 100% review. The associated Tune Form is initialed and dated as completed and reviewed by the submitter. The checklist in Attachment 9 is used as an aid to review.

Upon the first 100% review, the review checklist is initialed and dated as reviewed. The package, with its review sheet, comments, and any C/A forms is submitted to the unit leader or section manager for a second review and validation. The Tune Form remains in the BNA area. Once the data passes review and report generation 1) archival is verified or completed at that time 2) the files are deleted from the data system and documented. When all files associated with that 12-hour tune have been deleted from the system, the Tune Form is filed until the extracts are disposed of.

The entire sample tracking system can be summarized in Attachment 10. The complete analysis scheme can be summarized in Sections 7.1.1, 7.1.2 and in Attachment 10.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

- Waste from this procedure will enter the Methylene Chloride waste stream.
- Expired and single component standards will be turned over to the EHSC or Waste Technician.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Sections 1.0.

13.0 ATTACHMENTS

Table 1: Example: Reporting Limits (RLs); Internal Statistical Control Limits for MS/MSDs, LCSs, Surrogates for Water and Soil/Sediment Samples
Table 2: Characteristic Ions for Semi-Volatile Organic Compounds
Table 3: Internal Standards with Corresponding Analysts Assigned for Quantitation.
Table 4: DFTPP Key Ions and Ion Abundance Criteria
Table 5: Calibration Check Compounds and System Performance Check Cmpds.

Attachment 1: DFTPP Method
Attachment 2: Example: Tune Batch Form
Attachment 3: Example: BNA Method for Standards and Samples
Attachment 4: Example: Instrument Generated Initial Calibration - Form 6
Attachment 5: Example: Acceptable Initial Calibration - Form 6
Attachment 6: GC/MS Calibration - Evaluation and Acceptance Criteria
Attachment 7: Example: Semi-Volatile Analysis Logbook
Attachment 8: Example: Sample Corrective Action Report
Attachment 9: Example: Data review checklist
Attachment 10: Example: Analysis Scheme and Sample Tracking Flowcharts

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Historical File:

Revision 00: 08/03/90	Revision 05: 04/10/97	Revision 10: 09/12/00
Revision 01: 11/22/91	Revision 06: 06/13/97	Revision 11: 02/07/02
Revision 02: 03/22/93	Revision 07: 02/11/98	
Revision 03: 10/31/95	Revision 08: 01/29/99	
Revision 04: 04/09/96	Revision 09: 07/01/99	

Reason for Change; Revision 11:
- Sections 5.7 & 5.8.1.3 – Annual performance of an alternate CCV concentration.
- Annual Review – DFTPP revision, minor updates

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Table 1.

Example: Reporting Limits (RLs); Internal Statistical Control Limits for MS/MSDs, LCSs, Surrogates for Water and Soil/Sediment Samples

- RLs listed for soil/sediment are based on wet weight. Normally data is reported on a dry weight basis, therefore, RLs will be higher based on the % moisture in each sample. This is based on a 30-g sample (Normally, GPC clean-up is NOT performed on any samples. Upon GPC clean up, the RL listed would be 2x greater than normally reported.)
- Sample RLs are highly matrix-dependent. The RLs listed herein are provided for guidance and may not always be achievable.
- Statistical control limits and MDLs are determined annually and are subject to change. Contact the laboratory for the latest values.

STL Chicago
Method RL/MDL/Control Limit Summary
Revison Date: 01/31/02

Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
1,2,4,5-Tetrachlorobenzene	8270C	Water	ug/L	7.4	10	NA	NA	NA
1,2,4-Trichlorobenzene	8270C	Water	ug/L	5.7	10	43	106	34
1,2-Dichlorobenzene	8270C	Water	ug/L	5.4	10	39	95	29
1,2-Diphenylhydrazine	8270C	Water	ug/L	4.3	10	68	105	20
1,3-Dichlorobenzene	8270C	Water	ug/L	5.7	10	38	91	34
1,3-Diethyl-1,3-Diphenyl Urea	8270C	Water	ug/L	5	10	21	127	50
1,4-Dichlorobenzene	8270C	Water	ug/L	5.8	10	34	99	20
1,4-Dioxane	8270C	Water	ug/L	33	40	NA	NA	NA
1,4-Naphthoquinone	8270C	Water	ug/L	27	50	NA	NA	NA
1-Chloronaphthalene	8270C	Water	ug/L	10	10	NA	NA	NA
1-Methylnaphthalene	8270C	Water	ug/L	3.3	10	50	150	50
1-Naphthylamine	8270C	Water	ug/L	15	20	NA	NA	NA
2,2-oxybis (1-chloropropane)	8270C	Water	ug/L	4.2	10	37	112	15
2,3,4,6-Tetrachlorophenol	8270C	Water	ug/L	9.7	10	NA	NA	NA
2,4,5-Trichlorophenol	8270C	Water	ug/L	3.6	50	64	110	10
2,4,5-Trimethylaniline	8270C	Water	ug/L			NA	NA	NA
2,4,6-Trichlorophenol	8270C	Water	ug/L	2.8	10	63	103	21
2,4-Dichlorophenol	8270C	Water	ug/L	4.3	10	60	96	29
2,4-Dimethylphenol	8270C	Water	ug/L	4.6	10	47	87	28
2,4-Dinitrophenol	8270C	Water	ug/L	12	50	32	137	29
2,4-Dinitrotoluene	8270C	Water	ug/L	3.1	10	64	118	16
2,4-Toluenediamine	8270C	Water	ug/L		20	50	150	50
2,6-Dichlorophenol	8270C	Water	ug/L	9.6	10	NA	NA	NA
2,6-Dinitrotoluene	8270C	Water	ug/L	3	10	63	114	15
2-Acetylaminofluorene	8270C	Water	ug/L	11	20	NA	NA	NA
2-Chlorobenzaldehyde	8270C	Water	ug/L	7.4	10	10	190	50
2-Chlorobenzoic Acid	8270C	Water	ug/L	28	40	40	120	50
2-Chloronaphthalene	8270C	Water	ug/L	3.6	10	60	102	12
2-Chlorophenol	8270C	Water	ug/L	4.4	10	48	98	20
2-Methyl-3-Nitroaniline	8270C	Water	ug/L	5.5	10	10	162	50
2-Methylnaphthalene	8270C	Water	ug/L	4.3	10	52	107	21
2-Methylphenol (o-cresol)	8270C	Water	ug/L	5	10	50	95	30
2-Naphthylamine	8270C	Water	ug/L	15	20	NA	NA	NA
2-Nitroaniline	8270C	Water	ug/L	4	50	63	114	15

STL Chicago
Method RL/MDL/Control Limit Summary
Revison Date: 01/31/02

Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
2-Nitrodiphenylamine	8270C	Water	ug/L	6.2	10	20	134	50
2-Nitrophenol	8270C	Water	ug/L	4.3	10	57	98	34
2-Picoline	8270C	Water	ug/L	9.6	10	NA	NA	NA
2-sec-Butyl-4,6-dinitrophenol	8270C	Water	ug/L	19	20	NA	NA	NA
3,3-Dichlorobenzidine	8270C	Water	ug/L	4.4	20	25	109	21
3,3'-Dimethoxybenzidine	8270C	Water	ug/L			NA	NA	NA
3,3-Dimethylbenzidine	8270C	Water	ug/L	25	50	NA	NA	NA
3,5-Dinitroaniline	8270C	Water	ug/L	4.7	10	10	253	50
3-Chlorobenzaldehyde	8270C	Water	ug/L	6.5	10	15	158	50
3-Methylcholanthrene	8270C	Water	ug/L	5.7	10	NA	NA	NA
3-Nitroaniline	8270C	Water	ug/L	3.5	50	47	124	20
4,6-Dinitro-2-methylphenol	8270C	Water	ug/L	6.4	50	57	124	21
4-Aminobiphenyl	8270C	Water	ug/L	13	20	NA	NA	NA
4-Bromophenyl phenyl ether	8270C	Water	ug/L	2.9	10	65	108	16
4-Chloro-3-methylphenol	8270C	Water	ug/L	3.8	10	57	108	12
4-Chloroaniline	8270C	Water	ug/L	2.7	10	38	104	35
4-Chlorobenzaldehyde	8270C	Water	ug/L	8.4	10	10	142	50
4-Chlorophenyl phenyl ether	8270C	Water	ug/L	3.6	10	67	100	12
4-Methylphenol (m/p-cresol)	8270C	Water	ug/L	3.8	10	49	96	20
4-Nitroaniline	8270C	Water	ug/L	6.1	50	52	115	13
4-Nitrophenol	8270C	Water	ug/L	7.1	50	30	121	33
4-Nitroquinoline-1-oxide	8270C	Water	ug/L	35	50	NA	NA	NA
5-Nitro-o-toluidine	8270C	Water	ug/L	7.8	20	13	176	50
6-Methylchrysene	8270C	Water	ug/L	4.3	10	50	150	50
7,12-Dimethylbenz(a)anthracene	8270C	Water	ug/L	11	20	NA	NA	NA
a,a-Dimethylphenethylamine	8270C	Water	ug/L	47	50	NA	NA	NA
Acenaphthene	8270C	Water	ug/L	3.1	10	62	101	15
Acenaphthylene	8270C	Water	ug/L	3.2	10	63	99	16
Acetophenone	8270C	Water	ug/L	8.7	10	NA	NA	NA
Aniline	8270C	Water	ug/L	3	10	18	89	20
Anthracene	8270C	Water	ug/L	2.5	10	67	102	20
Aramite	8270C	Water	ug/L	12	20	NA	NA	NA
Benzenethiol	8270C	Water	ug/L	6	10	50	150	50
Benzidine	8270C	Water	ug/L	64	100	10	50	50

STL Chicago
Method RL/MDL/Control Limit Summary
Revison Date: 01/31/02

Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
Benzo(a)anthracene	8270C	Water	ug/L	2.5	10	71	109	12
Benzo(a)pyrene	8270C	Water	ug/L	3.7	10	68	103	20
Benzo(b)fluoranthene	8270C	Water	ug/L	3.6	10	64	115	12
Benzo(ghi)perylene	8270C	Water	ug/L	4.3	10	57	127	20
Benzo(k)fluoranthene	8270C	Water	ug/L	3.7	10	62	112	11
Benzoic acid	8270C	Water	ug/L	6.5	50	13	133	33
Benzyl alcohol	8270C	Water	ug/L	4.7	10	52	120	32
Bis(2-chloroethoxy)methane	8270C	Water	ug/L	4.8	10	60	103	24
Bis(2-chloroethyl)ether	8270C	Water	ug/L	4.8	10	51	102	20
Bis(2-ethylhexyl)phthalate	8270C	Water	ug/L	6	10	57	128	18
Butyl benzyl phthalate	8270C	Water	ug/L	5	10	65	115	12
Caprolactam	8270C	Water	ug/L	10	10	50	150	50
Carbazole	8270C	Water	ug/L	2.8	10	59	115	20
Chlorobenzilate	8270C	Water	ug/L	9.9	10	NA	NA	NA
Chrysene	8270C	Water	ug/L	3	10	70	108	20
Diallate	8270C	Water	ug/L	6.9	10	NA	NA	NA
Dibenzo(a,h)acridine	8270C	Water	ug/L	2.9	10	50	150	50
Dibenzo(a,h)anthracene	8270C	Water	ug/L	3.6	10	64	120	17
Dibenzo(a,j)acridine	8270C	Water	ug/L			NA	NA	NA
Dibenzofuran	8270C	Water	ug/L	3.4	10	67	100	20
Dicyclopentadiene	8270C	Water	ug/L	10	10	50	150	50
Diethyl phthalate	8270C	Water	ug/L	4.1	10	62	110	20
Dimethyl phthalate	8270C	Water	ug/L	3.1	10	66	105	15
Di-n-butyl phthalate	8270C	Water	ug/L	3.5	10	60	116	12
Di-n-octyl phthalate	8270C	Water	ug/L	4.3	10	54	125	19
Di-n-propyl Adipate	8270C	Water	ug/L	5.1	10	25	118	50
Diphenylamine	8270C	Water	ug/L	8.7	10	NA	NA	NA
Dodecylbenzene	8270C	Water	ug/L			NA	NA	NA
Ethyl methane sulfonate	8270C	Water	ug/L	9	10	NA	NA	NA
Fluoranthene	8270C	Water	ug/L	4.5	10	53	122	19
Fluorene	8270C	Water	ug/L	4	10	67	99	20
Hexachlorobenzene	8270C	Water	ug/L	2.8	10	66	109	20
Hexachlorobutadiene	8270C	Water	ug/L	8.4	10	37	108	20
Hexachlorocyclopentadiene	8270C	Water	ug/L	1.6	10	10	47	67

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Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
Hexachloroethane	8270C	Water	ug/L	8	10	31	94	32
Hexachlorophene	8270C	Water	ug/L	62	150	NA	NA	NA
Hexachloropropene	8270C	Water	ug/L	8.6	50	NA	NA	NA
Indene	8270C	Water	ug/L	5.4	10	50	150	50
Indeno(1,2,3-cd)pyrene	8270C	Water	ug/L	5	10	62	122	17
Isophorone	8270C	Water	ug/L	3.3	10	63	110	17
Isosafrole	8270C	Water	ug/L	6.1	10	NA	NA	NA
m-Dinitrobenzene	8270C	Water	ug/L	10	20	NA	NA	NA
Methapyrilene	8270C	Water	ug/L	46	50	NA	NA	NA
Methyl methane sulfonate	8270C	Water	ug/L	8	20	NA	NA	NA
Naphthalene	8270C	Water	ug/L	4.3	10	51	97	40
Nitrobenzene	8270C	Water	ug/L	3.9	10	56	105	48
n-Nitrosodiethylamine	8270C	Water	ug/L	5.4	20	NA	NA	NA
n-Nitrosodimethylamine	8270C	Water	ug/L	4.7	10	28	115	20
n-Nitrosodi-n-butylamine	8270C	Water	ug/L	8.8	10	NA	NA	NA
n-Nitroso-di-n-propylamine	8270C	Water	ug/L	3.9	10	51	107	18
n-Nitrosodiphenylamine	8270C	Water	ug/L	3.8	10	56	111	20
n-Nitrosomethylethylamine	8270C	Water	ug/L	5.2	20	NA	NA	NA
n-Nitrosomorpholine	8270C	Water	ug/L	8.8	20	NA	NA	NA
n-Nitrosopiperidine	8270C	Water	ug/L	6.3	10	NA	NA	NA
n-Nitrosopyrolidine	8270C	Water	ug/L	15	50	NA	NA	NA
o-Toluidine	8270C	Water	ug/L	9.5	10	NA	NA	NA
Parathion	8270C	Water	ug/L	10	10	NA	NA	NA
p-Cresidine	8270C	Water	ug/L			NA	NA	NA
p-Dimethylaminoazobenzene	8270C	Water	ug/L	12	20	NA	NA	NA
Pentachlorobenzene	8270C	Water	ug/L	3.7	10	NA	NA	NA
Pentachloronitrobenzene	8270C	Water	ug/L	6.3	10	NA	NA	NA
Pentachlorophenol	8270C	Water	ug/L	4.6	50	54	125	16
Phenacetin	8270C	Water	ug/L	11	20	NA	NA	NA
Phenanthrene	8270C	Water	ug/L	2.5	10	69	104	20
Phenol	8270C	Water	ug/L	3.8	10	27	102	35
Phthalic anhydride	8270C	Water	ug/L			NA	NA	NA
p-Phenylenediamine	8270C	Water	ug/L	39	40	NA	NA	NA
Pronamide	8270C	Water	ug/L	10	20	NA	NA	NA

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Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
Pyrene	8270C	Water	ug/L	3.9	10	58	125	23
Pyridine	8270C	Water	ug/L	3.8	20	10	96	20
Quinoline	8270C	Water	ug/L	3.4	10	50	150	50
Safrole	8270C	Water	ug/L	6.6	10	NA	NA	NA
Simazine	8270C	Water	ug/L		10	NA	NA	NA
Sym-Trinitrobenzene	8270C	Water	ug/L	23	40	NA	NA	NA
Toluene Diisocyanate	8270C	Water	ug/L	3	20	50	150	50
2,4,6-Tribromophenol (surr)	8270C	Water	ug/L			29	126	
2-Fluorobiphenyl (surr)	8270C	Water	ug/L			34	112	
2-Fluorophenol (surr)	8270C	Water	ug/L			21	97	
Nitrobenzene-d5 (surr)	8270C	Water	ug/L			38	113	
Phenol-d5 (surr)	8270C	Water	ug/L			18	97	
Terphenyl-d14 (surr)	8270C	Water	ug/L			10	119	
1,2,4,5-Tetrachlorobenzene	8270C	Solid	ug/Kg	184	330	NA	NA	NA
1,2,4-Trichlorobenzene	8270C	Solid	ug/Kg	49	330	54	111	20
1,2-Dichlorobenzene	8270C	Solid	ug/Kg	86	330	54	96	20
1,2-Diphenylhydrazine	8270C	Solid	ug/Kg	128	330	59	114	20
1,3-Dichlorobenzene	8270C	Solid	ug/Kg	93	330	52	93	20
1,3-Diethyl-1,3-Diphenyl Urea	8270C	Solid	ug/Kg	123	330	29	114	50
1,4-Dichlorobenzene	8270C	Solid	ug/Kg	74	330	21	104	20
1,4-Dioxane	8270C	Solid	ug/Kg	806	1300	NA	NA	NA
1,4-Naphthoquinone	8270C	Solid	ug/Kg	1220	1700	NA	NA	NA
1-Chloronaphthalene	8270C	Solid	ug/Kg	330	330	NA	NA	NA
1-Methylnaphthalene	8270C	Solid	ug/Kg	84	330	NA	NA	NA
1-Naphthylamine	8270C	Solid	ug/Kg	511	670	NA	NA	NA
2,2-oxybis (1-chloropropane)	8270C	Solid	ug/Kg	172	330	43	106	20
2,3,4,6-Tetrachlorophenol	8270C	Solid	ug/Kg	279	330	NA	NA	NA
2,4,5-Trichlorophenol	8270C	Solid	ug/Kg	67	1700	69	115	20
2,4,5-Trimethylaniline	8270C	Solid	ug/Kg			NA	NA	NA
2,4,6-Trichlorophenol	8270C	Solid	ug/Kg	68	330	66	107	20
2,4-Dichlorophenol	8270C	Solid	ug/Kg	57	330	63	104	20
2,4-Dimethylphenol	8270C	Solid	ug/Kg	223	330	60	102	20
2,4-Dinitrophenol	8270C	Solid	ug/Kg	197	1700	42	127	20
2,4-Dinitrotoluene	8270C	Solid	ug/Kg	74	330	61	127	20

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Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
2,4-Toluenediamine	8270C	Solid	ug/Kg		670	50	150	50
2,6-Dichlorophenol	8270C	Solid	ug/Kg	218	330	NA	NA	NA
2,6-Dinitrotoluene	8270C	Solid	ug/Kg	78	330	65	113	20
2-Acetylaminofluorene	8270C	Solid	ug/Kg	538	670	NA	NA	NA
2-Chlorobenzaldehyde	8270C	Solid	ug/Kg	127	330	23	143	50
2-Chlorobenzoic Acid	8270C	Solid	ug/Kg	964	1300	40	120	50
2-Chloronaphthalene	8270C	Solid	ug/Kg	54	330	62	103	20
2-Chlorophenol	8270C	Solid	ug/Kg	69	330	55	100	20
2-Methyl-3-Nitroaniline	8270C	Solid	ug/Kg	118	330	10	138	50
2-Methylnaphthalene	8270C	Solid	ug/Kg	238	330	60	111	20
2-Methylphenol (o-cresol)	8270C	Solid	ug/Kg	124	330	59	101	20
2-Naphthylamine	8270C	Solid	ug/Kg	516	670	NA	NA	NA
2-Nitroaniline	8270C	Solid	ug/Kg	107	1700	67	110	20
2-Nitrodiphenylamine	8270C	Solid	ug/Kg	167	330	31	121	50
2-Nitrophenol	8270C	Solid	ug/Kg	77	330	62	100	20
2-Picoline	8270C	Solid	ug/Kg	225	330	NA	NA	NA
2-sec-Butyl-4,6-dinitrophenol	8270C	Solid	ug/Kg	453	670	NA	NA	NA
3,3-Dichlorobenzidine	8270C	Solid	ug/Kg	114	670	16	96	20
3,3'-Dimethoxybenzidine	8270C	Solid	ug/Kg			NA	NA	NA
3,3-Dimethylbenzidine	8270C	Solid	ug/Kg	303	1700	NA	NA	NA
3,5-Dinitroaniline	8270C	Solid	ug/Kg	272	330	10	228	50
3-Chlorobenzaldehyde	8270C	Solid	ug/Kg	224	330	33	125	50
3-Methylcholanthrene	8270C	Solid	ug/Kg	303	330	NA	NA	NA
3-Nitroaniline	8270C	Solid	ug/Kg	139	1700	31	87	20
4,6-Dinitro-2-methylphenol	8270C	Solid	ug/Kg	141	1700	60	123	20
4-Aminobiphenyl	8270C	Solid	ug/Kg	285	670	NA	NA	NA
4-Bromophenyl phenyl ether	8270C	Solid	ug/Kg	92	330	63	117	20
4-Chloro-3-methylphenol	8270C	Solid	ug/Kg	85	330	57	122	20
4-Chloroaniline	8270C	Solid	ug/Kg	127	330	10	79	20
4-Chlorobenzaldehyde	8270C	Solid	ug/Kg	118	330	10	140	50
4-Chlorophenyl phenyl ether	8270C	Solid	ug/Kg	87	330	66	106	20
4-Methylphenol (m/p-cresol)	8270C	Solid	ug/Kg	118	330	58	107	20
4-Nitroaniline	8270C	Solid	ug/Kg	135	1700	32	108	20
4-Nitrophenol	8270C	Solid	ug/Kg	366	1700	52	140	20

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Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
4-Nitroquinoline-1-oxide	8270C	Solid	ug/Kg	1370	1700	NA	NA	NA
5-Nitro-o-toluidine	8270C	Solid	ug/Kg	309	670	32	135	50
6-Methylchrysene	8270C	Solid	ug/Kg	143	330	NA	NA	NA
7,12-Dimethylbenz(a)anthracene	8270C	Solid	ug/Kg	464	670	NA	NA	NA
a,a-Dimethylphenethylamine	8270C	Solid	ug/Kg	1470	1700	NA	NA	NA
Acenaphthene	8270C	Solid	ug/Kg	53	330	58	112	20
Acenaphthylene	8270C	Solid	ug/Kg	55	330	63	102	20
Acetophenone	8270C	Solid	ug/Kg	281	330	NA	NA	NA
Aniline	8270C	Solid	ug/Kg	106	330	10	65	20
Anthracene	8270C	Solid	ug/Kg	73	330	65	105	20
Aramite	8270C	Solid	ug/Kg	352	670	NA	NA	NA
Benzenethiol	8270C	Solid	ug/Kg	330	330	NA	NA	NA
Benzidine	8270C	Solid	ug/Kg	1970	3300	10	50	50
Benzo(a)anthracene	8270C	Solid	ug/Kg	53	330	70	111	20
Benzo(a)pyrene	8270C	Solid	ug/Kg	58	330	71	106	20
Benzo(b)fluoranthene	8270C	Solid	ug/Kg	108	330	67	114	20
Benzo(ghi)perylene	8270C	Solid	ug/Kg	152	330	53	128	20
Benzo(k)fluoranthene	8270C	Solid	ug/Kg	115	330	68	109	20
Benzoic acid	8270C	Solid	ug/Kg	171	1700	45	156	20
Benzyl alcohol	8270C	Solid	ug/Kg	103	330	54	128	20
Bis(2-chloroethoxy)methane	8270C	Solid	ug/Kg	59	330	60	102	20
Bis(2-chloroethyl)ether	8270C	Solid	ug/Kg	91	330	54	98	20
Bis(2-ethylhexyl)phthalate	8270C	Solid	ug/Kg	113	330	63	120	20
Butyl benzyl phthalate	8270C	Solid	ug/Kg	115	330	66	116	20
Caprolactam	8270C	Solid	ug/Kg	138	330	50	150	50
Carbazole	8270C	Solid	ug/Kg	85	330	63	110	20
Chlorobenzilate	8270C	Solid	ug/Kg	230	330	NA	NA	NA
Chrysene	8270C	Solid	ug/Kg	40	330	69	108	20
Diallate	8270C	Solid	ug/Kg	292	330	NA	NA	NA
Dibenzo(a,h)acridine	8270C	Solid	ug/Kg	330	330	NA	NA	NA
Dibenzo(a,h)anthracene	8270C	Solid	ug/Kg	112	330	56	124	20
Dibenzo(a,j)acridine	8270C	Solid	ug/Kg			NA	NA	NA
Dibenzofuran	8270C	Solid	ug/Kg	55	330	68	103	20
Dicyclopentadiene	8270C	Solid	ug/Kg	330	330	10	150	50

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Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
Diethyl phthalate	8270C	Solid	ug/Kg	95	330	63	114	20
Dimethyl phthalate	8270C	Solid	ug/Kg	75	330	68	107	20
Di-n-butyl phthalate	8270C	Solid	ug/Kg	72	330	63	115	20
Di-n-octyl phthalate	8270C	Solid	ug/Kg	266	330	55	129	20
Di-n-propyl Adipate	8270C	Solid	ug/Kg	108	330	42	103	50
Diphenylamine	8270C	Solid	ug/Kg	203	330	NA	NA	NA
Dodecylbenzene	8270C	Solid	ug/Kg			NA	NA	NA
Ethyl methane sulfonate	8270C	Solid	ug/Kg	328	330	NA	NA	NA
Fluoranthene	8270C	Solid	ug/Kg	94	330	62	114	20
Fluorene	8270C	Solid	ug/Kg	98	330	65	103	20
Hexachlorobenzene	8270C	Solid	ug/Kg	71	330	64	116	20
Hexachlorobutadiene	8270C	Solid	ug/Kg	69	330	58	110	20
Hexachlorocyclopentadiene	8270C	Solid	ug/Kg	121	330	42	127	20
Hexachloroethane	8270C	Solid	ug/Kg	78	330	53	96	20
Hexachlorophene	8270C	Solid	ug/Kg	1300	5000	NA	NA	NA
Hexachloropropene	8270C	Solid	ug/Kg	300	1700	NA	NA	NA
Indene	8270C	Solid	ug/Kg	330	330	NA	NA	NA
Indeno(1,2,3-cd)pyrene	8270C	Solid	ug/Kg	112	330	62	124	20
Isophorone	8270C	Solid	ug/Kg	50	330	63	110	20
Isosafrole	8270C	Solid	ug/Kg	215	330	NA	NA	NA
m-Dinitrobenzene	8270C	Solid	ug/Kg	336	670	NA	NA	NA
Methapyrilene	8270C	Solid	ug/Kg	1480	1700	NA	NA	NA
Methyl methane sulfonate	8270C	Solid	ug/Kg	333	670	NA	NA	NA
Naphthalene	8270C	Solid	ug/Kg	64	330	59	97	20
Nitrobenzene	8270C	Solid	ug/Kg	63	330	58	102	20
n-Nitrosodiethylamine	8270C	Solid	ug/Kg	337	670	NA	NA	NA
n-Nitrosodimethylamine	8270C	Solid	ug/Kg	109	330	22	124	20
n-Nitrosodi-n-butylamine	8270C	Solid	ug/Kg	177	330	NA	NA	NA
n-Nitroso-di-n-propylamine	8270C	Solid	ug/Kg	101	330	52	108	20
n-Nitrosodiphenylamine	8270C	Solid	ug/Kg	108	330	65	111	20
n-Nitrosomethylethylamine	8270C	Solid	ug/Kg	522	670	NA	NA	NA
n-Nitrosomorpholine	8270C	Solid	ug/Kg	392	670	NA	NA	NA
n-Nitrosopiperidine	8270C	Solid	ug/Kg	263	330	NA	NA	NA
n-Nitrosopyrolidine	8270C	Solid	ug/Kg	496	1700	NA	NA	NA

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Description	Method	Test Matrix	Units	MDL	Lab RL	Control Limits LCL	UCL	RPD
o-Toluidine	8270C	Solid	ug/Kg	237	330	NA	NA	NA
Parathion	8270C	Solid	ug/Kg	330	330	NA	NA	NA
p-Cresidine	8270C	Solid	ug/Kg			NA	NA	NA
p-Dimethylaminoazobenzene	8270C	Solid	ug/Kg	374	670	NA	NA	NA
Pentachlorobenzene	8270C	Solid	ug/Kg	169	330	NA	NA	NA
Pentachloronitrobenzene	8270C	Solid	ug/Kg	216	330	NA	NA	NA
Pentachlorophenol	8270C	Solid	ug/Kg	185	1700	55	131	20
Phenacetin	8270C	Solid	ug/Kg	389	670	NA	NA	NA
Phenanthrene	8270C	Solid	ug/Kg	69	330	70	106	20
Phenol	8270C	Solid	ug/Kg	83	330	52	107	20
Phthalic anhydride	8270C	Solid	ug/Kg			NA	NA	NA
p-Phenylenediamine	8270C	Solid	ug/Kg	805	1300	NA	NA	NA
Pronamide	8270C	Solid	ug/Kg	408	670	NA	NA	NA
Pyrene	8270C	Solid	ug/Kg	143	330	54	135	20
Pyridine	8270C	Solid	ug/Kg	103	670	10	102	20
Quinoline	8270C	Solid	ug/Kg	330	330	NA	NA	NA
Safrole	8270C	Solid	ug/Kg	184	330	NA	NA	NA
Simazine	8270C	Solid	ug/Kg		330	NA	NA	NA
Sym-Trinitrobenzene	8270C	Solid	ug/Kg	737	1300	NA	NA	NA
Toluene Diisocyanate	8270C	Solid	ug/Kg	170	670	50	150	50
2,4,6-Tribromophenol (surr)	8270C	Solid	ug/Kg			24	150	
2-Fluorobiphenyl (surr)	8270C	Solid	ug/Kg			32	131	
2-Fluorophenol (surr)	8270C	Solid	ug/Kg			25	113	
Nitrobenzene-d5 (surr)	8270C	Solid	ug/Kg			25	120	
Phenol-d5 (surr)	8270C	Solid	ug/Kg			27	122	
Terphenyl-d14 (surr)	8270C	Solid	ug/Kg			35	140	

Table 2. Characteristic Ions for Semi-Volatile Organic Compounds

Compound	Approx. Retention Time (Min)	Primary Ion	Secondary Ion(s)
Acenaphthene	15.13	154	153, 152
Acenaphthene-d_{10} (I.S.)	15.05	164	162, 160
Acenaphthylene	14.57	152	151, 153
Acetophenone	7.96[a]	105	77, 51
2-Acetylaminofluorene	25.41[a]	181	180, 182, 223
Aniline	5.68	93	66, 65
Anthracene	19.77	178	176, 179
4-Aminobiphenyl	19.18[a]	169	168, 170
Aramite	23.73[a]	63	185, 191, 187
Benzidine	23.87	184	92, 185
Benzoic Acid	9.38	122	105, 77
Benzo(a)anthracene	27.83	228	229, 226
Benzo(b)fluoranthene	31.45	252	253, 125
Benzo(k)fluoranthene	31.55	252	253, 125
Benzo(g,h,i)perylene	41.43	276	138, 277
Benzo(a)pyrene	32.80	252	253, 125
Benzyl alcohol	6.78	108	79, 77
Bis(2-chloroethoxy)methane	9.23	93	95, 123
Bis(2-chloroethyl)ether	5.82	93	63, 95
2,2'-oxybis(1-Chloroproopane)	7.22	45	77, 121
Bis(2-ethylhexyl)phthalate	28.47	149	167, 279
4-Bromophenyl phenyl ether	18.27	248	250, 141
Butylbenzylphthalate	26.43	149	91, 206
sec-Butyl-4,6-dinitrophenol	19.86	211	212, 240, 163
4-Chloroaniline	10.08	127	129
Chlorobenzilate	21.15	139	251, 253, 141
2-Chloronaphthalene	13.30	162	127, 164
4-Chloro-3-methylphenol	11.68	107	144, 142
2-Chlorophenol	5.97	128	64, 130
4-Chlorophenyl phenyl ether	16.78	204	206, 141
Carbazole	21.58	167	166, 139
Chrysene	27.97	228	226, 229
Chrysene-d_{12} (I.S.)	27.88	240	120, 236
Diallate	18.64	43	86, 234
Dibenz(a,h)anthracene	39.82	278	139, 279
Dibenzofuran	15.63	168	139
Di-n-butylphthalate	21.78	149	150, 104
1,3-Dichlorobenzene	6.27	146	148, 111
1,4-Dichlorobenzene	6.40	146	148, 111
1,4-Dichlorobenzene-d_4 (I.S.)	6.35	152	150, 115
1,2-Dichlorobenzene	6.85	146	148, 111
3,3'-Dichlorobenzidine	27.88	252	254, 126
2,4-Dichlorophenol	9.48	162	164, 98
2,6-Dichlorophenol	10.05	162	164, 98
3,3'-Dimethylbenzidine	24.81	212	211, 213, 196
meta-Dinitrobenzene	15.78	168	76, 75, 92

Table 2. Characteristic Ions for Semi-Volatile Organic Compounds

Compound	Approx. Retention Time (Min)	Primary Ion	Secondary Ion(s)
1,4-Dioxane	1.59	88	58, 87
Diethylphthalate	16.70	149	177, 150
p-Dimethylaminoazobenzene	24.48[a]	120	225, 77
7,12-Dimethylbenz(a)anthracene	29.54[a]	256	241, 257
a-,a-Dimethylphenethylamine	9.51[a]	58	91, 42
2,4-Dimethylphenol	9.03	122	107, 121
Dimethylphthalate	14.48	163	194, 164
4,6-Dinitro-2-methylphenol	17.05	198	51, 105
2,4-Dinitrophenol	15.35	184	63, 154
2,4-Dinitrotoluene	15.80	165	63, 89
2,6-Dinitrotoluene	14.62	165	63, 89
Diphenylamine	17.54[a]	169	168, 167
1,2-Diphenylhydrazine	----	77	105, 182
Di-n-octylphthalate	30.48	149	167, 43
Ethyl Methanesulfonate	5.33[a]	79	109, 97
Fluoranthene	23.33	202	101, 203
Fluorene	16.70	166	165, 167
2-Fluorobiphenyl (surr.)	----	172	171
2-Fluorophenol (surr.)	----	112	64
Hexachlorobenzene	18.65	284	142, 249
Hexachlorobutadiene	10.43	225	223, 227
Hexachlorocyclopentadiene	12.60	237	235, 272
Hexachloroethane	7.65	117	201, 199
Hexachlorophene	28.63	196	198, 209, 406
Hexachloropropene	12.27	213	215, 211, 143
Indeno(1,2,3-cd)pyrene	39.52	276	138, 227
Isophorone	8.53	82	95, 138
Isosafrole	14.86	162	161, 131, 78
Methapyrilene	21.98[a]	58	97, 72, 191
3-Methylcholanthrene	31.14[a]	268	253, 267
Methyl Methanesulfonate	4.32[a]	80	79, 65
2-methylnaphthalene	11.87	142	141
2-Methylphenol (o-cresol)	7.22	108	107, 79
4-Methylphenol (m&p-cresol)	7.60	108	107, 79
Naphthalene	9.82	128	129, 127
Naphthalene-d_8 (I.S.)	9.75	136	68
1,4-Naphthoquinone	15.35[a]	158	130, 104, 102
1-Naphthylamine	15.80[a]	143	115, 116
2-Naphthylamine	16.00[a]	143	115, 116
2-Nitroaniline	13.75	65	92, 138
3-Nitroaniline	15.02	138	108, 92
4-Nitroaniline	16.90	138	108, 92
Nitrobenzene	7.87	77	123, 65
Nitrobenzene-d_5 (surr.)	----	82	128, 54
2-Nitrophenol	8.75	139	109, 65
4-Nitrophenol	15.80	139	109, 65
5-Nitro-o-toluidine	17.64	77	152, 106, 79

Table 2. Characteristic Ions for Semi-Volatile Organic Compounds

Compound	Approx. Retention Time (Min)	Primary Ion	Secondary Ion(s)
4-Nitroquinoline-1-oxide	21.67	190	160, 128, 89
N-Nitroso-di-n-butylamine	10.99[a]	84	57, 41
N-Nitrosodimethylamine	----	42	74, 44
N-Nitrosodiethylamine	----	42	102, 56, 57
N-Nitrosodiphenylamine	17.17	169	168, 167
N-Nitrosodinpropylamine	7.55	70	42, 101, 130
N-Nitrosomethylethylamine	4.50	42	88, 43, 56
N-Nitrosomorpholine	10.13	56	88, 43, 56
N-Nitrosopiperidine	----	42	116, 86
N-Nitrosopyrrolidine	----	100	41, 68
Pentachlorobenzene	15.64[a]	250	252, 248
Pentachloronitrobenzene	19.47[a]	295	237, 142
Pentachlorophenol	19.25	266	264, 268
Perylene-d_{12} (I.S.)	33.05	264	260, 265
Phenacetin	18.59[a]	108	109, 179
Phenanthrene	19.62	178	179, 176
Phenanthrene-d_{12} (I.S.)	19.55	188	94, 80
Phenol	5.77	94	65, 66
Phenol-d_6 (surr.)	----	99	42, 71
p-Phenylenediamine	13.39	108	80, 52, 54
2-Picoline	3.75[a]	93	66, 92
Pronamide	19.61[a]	173	175, 145
Pyrene	24.02	202	200, 203
Pyridine	3.36	79	52, 51
Safrole	14.33	162	161, 131, 104
Terphenyl-d_{14} (surr.)	----	244	122, 212
1,2,4,5-Tetrachlorobenzene	13.62[a]	216	214, 218
2,3,4,6-Tetrachlorophenol	16.09[a]	232	230, 131
2,4,6-Tribromophenol (surr.)	----	330	332, 141
1,2,4-Trichlorobenzene	9.67	180	182, 145
2,4,5-Trichlorophenol	13.00	196	198, 200
2,4,6-Trichlorophenol	12.85	196	198, 200
o-Toluidine	10.12	106	107, 77, 56
Sym-Trinitrobenzene	18.72	75	213, 74

Table 3. Internal Standards with Corresponding Analysts Assigned for Quantitation. (Listed in order of elution)

(1) 1,4-Dichlorobenzene-d_4	(2) Naphthalene-d_8	(3) Acenaphthene-d_{10}
1,4-Dioxane	n-Nitrosopiperidine	1,2,4,5-Tetrachlorobenzene
n-Nitrosodimethylamine	Nitrobenzene-d5*	Isosafrole
Pyridine	Nitrobenzene	Hexachlorocyclopentadiene
2-Picoline	Isophorone	1,4-Naphthoquinone
n-Nitrosomethylethylamine	Hexachloropropene	2,4,6-Trichlorophenol
Methyl Methanesulfonate	a,a-Dimethylphenethylamine	2,4,5-Trichlorophenol
n-Nitrosodiethylamine	2,6-Dichlorophenol	meta-Dinitrobenzene
2-Fluorophenol*	2-Nitrophenol	2-Fluorobiphenyl*
Ethyl Methanesulfonate	2,4-Dimethylphenol	2-Chloronaphthalene
Aniline	bis(2-Chloroethoxy)methane	2-Nitroaniline
Phenol-d5*	2,4-Dichlorophenol	Pentachlorobenzene
Phenol	Benzoic acid	1-Naphthylamine
bis(2-Chloroethyl)ether	1,2,4-Trichlorobenzene	Dimethylphthalate
2-Chlorophenol	n-Nitrosodi-N-Butylamine	2,6-Dinitrotoluene
n-Nitrosopyrrolidine	Naphthalene	Acenaphthylene
Acetophenone	P-Phenylenediamine	2,3,4,6-Tetrachlorophenol
1,3-Dichlorobenzene	4-Chloroaniline	2-Naphthylamine
o-Toluidine	Hexachlorobutadiene	3-Nitroaniline
n-Nitrosomorpholine	Safrole	Acenaphthene
1,4-Dichlorobenzene	4-Chloro-3-methylphenol	2,4-Dinitrophenol
1,2-Dichlorobenzene	2-Methylnaphthalene	Dibenzofuran
Benzyl alcohol		4-Nitrophenol
2-Methylphenol		2,4-Dinitrotoluene
o-Cresol		Diethylphthalate
2,2'-oxybis(1-Chloropropane)		Fluorene
N-Nitroso-di-n-propylamine		4-Chlorophenyl-phenylether
4-Methylphenol		4-Nitroaniline
meta & para-Cresol		1,2-Diphenylhydrazine
Hexachloroethane		2,4,6-Tribromophenol*

(4) Phenanthrene-d_{10}	(5)Chrysene-d_{12}	(6)Perylene-d_{12}
5-Nitro-o-Toluidine	Aramite	7,12-Dimethylbenz(a)anthracene
Diphenylamine	P-Dimethylaminoazobenzene	Hexachlorophene
Diallate	Chlorobenzilate	Di-n-octylphthalate
Sym-Trinitrobenzene	Benzidine	Benzo(b)fluoranthene
Phenacetin	Pyrene	3-Methylcholanthrene
4,6-Dinitro-2-methylphenol	3,3'-Dimethylbenzidine	Benzo(k)fluoranthene
n-Nitrosodiphenylamine	Terphenyl-d14*	Benzo(a)pyrene
Pentachloronitrobenzene	2-Acetylaminofluorene	Indeno(1,2,3-cd)pyrene
4-Aminobiphenyl	Butylbenzylphthalate	Dibenzo(a,h)anthracene
Pronamide	Benzo(a)anthracene	Benzo(g,h,i)perylene
2-Sec-Butyl-4,6-Dinitrophenol	3,3'-Dichlorobenzidine	
4-Bromophenyl-phenylether	Chrysene	
Hexachlorobenzene	bis(2-Ethylhexyl)phthalate	
Pentachlorophenol		
Phenanthrene		* Surrogate Compounds
Anthracene		
Carbazole		
4-Nitroquinoline-1-Oxide		
Methapyrilene		
Di-n-butylphthalate		
Fluoranthene		

Table 4. DFTPP Key Ions and Ion Abundance Criteria[a]

Mass	Ion Abundance Criteria
51	30 - 60% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	40 - 60% of mass 198
197	<1% of mass 198
198	Base peak, 100% relative abundance
199	5 - 9% of mass 198
275	10 - 30% of mass 198
365	>1% of mass 198
441	Present but less than mass 443
442	>40% of mass 198
443	17 - 23% of mass 442

[a]J.W. Eichelberger, L.E. Harris, and W.L. Budde. "Reference Compound to Calibrate Ion Abundance Measurement in Gas Chromatography-Mass Spectrometry", Analytical Chemistry, 47, 995 (1975).

Table 5. Calibration Check Compounds and System Performance Check Cmpds.*

Base/Neutral Fraction	Acid Fraction
Acenaphthene	4-Chloro-3-methylphenol
1,4-Dichlorobenzene	2,4-Dichlorophenol
Hexachlorobutadiene	2-Nitrophenol
N-Nitroso-di-n-phenylamine	Phenol
Di-n-octylphthalate	Pentachlorophenol
Fluoranthene	2,4,6-Trichlorophenol
Benzo(a)pyrene	2,4-Dinitrophenol*
N-Nitroso-di-n-propylamine*	4-Nitrophenol*
Hexachlorocyclopentadiene*	

Attachment 1.

Example: DFTPP Method

GC Oven Parameters

Temp. (°C)	Hold Time (min.)	Ramp Rate (°C/min.)
160	4	8
220	until Benzidine elutes	

GC Electronic Pressure Control (EPC) Parameters

Split Flow: 15.0 mL/minute
Split Ratio: 15:1
Split/Splitless Time: .75 minutes
Constant Flow 1.0 mL/minute

Mass Spectrometer Parameters

Scan Range: 35 - 500 m/z
Threshold: 150
A/D Ratio: 4
Scan/second: 2
Solvent Delay (scan start time): approximately 5.0 minutes (before the elution of Pentachlorophenol).
Run Time (scan stop time): approximately 15.0 minutes (after the elution of Benzidine).

Attachment 2.

Example: Tune Batch Form

CHI 21-216-16125 A-6 99

_____	Begin Tune Time:_____	Batch:
_____		
R#_____	End Tune Time:_____	
td(s)		Real-time Labnet
__excptn)_____	CAR#_____	
__excptn)_____		

#	STL#	File #	S\W	Method	sublist	Comments	Checked	#TICS	A1/01	Loaded
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
[illegible]										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										

STS #_____	STS #_____	STS #_____	STS #_____	STS #_____	STS #_____
Ext Batch:_____	Ext Batch:_____	Ext Batch:_____	Ext Batch:_____	Ext Batch:_____	Ext Batch:_____
n Batch:_____	An. Batch:_____	An. Batch:_____	An. Batch:_____	An. Batch:_____	An. Batch:_____

Attachment 3.

Example: BNA Method for Standards and Samples

GC Oven Parameters
Initial Temp. 40°
Initial Time 3.5 min.

Ramp rate (°C/Min.)	Final Temp. (°C)	Final Time (min.)
1. 40	95	1.0
2. 17	295	2.0
3. 40	320	until the last compound elutes

GC Electronic Pressure Control (EPC) Parameters

Split Flow: 15.0 mL/minute
Split Ratio: 15:1
Split/Splitless Time: .75 minutes

Pressure (psi)	Hold Time (min.)	Ramp Rate (psi/min.)
1. 7.1	0.0	99.0
2. 40.0	0.1	99.0
3. 7.1	2.0	00.55
4. 21.2	until the end of the run	

Mass Spectrometer Parameters

Scan Range: 35 - 500 m/z
Threshold: 150
A/D Ratio: 4
Scan/second: 2
Solvent Delay (scan start time): before the elution of the first compound.
Run Time (scan stop time): until after the elution of last compound.

Attachment 4.

Example: Instrument Generated Initial Calibration - Form 6

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
End Cal Date : 06-FEB-2002 16:03
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Calibration File Names:
Level 1: /var/chem/gc110.i/feb06-8270bna.b/10i206h.d
Level 2: /var/chem/gc110.i/feb06-8270bna.b/10i206g.d
Level 3: /var/chem/gc110.i/feb06-8270bna.b/10i206f.d
Level 4: /var/chem/gc110.i/feb06-8270bna.b/10i206e.d
Level 5: /var/chem/gc110.i/feb06-8270bna.b/10i206d.d
Level 6: /var/chem/gc110.i/feb06-8270bna.b/10i206c.d
Level 7: /var/chem/gc110.i/feb06-8270bna.b/10i206b.d
Level 8: /var/chem/gc110.i/feb06-8270bna.b/10i206a.d

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
1 Methyl Methanesulfonate	0.74870 0.61277	0.61799 0.62612	0.65552	0.66183	0.64414	0.68216	AVRG		0.65615		6.73215
2 Acrylamide	+++++ +++++	+++++ +++++	+++++	+++++	+++++	+++++	AVRG		0.000e+00		0.000e+00 <-
3 1,4-Dioxane	244284 2001387	314445 2542283	698098	849718	1146910	1122438	WLINR	-0.70773	0.38263		0.99361
4 n-Nitrosodimethylamine	0.57755 0.58921	0.50906 0.48863	0.59693	0.60440	0.62988	0.58959	AVRG		0.57316		8.48594
5 Pyridine	1.61044 1.84669	1.49298 1.69136	1.72758	1.86009	1.91046	2.17079	AVRG		1.78880		11.60612

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
End Cal Date : 06-FEB-2002 16:03
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
6 2-Picoline	1.08695	1.13448	1.13368	1.02314	1.00806	1.16198					
	1.19877	0.94364					AVRG		1.08634		8.04040
7 n-Nitrosomethylethylamine	0.53241	0.53865	0.51510	0.51329	0.53687	0.50928					
	0.52751	0.52045					AVRG		0.52420		2.14658
9 n-Nitrosodiethylamine	0.58157	0.61500	0.51909	0.58727	0.56076	0.54220					
	0.53601	0.52874					AVRG		0.55883		5.96084
10 Ethyl Methanesulfonate	1.31118	1.18218	1.22447	1.19720	1.23348	1.23119					
	1.17186	1.10409					AVRG		1.20696		4.94963
12 Aniline	2.03611	2.15969	2.20326	2.13572	2.16302	2.15776					
	2.04953	1.81660					AVRG		2.09021		5.96964
13 Phenol	2.28679	2.44105	2.46940	2.32694	2.37885	2.13143					
	2.05691	1.76139					AVRG		2.23160		10.65654
14 bis(2-Chloroethyl)ether	1.64641	1.65384	1.85835	1.79228	1.86161	1.78184					
	1.70431	1.67789					AVRG		1.74707		5.03637
15 Benzal Chloride	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++					AVRG		0.000e+00		0.000e+00 <-
16 1,3-Dichlorobenzene	1.65387	1.64141	1.66029	1.65839	1.70563	1.64568					
	1.63252	1.63672					AVRG		1.65431		1.39177

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
End Cal Date : 06-FEB-2002 16:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1	20 Level 2	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	120 Level 7	160 Level 8									
18 1,4-Dichlorobenzene	1.68396	1.65849	1.69881	1.67263	1.76915	1.65522					
	1.60907	1.63487					AVRG		1.67278		2.86685
19 1,2-Dichlorobenzene	1.51237	1.51200	1.53567	1.52992	1.59362	1.48681					
	1.44983	1.40825					AVRG		1.50356		3.74854
20 Benzyl alcohol	0.89984	0.99264	1.03098	1.00808	1.02830	0.97262					
	0.88302	0.78710					AVRG		0.95032		9.06304
21 o-Cresol	1.38601	1.51790	1.47379	1.45718	1.49853	1.39992					
	1.27681	1.17823					AVRG		1.39854		8.41098
22 2-Methylphenol	1.38601	1.51790	1.47379	1.45718	1.49853	1.39992					
	1.27681	1.17823					AVRG		1.39854		8.41098
23 Phthalic Anhydride	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++					AVRG		0.000e+00		0.000e+00 <-
24 2,2'-oxybis(1-Chloropropane)	2.78695	2.95677	2.84959	2.78099	2.87074	2.67897					
	2.59616	2.37717					AVRG		2.73717		6.70776
25 n-Nitrosopyrrolidine	0.74503	0.66266	0.64381	0.67015	0.64527	0.67338					
	0.63228	0.58041					AVRG		0.65662		7.05224
26 Acetophenone	1.81291	1.66127	1.58193	1.59500	1.54759	1.56271					
	1.47663	1.39042					AVRG		1.57856		7.90646

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
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Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
27 n-Nitrosomorpholine	0.77545	0.69550	0.69050	0.69199	0.65893	0.69286					
	0.60413	0.59069					AVRG		0.67501		8.62878
28 N-Nitroso-di-n-propylamine	0.74118	0.85766	0.80753	0.76236	0.75812	0.75582					
	0.71316	0.65249					AVRG		0.75604		8.03063
29 Hexachloroethane	0.74706	0.74845	0.75908	0.74445	0.77333	0.73861					
	0.73783	0.73066					AVRG		0.74743		1.80049
30 meta & para-Cresol	1.38356	1.57055	1.49618	1.50648	1.54174	1.43696					
	1.29698	1.20029					AVRG		1.42909		8.97383
31 4-Methylphenol	1.38356	1.57055	1.49618	1.50648	1.54174	1.43696					
	1.29698	1.20029					AVRG		1.42909		8.97383
32 p-Phenylenediamine	0.52866	0.47553	0.39503	0.41192	0.37142	0.37579					
	0.29798	0.23864					AVRG		0.38687		23.70867 <-
33 2-Chlorophenol	1.51870	1.50958	1.59198	1.52304	1.55477	1.47395					
	1.37121	1.20254					AVRG		1.46822		8.54201
34 o-Toluidine	2.27259	2.04897	1.91821	1.85991	1.85950	1.82168					
	1.52549	1.40273					AVRG		1.83864		14.93929
35 n-Nitrosopiperidine	0.28809	0.27245	0.26466	0.27662	0.26398	0.26788					
	0.25345	0.25550					AVRG		0.26783		4.21675

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
End Cal Date : 06-FEB-2002 16:03
Quant Method : ISID
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
37 Nitrobenzene	0.39338	0.37331	0.40933	0.39272	0.42614	0.38899					
	0.39759	0.37411					AVRG		0.39445		4.42296
38 bis(2-Chloroethoxy)methane	0.55429	0.58595	0.57427	0.56247	0.57926	0.55747					
	0.57463	0.55623					AVRG		0.56807		2.10426
39 1,2,4-Trichlorobenzene	0.33690	0.31710	0.33378	0.32520	0.34018	0.32246					
	0.33382	0.32823					AVRG		0.32971		2.37368
40 Benzoic acid	0.11086	0.16325	0.14593	0.15522	0.16120	0.14543					
	0.14734	0.14900					AVRG		0.14728		11.02911
41 Hexachloropropene	0.25969	0.25318	0.24104	0.23591	0.23297	0.23029					
	0.22894	0.21689					AVRG		0.23736		5.79372
42 Isophorone	0.81797	0.87379	0.87752	0.86422	0.89596	0.84185					
	0.82217	0.80630					AVRG		0.84997		3.82905
43 2,4-Dimethylphenol	0.42363	0.44078	0.45637	0.44308	0.46087	0.43305					
	0.41719	0.41365					AVRG		0.43608		3.99184
44 Hexachlorobutadiene	0.16680	0.16123	0.17030	0.16659	0.17477	0.16446					
	0.16686	0.17036					AVRG		0.16767		2.45845
45 1,4-Dinitrobenzene	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++					AVRG		0.000e+00		0.000e+00 <-

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
End Cal Date : 06-FEB-2002 16:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	Coefficients m1	Coefficients m2	%RSD or R^2
46 n-Nitrosodi-N-Butylamine	0.29905 0.24507	0.27866 0.22563	0.24899	0.25682	0.22583	0.24727	AVRG		0.25341		9.88439
47 Naphthalene	1.14799 1.15064	1.14153 1.15557	1.18824	1.15692	1.20365	1.15534	AVRG		1.16249		1.86145
48 2,4-Dichlorophenol	0.28374 0.27446	0.27832 0.27133	0.30149	0.29185	0.30405	0.28689	AVRG		0.28652		4.19463
50 2,6-Dichlorophenol	0.33374 0.30536	0.32413 0.29213	0.31248	0.32252	0.31231	0.31908	AVRG		0.31522		4.04270
51 Safrole	0.33618 0.27616	0.30762 0.26599	0.28557	0.29418	0.28007	0.28446	AVRG		0.29128		7.52689
52 4-Chloroaniline	0.41165 0.42986	0.44140 0.43496	0.44633	0.43259	0.44476	0.44524	AVRG		0.43585		2.66025
53 1,2,4,5-Tetrachlorobenzene	0.71689 0.59417	0.67825 0.58604	0.65545	0.61822	0.63390	0.59282	AVRG		0.63447		7.32496
54 a,a-Dimethylphenethylamine	0.80585 0.84318	0.69351 0.77290	0.77250	0.83843	0.73950	0.91460	AVRG		0.79756		8.60266
55 2,4,6-Trichlorophenol	0.38385 0.39659	0.38295 0.39231	0.40826	0.40405	0.42952	0.40204	AVRG		0.39995		3.75898

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
End Cal Date : 06-FEB-2002 16:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
56 2,4,5-Trichlorophenol	0.41225	0.41493	0.44452	0.44422	0.46958	0.43342					
	0.43572	0.42093					AVRG		0.43445		4.34140
58 Isosafrole	1.12991	1.05090	1.02608	0.96514	1.01379	0.94548					
	0.93311	0.92429					AVRG		0.99859		7.05220
59 1,4-Naphthoquinone	0.50701	0.44503	0.34763	0.32903	0.33350	0.20911					
	0.18238	0.18670					AVRG		0.31755		37.75025 <-
60 Hexachlorocyclopentadiene	20115	41945	165822	159252	143278	283442					
	414868	472927					WLINR	0.12878	0.34895		0.99740
61 2-Methylnaphthalene	0.63295	0.68391	0.69301	0.67188	0.68983	0.63949					
	0.65049	0.65256					AVRG		0.66427		3.52815
62 Meta-Dinitrobenzene	0.21974	0.22805	0.22460	0.22682	0.22867	0.24106					
	0.23930	0.22040					AVRG		0.22858		3.44886
63 Sym-Trinitrobenzene	0.13303	0.14336	0.13605	0.13668	0.13116	0.13300					
	0.11744	0.10519					AVRG		0.12949		9.45936
64 2-Nitroaniline	0.35031	0.36151	0.38338	0.37852	0.40243	0.36891					
	0.36573	0.36475					AVRG		0.37194		4.28680
65 2-Chloronaphthalene	1.34447	1.24389	1.33731	1.33788	1.41418	1.31670					
	1.31472	1.29397					AVRG		1.32539		3.64798

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Start Cal Date : 17-DEC-2001 10:29
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Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
66 4-Chloro-3-methylphenol	0.30871	0.34100	0.34126	0.33124	0.33849	0.32308					
	0.30596	0.31733					AVRG		0.32588		4.37891
67 Pentachlorobenzene	0.61471	0.58096	0.53243	0.53074	0.52915	0.51345					
	0.50563	0.49169					AVRG		0.53735		7.60277
68 2,6-Dinitrotoluene	0.33489	0.34014	0.36059	0.35952	0.38278	0.34860					
	0.35260	0.35571					AVRG		0.35435		4.12101
69 2-Nitrophenol	0.21883	0.21440	0.23688	0.23377	0.24386	0.22908					
	0.23267	0.22113					AVRG		0.22883		4.36281
70 1-Naphthylamine	229162	323949	710342	902635	1128064	1083631					
	1646574	1783068					QUAD	0.30688	-0.06343	0.62581	0.99152
71 3-Nitroaniline	0.36245	0.34758	0.32681	0.31698	0.31051	0.37683					
	0.38969	0.38002					AVRG		0.35136		8.69297
72 2,3,4,6-Tetrachlorophenol	0.27363	0.31842	0.30928	0.30767	0.30101	0.31595					
	0.30551	0.27712					AVRG		0.30108		5.58521
73 Dimethylphthalate	1.33623	1.38921	1.39119	1.38090	1.46488	1.33638					
	1.33715	1.32650					AVRG		1.37031		3.39847
75 2-Naphthylamine	1.28540	1.16808	1.01944	1.02124	0.99861	0.86603					
	0.65915	0.51167					AVRG		0.94120		27.10199 <-

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Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
76 2,4-Dinitrophenol	+++++	22127	89650	89346	76810	160063					
	231152	292782					WLINR	0.23393	0.21213		0.99875
77 Acenaphthylene	2.03268	2.00242	2.06063	2.05493	2.18564	2.03914					
	2.02152	1.99005					AVRG		2.04838		2.95231
78 2,4-Dinitrotoluene	0.43001	0.44854	0.46921	0.46440	0.49637	0.44570					
	0.44312	0.44541					AVRG		0.45534		4.53665
79 Acenaphthene	1.19981	1.18120	1.21917	1.21083	1.28050	1.18655					
	1.18999	1.18435					AVRG		1.20655		2.71319
80 Dibenzofuran	1.68496	1.68621	1.71959	1.71450	1.80654	1.67526					
	1.67657	1.67569					AVRG		1.70491		2.61554
81 4-Nitrophenol	0.11730	0.14353	0.15333	0.14714	0.15479	0.14542					
	0.13792	0.14166					AVRG		0.14264		8.19338
82 5-Nitro-o-Toluidine	0.22007	0.21189	0.18884	0.18522	0.18663	0.18338					
	0.17825	0.17173					AVRG		0.19075		8.70639
83 Diphenylamine	0.89013	0.82091	0.78015	0.74934	0.77122	0.72679					
	0.72585	0.70490					AVRG		0.77116		7.84171
84 4-Aminobiphenyl	250745	355887	696888	885176	1040859	986632					
	1623289	1642162					QUAD	0.14732	0.31858	1.42650	0.99064

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Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
85 Fluorene	1.27371	1.31881	1.31289	1.28213	1.37458	1.26126					
	1.23161	1.23443					AVRG		1.28618		3.72197
87 4-Nitroaniline	0.31720	0.34914	0.35350	0.35172	0.37130	0.35872					
	0.35305	0.36817					AVRG		0.35285		4.66445
88 Diallate	1.02856	0.92448	0.87099	0.81520	0.80170	0.73256					
	0.76985	0.69737					AVRG		0.83009		13.01933
89 1.2-Diphenylhydrazine	1.46054	1.56074	1.54019	1.53347	1.61714	1.48978					
	1.59550	1.61763					AVRG		1.55187		3.71277
90 4-Bromophenyl-phenylether	0.17668	0.17340	0.18157	0.17727	0.18700	0.18225					
	0.17949	0.18182					AVRG		0.17994		2.32148
91 Hexachlorobenzene	0.21312	0.20823	0.21704	0.21286	0.22498	0.21481					
	0.21099	0.20806					AVRG		0.21376		2.56013
92 Diethylphthalate	1.35765	1.44231	1.40374	1.37079	1.48411	1.33906					
	1.35397	1.35265					AVRG		1.38803		3.69904
93 Phenacetin	0.41717	0.41393	0.34745	0.36101	0.33324	0.36424					
	0.34218	0.35777					AVRG		0.36712		8.60525
94 4-Chlorophenyl-phenylether	0.56437	0.59404	0.59383	0.57413	0.61483	0.56584					
	0.55228	0.54897					AVRG		0.57603		3.98396

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Method file : /var/chem/gc110_i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
95 Pentachlorophenol	+++++	0.09525	0.11411	0.11085	0.11555	0.11840					
	0.11698	0.12540					AVRG		0.11379		8.19599
96 Aramite	0.10177	0.09382	0.10341	0.09214	0.09535	0.08936					
	0.09096	0.08363					AVRG		0.09380		6.88813
97 n-Nitrosodiphenylamine	0.65246	0.65503	0.68229	0.67435	0.70954	0.68286					
	0.68565	0.67894					AVRG		0.67764		2.66808
98 Pronamide	0.40018	0.37684	0.34721	0.33028	0.32026	0.32248					
	0.31134	0.29061					AVRG		0.33740		10.64378
99 4,6-Dinitro-2-methylphenol	0.13053	0.15026	0.19314	0.19043	0.19609	0.19758					
	0.20126	0.20155					AVRG		0.18261		14.69929
100 Pentachloronitrobenzene	0.05706	0.05450	0.05145	0.05072	0.04955	0.04758					
	0.04829	0.04708					AVRG		0.05078		6.87749
101 2-Sec-Butyl-4,6-Dinitrophenol	0.15403	0.17262	0.19218	0.19731	0.19820	0.20688					
	0.20108	0.20519					AVRG		0.19094		9.60225
103 4-Nitroquinoline-1-Oxide	+++++	0.05654	0.04722	0.06242	0.05349	0.06299					
	0.06751	0.06226					AVRG		0.05892		11.71607
104 3,3'-Dimethylbenzidine	135425	229832	405316	586470	567749	643888					
	887284	1077544					QUAD	-0.01967	1.09045	0.80057	0.99149

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Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2	
105 Phenanthrene	1.20923 1.24205	1.20916 1.21653	1.25856	1.23031	1.28580	1.24186	AVRG		1.23669		2.14051	
106 Anthracene	1.24483 1.20596	1.26891 1.20745	1.24401	1.21531	1.29376	1.24674	AVRG		1.24087		2.48053	
107 Carbazole	1.02955 1.08553	0.86799 1.12758	0.89354	0.99425	1.02482	1.03120	AVRG		1.00681		8.76220	
108 Methapyrilene	+++++ 0.32096	0.47728 0.32300	0.33462	0.41004	0.34278	0.40677	AVRG		0.37364		15.82509	<-
109 Di-n-butylphthalate	1.65199 1.68893	1.71986 1.72742	1.77017	1.69117	1.81631	1.71148	AVRG		1.72217		2.96937	
110 Kepone	+++++ +++++	+++++ +++++	+++++	+++++	+++++	+++++	AVRG		0.000e+00		0.000e+00	<-
111 P-Dimethylaminoazobenzene	0.53875 0.44012	0.49415 0.42793	0.47791	0.46433	0.47080	0.44016	AVRG		0.46927		7.62143	
112 Benzidine	0.34267 0.35183	0.22840 0.45120	0.14538	0.17951	0.19005	0.22909	AVRG		0.26477		39.89620	<-
114 Chlorobenzilate	0.59350 0.48752	0.53343 0.47881	0.54748	0.50885	0.50762	0.50116	AVRG		0.51980		7.16938	

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
End Cal Date : 06-FEB-2002 16:03
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc110.i/feb06-8270bna.b/8270bna.m
Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
115 Fluoranthene	1.13838	1.13425	1.17223	1.12763	1.20282	1.11966					
	1.08900	1.16431					AVRG		1.14354		3.07932
116 Pyrene	1.86294	1.86861	1.80175	1.70404	1.88423	1.75248					
	1.66369	1.67205					AVRG		1.77622		5.10971
117 Butylbenzylphthalate	1.15926	1.35949	1.21026	1.17571	1.33337	1.20693					
	1.17079	1.16662					AVRG		1.22280		6.44187
118 4,4MethyleneBis2Chloroaniline	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++					AVRG		0.000e+00		0.000e+00 <-
119 2-Acetylaminofluorene	0.40408	0.44997	0.49023	0.51671	0.50544	0.55249					
	0.52343	0.55681					AVRG		0.49989		10.32251
120 Benzo(a)anthracene	1.39713	1.46458	1.43165	1.41440	1.56325	1.42596					
	1.36760	1.36312					AVRG		1.42846		4.47795
121 Chrysene	1.49434	1.57548	1.40110	1.45261	1.62552	1.37128					
	1.32349	1.35884					AVRG		1.45033		7.43654
122 Hexachlorophene	40814	233613	617578	1236193	1209252	1231901					
	1666855	2077246					WLINR	2.97798	0.13127		0.99318
124 3,3'-Dichlorobenzidine	0.47883	0.61381	0.46894	0.49729	0.51369	0.48254					
	0.47935	0.45897					AVRG		0.49918		9.86369

INITIAL CALIBRATION DATA

Start Cal Date : 17-DEC-2001 10:29
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Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
125 Tris2,3DibromopropylPhosphate	+++++ / +++++	+++++ / +++++	+++++	+++++	+++++	+++++	AVRG		0.000e+00		0.000e+00 <-
126 bis(2-Ethylhexyl)phthalate	140337 / 1804940	500599 / 2117516	820035	805893	779386	1248268	QUAD	0.03353	0.43455	0.03309	0.99114
127 7,12-Dimethylbenz(a)anthracen	0.88393 / 0.76257	0.86269 / 0.74954	0.81570	0.84134	0.79434	0.83866	AVRG		0.81860		5.77385
128 Di-n-octylphthalate	247317 / 3272548	877673 / 3569653	1463828	1517010	1386789	2274308	QUAD	0.00284	0.21292	0.00435	0.99016
129 Benzo(b)fluoranthene	1.81450 / 1.76680	2.15148 / 1.76848	1.79546	1.77800	2.01916	1.73897	AVRG		1.85411		8.01757
130 Benzo(k)fluoranthene	1.93232 / 2.00701	2.49106 / 2.04326	1.97843	1.94897	2.06167	2.03754	AVRG		2.06253		8.68542
131 3-Methylcholanthrene	0.82961 / 0.79579	0.80421 / 0.78003	0.76964	0.78357	0.79737	0.80597	AVRG		0.79577		2.32792
132 Benzo(a)pyrene	1.54114 / 1.63044	1.91633 / 1.60983	1.58954	1.60743	1.75809	1.61616	AVRG		1.65862		7.29491
134 Indeno(1,2,3-cd)pyrene	1.78895 / 1.70343	2.18312 / 1.66051	1.70672	1.67739	1.83108	1.67447	AVRG		1.77821		9.79482

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Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1 / 120 Level 7	20 Level 2 / 160 Level 8	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2	
135 Dibenzo(a,e)pyrene	+++++ / +++++	+++++ / +++++	+++++	+++++	+++++	+++++	AVRG		0.000e+00		0.000e+00	<-
136 Dibenzo(a,h)anthracene	1.41973 / 1.43512	1.81888 / 1.38926	1.45010	1.42477	1.56050	1.41354	AVRG		1.48899		9.59629	
137 Benzo(g,h,i)perylene	1.48874 / 1.45945	1.84048 / 1.42863	1.48983	1.46550	1.61040	1.43924	AVRG		1.52778		9.04893	
197 Parathion	+++++ / +++++	+++++ / +++++	+++++	+++++	+++++	+++++	AVRG		0.000e+00		0.000e+00	<-
198 2,3,7,8-TCDD	+++++ / +++++	+++++ / +++++	+++++	+++++	+++++	+++++	AVRG		0.000e+00		0.000e+00	<-
$ 8 2-Fluorophenol	1.66344 / 1.49659	1.65559 / 1.26766	1.74047	1.67354	1.69462	1.60350	AVRG		1.59943		9.52199	
$ 11 Phenol-d5	1.94434 / 1.75989	1.98181 / 1.57033	2.08797	2.00909	2.05395	1.91121	AVRG		1.91482		8.96478	
$ 36 Nitrobenzene-d5	0.41973 / 0.42209	0.40829 / 0.40831	0.43446	0.43417	0.45927	0.42301	AVRG		0.42617		3.90108	

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Cal Date : 08-Feb-2002 11:58 bergenj

Compound	10 Level 1	20 Level 2	40 Level 3	50 Level 4	60 Level 5	80 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	120 Level 7	160 Level 8									
$ 57 2-Fluorobiphenyl	1.39069 1.36950	1.33279 1.33289	1.38937	1.39755	1.46979	1.37265	AVRG		1.38190		3.13705
$ 86 2.4.6-Tribromophenol	0.11888 0.13028	0.13267 0.13218	0.13748	0.13610	0.14035	0.12961	AVRG		0.13219		4.93250
$ 113 Terphenyl-d14	1.11967 1.03357	1.17344 1.05429	1.12066	1.05641	1.16885	1.08723	AVRG		1.10176		4.78902

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Average %RSD Results.

Calculated Average %RSD = 7.21137952
Maximun Average %RSD = 15
* Passed Average %RSD Test.

Curve	Formula	Units
Averaged	Amt = Rsp/m1	Response
Wt Linear	Amt = b + Rsp/m1	Response
Quad	Amt = b + m1*Rsp + m2*Rsp^2	Response

Attachment 5.

Example: Acceptable Initial Calibration - Form 6

6B

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STS CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: FEB06-8270BNA

Instrument ID: GCL10 Calibration Date(s): 12/17/01 02/06/02

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF1 =10i206h.d RRF2 =10i206g.d
RRF3 =10i206f.d RRF4 =10i206e.d RRF5 =10i206d.d

COMPOUND	RRF1	RRF2	RRF3	RRF4	RRF5	RRF	% RSD
Phenol	2.287	2.441	2.469	2.327	2.379		
bis(2-Chloroethyl)ether	1.646	1.654	1.858	1.792	1.862		
2-Chlorophenol	1.519	1.510	1.592	1.523	1.555		
1,3-Dichlorobenzene	1.654	1.641	1.660	1.658	1.706		
1,4-Dichlorobenzene	1.684	1.658	1.699	1.673	1.769		
1,2-Dichlorobenzene	1.512	1.512	1.536	1.530	1.594		
2-Methylphenol	1.386	1.518	1.474	1.457	1.498		
o-Cresol	1.386	1.518	1.474	1.457	1.498		
N-Nitroso-di-n-propylamine #	0.741	0.858	0.808	0.762	0.758		#
meta & para-Cresol	1.384	1.570	1.496	1.506	1.542		
4-Methylphenol	1.384	1.570	1.496	1.506	1.542		
Hexachloroethane	0.747	0.748	0.759	0.744	0.773		
Nitrobenzene	0.393	0.373	0.409	0.393	0.426		
Isophorone	0.818	0.874	0.878	0.864	0.896		
2-Nitrophenol	0.219	0.214	0.237	0.234	0.244		
2,4-Dimethylphenol	0.424	0.441	0.456	0.443	0.461		
bis(2-Chloroethoxy)methane	0.554	0.586	0.574	0.562	0.579		
2,4-Dichlorophenol	0.284	0.278	0.301	0.292	0.304		
1,2,4-Trichlorobenzene	0.337	0.317	0.334	0.325	0.340		
Naphthalene	1.148	1.142	1.188	1.157	1.204		
4-Chloroaniline	0.412	0.441	0.446	0.432	0.445		
Hexachlorobutadiene	0.167	0.161	0.170	0.166	0.175		
4-Chloro-3-methylphenol	0.309	0.341	0.341	0.331	0.338		
2-Methylnaphthalene	0.633	0.684	0.693	0.672	0.690		
Hexachlorocyclopentadiene #	0.202	0.212	0.315	0.308	0.323		#
2,4,6-Trichlorophenol	0.384	0.383	0.408	0.404	0.430		
2,4,5-Trichlorophenol	0.412	0.415	0.444	0.444	0.470		
2-Chloronaphthalene	1.344	1.244	1.337	1.338	1.414		
2-Nitroaniline	0.350	0.362	0.383	0.378	0.402		
Acenaphthylene	2.033	2.002	2.061	2.055	2.186		
2,6-Dinitrotoluene	0.335	0.340	0.360	0.360	0.383		
3-Nitroaniline	0.362	0.348	0.327	0.317	0.310		
Acenaphthene	1.200	1.181	1.219	1.211	1.280		
2,4-Dinitrophenol #		0.112	0.170	0.173	0.173		#
Dibenzofuran	1.685	1.686	1.720	1.714	1.806		
4-Nitrophenol #	0.117	0.144	0.153	0.147	0.155		#
2,4-Dinitrotoluene	0.430	0.448	0.469	0.464	0.496		

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SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STS CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: FEB06-8270BNA

Instrument ID: GCL10 Calibration Date(s): 12/17/01 02/06/02

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF1 =10i206h.d RRF2 =10i206g.d
RRF3 =10i206f.d RRF4 =10i206e.d RRF5 =10i206d.d

COMPOUND	RRF1	RRF2	RRF3	RRF4	RRF5	RRF	% RSD
Fluorene	1.274	1.319	1.313	1.282	1.374		
Dimethylphthalate	1.336	1.389	1.391	1.381	1.465		
Diethylphthalate	1.358	1.442	1.404	1.371	1.484		
4-Chlorophenyl-phenylether	0.564	0.594	0.594	0.574	0.615		
4-Nitroaniline	0.317	0.349	0.353	0.352	0.371		
4,6-Dinitro-2-methylphenol	0.130	0.150	0.193	0.190	0.196		
4-Bromophenyl-phenylether	0.177	0.173	0.182	0.177	0.187		
Hexachlorobenzene	0.213	0.208	0.217	0.213	0.225		
Pentachlorophenol		0.095	0.114	0.111	0.116		
Phenanthrene	1.209	1.209	1.258	1.230	1.286		
Anthracene	1.245	1.269	1.244	1.215	1.294		
Di-n butylphthalate	1.652	1.720	1.770	1.691	1.816		
Fluoranthene	1.138	1.134	1.172	1.128	1.203		
Pyrene	1.863	1.869	1.802	1.704	1.884		
Butylbenzylphthalate	1.159	1.359	1.210	1.176	1.333		
Benzo(a)anthracene	1.397	1.464	1.432	1.414	1.563		
3,3'-Dichlorobenzidine	0.479	0.614	0.469	0.497	0.514		
Chrysene	1.494	1.575	1.401	1.453	1.626		
bis(2-Ethylhexyl)phthalate	1.665	2.869	1.732	1.706	1.932		
Di-n-octylphthalate	3.791	6.701	3.845	3.784	4.240		
Benzo(b)fluoranthene	1.814	2.151	1.795	1.778	2.019		
Benzo(k)fluoranthene	1.932	2.491	1.978	1.949	2.062		
Benzo(a)pyrene	1.541	1.916	1.590	1.607	1.758		
Indeno(1,2,3-cd)pyrene	1.789	2.183	1.707	1.677	1.831		
Dibenzo(a,h)anthracene	1.420	1.819	1.450	1.425	1.560		
Benzo(g,h,i)perylene	1.489	1.840	1.490	1.465	1.610		
Carbazole	1.030	0.868	0.894	0.994	1.025		
n-Nitrosodiphenylamine (1)	0.652	0.655	0.682	0.674	0.710		
Benzyl alcohol	0.900	0.993	1.031	1.008	1.028		
Benzoic acid	0.111	0.163	0.146	0.155	0.161		
Benzidine	0.343	0.228	0.145	0.180	0.190		
n-Nitrosodimethylamine	0.578	0.509	0.597	0.604	0.630		
Pyridine	1.610	1.493	1.728	1.860	1.910		
1,2-Diphenylhydrazine	1.460	1.561	1.540	1.533	1.617		
Aniline	2.036	2.160	2.203	2.136	2.163		

(1) Cannot be separated from Diphenylamine

6C

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STS CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: FEB06-8270BNA

Instrument ID: GCL10 Calibration Date(s): 12/17/01 02/06/02

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF1 =10i206h.d RRF2 =10i206g.d
RRF3 =10i206f.d RRF4 =10i206e.d RRF5 =10i206d.d

COMPOUND	RRF1	RRF2	RRF3	RRF4	RRF5	RRF	% RSD
2,2'-oxybis(1-Chloropropane	2.787	2.957	2.850	2.781	2.871		
2-Fluorophenol	1.663	1.656	1.740	1.674	1.695		
Phenol-d5	1.944	1.982	2.088	2.009	2.054		
Nitrobenzene-d5	0.420	0.408	0.434	0.434	0.459		
2-Fluorobiphenyl	1.391	1.333	1.389	1.398	1.470		
2,4,6-Tribromophenol	0.119	0.133	0.137	0.136	0.140		
Terphenyl-d14	1.120	1.173	1.121	1.056	1.169		

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6B

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STS CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: FEB06-8270BNA

Instrument ID: GCL10 Calibration Date(s): 12/17/01 02/06/02

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF6 =10i206c.d RRF7 =10i206b.d
RRF8 =10i206a.d

COMPOUND	RRF6	RRF7	RRF8			RRF	% RSD
Phenol	2.131	2.057	1.761			2.232	10.7
bis(2-Chloroethyl)ether	1.782	1.704	1.678			1.747	5.0
2-Chlorophenol	1.474	1.371	1.202			1.468	8.5
1,3-Dichlorobenzene	1.646	1.632	1.637			1.654	1.4
1,4-Dichlorobenzene	1.655	1.609	1.635			1.673	2.9
1,2-Dichlorobenzene	1.487	1.450	1.408			1.504	3.7
2-Methylphenol	1.400	1.277	1.178			1.398	8.4
o-Cresol	1.400	1.277	1.178			1.398	8.4
N-Nitroso-di-n-propylamine #	0.756	0.713	0.652			0.756	8.0#
meta & para-Cresol	1.437	1.297	1.200			1.429	9.0
4-Methylphenol	1.437	1.297	1.200			1.429	9.0
Hexachloroethane	0.739	0.738	0.731			0.747	1.8
Nitrobenzene	0.389	0.398	0.374			0.394	4.4
Isophorone	0.842	0.822	0.806			0.850	3.8
2-Nitrophenol	0.229	0.233	0.221			0.229	4.4
2,4-Dimethylphenol	0.433	0.417	0.414			0.436	4.0
bis(2-Chloroethoxy)methane	0.557	0.575	0.556			0.568	2.1
2,4-Dichlorophenol	0.287	0.274	0.271			0.286	4.2
1,2,4-Trichlorobenzene	0.322	0.334	0.328			0.330	2.4
Naphthalene	1.155	1.151	1.156			1.163	1.9
4-Chloroaniline	0.445	0.430	0.435			0.436	2.7
Hexachlorobutadiene	0.164	0.167	0.170			0.168	2.5
4-Chloro-3-methylphenol	0.323	0.306	0.317			0.326	4.4
2-Methylnaphthalene	0.639	0.650	0.652			0.664	3.5
Hexachlorocyclopentadiene #	0.332	0.342	0.328			0.295	1.0#
2,4,6-Trichlorophenol	0.402	0.396	0.392			0.400	3.8
2,4,5-Trichlorophenol	0.433	0.436	0.421			0.434	4.3
2-Chloronaphthalene	1.317	1.315	1.294			1.325	3.6
2-Nitroaniline	0.369	0.366	0.365			0.372	4.3
Acenaphthylene	2.039	2.022	1.990			2.048	3.0
2,6-Dinitrotoluene	0.348	0.352	0.356			0.354	4.1
3-Nitroaniline	0.377	0.390	0.380			0.351	8.7
Acenaphthene	1.186	1.190	1.184			1.206	2.7
2,4-Dinitrophenol #	0.188	0.190	0.203			0.173	1.0#
Dibenzofuran	1.675	1.676	1.676			1.705	2.6
4-Nitrophenol #	0.145	0.138	0.142			0.143	8.2#
2,4-Dinitrotoluene	0.446	0.443	0.445			0.455	4.5

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6C

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STS CHICAGO Contract:

Lab Code: Case No : SAS No.: SDG No.: FEB06-8270BNA

Instrument ID: GCL10 Calibration Date(s): 12/17/01 02/06/02

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF6 =10i206c.d RRF7 =10i206b.d
RRF8 =10i206a.d

COMPOUND	RRF6	RRF7	RRF8			RRF	% RSD	
Fluorene	1.261	1.232	1.234			1.286	3.7	
Dimethylphthalate	1.336	1.337	1.326			1.370	3.4	
Diethylphthalate	1.339	1.354	1.353			1.388	3.7	
4-Chlorophenyl-phenylether	0.566	0.552	0.549			0.576	4.0	
4-Nitroaniline	0.359	0.353	0.368			0.353	4.7	
4,6-Dinitro-2-methylphenol	0.198	0.201	0.202			0.182	14.7	
4-Bromophenyl-phenylether	0.182	0.179	0.182			0.180	2.3	
Hexachlorobenzene	0.215	0.211	0.208			0.214	2.6	
Pentachlorophenol	0.118	0.117	0.125			0.114	8.2	
Phenanthrene	1.242	1.242	1.216			1.236	2.1	
Anthracene	1.247	1.206	1.207			1.241	2.5	
Di-n-butylphthalate	1.711	1.689	1.727			1.722	3.0	
Fluoranthene	1.120	1.089	1.164			1.144	3.1	
Pyrene	1.752	1.664	1.672			1.776	5.1	
Butylbenzylphthalate	1.207	1.171	1.167			1.223	6.4	
Benzo(a)anthracene	1.426	1.368	1.363			1.428	4.5	
3,3'-Dichlorobenzidine	0.482	0.479	0.459			0.499	9.9	
Chrysene	1.371	1.323	1.359			1.450	7.4	
bis(2-Ethylhexyl)phthalate	1.739	1.688	1.538			1.859	1.0	
Di-n-octylphthalate	3.968	3.867	3.603			4.225	1.0	
Benzo(b)fluoranthene	1.739	1.767	1.768			1.854	8.0	
Benzo(k)fluoranthene	2.038	2.007	2.043			2.062	8.7	
Benzo(a)pyrene	1.616	1.630	1.610			1.658	7.3	
Indeno(1,2,3-cd)pyrene	1.674	1.703	1.660			1.778	9.8	
Dibenzo(a,h)anthracene	1.414	1.435	1.389			1.489	9.6	
Benzo(g,h,i)perylene	1.439	1.459	1.429			1.528	9.0	
Carbazole	1.031	1.086	1.128			1.007	8.8	
n-Nitrosodiphenylamine (1)	0.683	0.686	0.679			0.678	2.7	
Benzyl alcohol	0.973	0.883	0.787			0.950	9.1	
Benzoic acid	0.145	0.147	0.149			0.147	11.0	
Benzidine	0.229	0.352	0.451			0.265	39.9	<-
n-Nitrosodimethylamine	0.590	0.589	0.489			0.573	8.5	
Pyridine	2.171	1.847	1.691			1.789	11.6	
1,2-Diphenylhydrazine	1.490	1.596	1.618			1.552	3.7	
Aniline	2.158	2.050	1.816			2.090	6.0	

(1) Cannot be separated from Diphenylamine

6C

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STS CHICAGO Contract:

ab Code: Case No.: SAS No.: SDG No.: FEB06-8270BNA

Instrument ID: GCL10 Calibration Date(s): 12/17/01 02/06/02

Min RRF for SPCC(#) = 0.050 Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF6 =10i206c.d RRF7 =10i206b.d
RRF8 =10i206a.d

COMPOUND	RRF6	RRF7	RRF8			RRF	% RSD
2,2' oxybis(1-Chloropropane	2.679	2.596	2.377			2.737	6.7
2-Fluorophenol	1.604	1.496	1.268			1.600	9.5
Phenol-d5	1.911	1.760	1.570			1.915	9.0
Nitrobenzene-d5	0.423	0.422	0.408			0.426	3.9
2-Fluorobiphenyl	1.373	1.370	1.333			1.382	3.1
2,4,6-Tribromophenol	0.130	0.130	0.132			0.132	4.9
Terphenyl-d14	1.087	1.034	1.054			1.102	4.8

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Attachment 6.

GC/MS Calibration - Evaluation and Acceptance Criteria

GCMS Calibration – Evaluation and Acceptance Criteria

Prepare standards	• The concentrations must cover the range of quantitation for all analytes • The lowest point of the calibration curve must be at, or below, the reporting limit	
Run calibration standards	• All analytes must contain at a minimum 5 calibration points for Linear regressions, linear curves, or average response factors • Analytes using second order fits must have a minimum of 6 calibration points on a curve • Analytes using 3rd order curves must have a minimum of 7 calibration points	• Calibration levels deemed to be statistical or visual outliers shall be dropped from the curve and replaced by a similar concentration standard The standard shall be dropped in its entirety, not on a per analyte basis
Calculate "grand mean RSD" of all compounds	• The "grand mean RSD" is calculated before attempting to fit compounds to any calibration curves only because it is easier to do at this time The "grand mean RSD" acceptance is only to be used as a last resort in determining whether a compound's calibration is acceptable • Calibrations for compounds which occur on different dates (i e appix compounds analyzed at different dates than the HSL compounds), the "grand mean RSD" is calculated separately for each curve.	• If no %RSD for any given compound is above 15%, the "grand mean RSD will be less than 15%
Evaluation each compound for linear fit, second order fit or 3rd order fit	• Having determined that the calibration meets minimum requirements, the laboratory will evaluate each compound to determine the best calibration fit using statistical and visual evaluation of the curve • Using "priori" knowledge some compounds ranges may be shortened (i e. not as low a reporting limit or not as high a range)	• Citing priori knowledge the laboratory may decide to "keep" calibrations for several compounds despite exceeding the statistical threshold allowed by the method The compounds that fall in this category are known poor performers as indicated by the method or as indicated from historical performance data (e.g. Appendix IX compounds) These compounds will be listed in the OP as possible trouble analytes Quantitation for these compounds may be biased and should be useo only with caution.
Determine the best calibration approach for each compound	• RRF • Linear • 2nd order • Grand Mean RSD	• Even when the "grand mean RSD" indicates minimum acceptance has been met, the analyst must use discretion for quantification because some compounds may be biased This approach must be used with caution.

Attachment 7.

Example: Semi-Volatile Analysis Logbook

STL Chicago
GC/MS Semi-Volatiles Analysis Logbook

Instrument ID# 11

CHI-22-21-029/A-01/02

Analysis Date/ Time	File Name	Sample Number	Client / Sample ID	Sample Prep.	Prep Inj. Vol. (uL)	Proc Instr Dil.	Int. Std. No.	Final Vol. (mL)	Comments	Need Re-anal-ysis	Need Dil	Anal Init

Analyst Signature/Date:_____ Reviewer Signature/Date:_____ Page No._____

STL Chicago

Instrument ID # 11 **GC/MS Semi-Volatiles Corrective Action / Qualification Report** Page No._____

Tune Name:_____'02 **Performance of daily maintenance by:** Analyst Initials/Date _____/_____

Methods: __SW846 8270C __SW846 8270SIM __USEPA OLM03.2 __ USEPA OLM04.2 __USEPA OLC02.1 __ 40CFR 625 _Other_____

ISTD/RT report

1,4-Dichlorobenzene-d4	RT1	Naphthalene-d8	RT2	Acenaphthene-d8	RT3
Phenanthrene-d10	RT4	Chrysene-d12	RT5	Perylene-d12	RT6

Tune Criteria

Description of Situation:_____

Action Taken:_____

Demonstration of Control:_____

Initial Calibration Cirteria

Description of Situation:_____

Action Taken:_____

Demonstration of Control_____

Continuing Calibration Criteria

Description of Situation:_____

Action Taken:_____

Demonstration of Control:_____

Internal Standards (continuing cal to continuing cal)

Description of Situation:_____

Action Taken:_____

Demonstration of Control:_____

Qualification of Data

Data Affected (Client/Sample #)_____

Qualification:_____

Associated samples reanalyzed: Yes No (see below)

Explanation for no reanalysis/data MUST be qualified and narrated:_____

Analyst Signature/Date_____/_____

Reviewer Signature/Date_____/_____

CHI-22-21-029/A-01/02

Attachment 8.

Example: Sample Corrective Action Report

STL Chicago
Sample Corrective Action Report for Semi-Volatiles by GC/MS

Sample Number:_____ Matrix Soil Water Both Drum Target Method:_____

Note: Any corrective actions that are not listed below must be documented in the comments section.

Sample ID											MB1	MB1S	MB1T
Tune:____ CAR: ____											Prep Batch:		
Dilution													
Int. Std.													
Surrogate													
Other													
OK													
Tune:____ CAR: ____											Prep Batch:		
Dilution													
Int. Std.													
Surrogate													
Other													
OK													
Tune:____ CAR: ____											Prep Batch:		
Dilution													
Int. Std.													
Surrogate													
Other													
OK													

Sample ID											MB1	MB1S	MB1T
Tune:____ CAR: ___											Prep Batch:		
Dilution													
Int. Std.													
Surrogate													
Other													
OK													
Tune:____ CAR: ___											Prep Batch:		
Dilution													
Int. Std.													
Surrogate													
Other													
OK													
Tune:____ CAR: ___											Prep Batch:		
Dilution													
Int. Std.													
Surrogate													
Other													
OK													

Comments:_____

Reviewed by:_____ Date:_____

Attachment 9.

Example: Data Review Checklist

STL Chicago

GCMS DATA REVIEW CHECKLIST

Site Name:_____ Primary Reviewer:_____ Review Date:_____

JOB Number: _____ Secondary Reviewer:_____ Review Date:_____

No. of Samples/Matrix: a) _____ WATER b) _____ SOIL c) _____ SPLP / TCLP d) _____ Other (_____)

Method: a) VOA _____ 5030_____ Encores: 5035–High _____ 5035-Low_____ b) BNA _____

TASK	PRI REV	SEC REV	COMMENTS
LAB CHRON: 1) Matches Big Board			
2) Matches Raw Data (Form 4 / 5)			
3) Note Sample dilutions and list reason. a) High Sample Conc. b) Interference present IF original and re-run are to be reported in LabNet Re-log Samples (Indicate data type used) Re-Analyzed (RE) Re-Extracted (RA) Dilution (DL)			Smp # Original Dilution Comments BNA Only: Final Volume Adjustment _____
4) Sample Hold Times Met			
5) Proper Prep Links Created S-F6: Routine Preps; 5035PL; 5035PH S-F9: TCLP; SPLP ; 5035 Archon Purge & Trap			
Incomplete JOB Status Report reveals No Outstanding Data			
PROJ. REQ. MET: 1) Sample Detection Limit Met			
2) Reported J values meet reporting criteria			
3) Method Blank Detection Limits Met			
LabNet Report matches Quant Report			
Manual Integration documentation / verification complete			
FORM 2: Surrogate Recoveries Within Limits Statistical Limits _____ Method Limits _____ Project Limits _____ (S-F10 used to Clone By Project) Directed Note to PM: Yes / No			Smp # Original Re-analysis Comments
FORM 3: MS/MSD Recoveries Acceptable Statistical Limits _____ Method Limits _____ Project Limits _____ (S-F10 used to Clone By Project) Directed Note to PM: Yes / No			Smp # _____ MS MSD
FORM 3: BS Recoveries Acceptable Statistical Limits _____ Method Limits _____ Project Limits _____ (S-F10 used to Clone By Project) Directed Note to PM: Yes / No			Batch # _____ Batch # _____ Batch # _____ Batch # _____ Batch # _____ Batch # _____

TASK	PRI REV	SEC REV	COMMENTS
FORM 5: Tuning Criteria Met			
FORM 6: Initial Calibration Criteria Met			
FORM 7: Daily Calibration (CCV) Criteria Met			
FORM 8: Internal Standards Criteria Met Directed Note to PM: Yes / No			Smp # Original Re-analysis Comments
LabNet Batch Status Report Displays Data at RPT / RVWD Status	RPT	RVWD	
RAW DATA: 1) Raw Data Verified/Complete			
2) Raw Data Matches Forms			
3) Quant Report Matches Spectra			
4) Manual integration reports present (when required by client) and reason correctly documented.			File ID:
NARRATIVE: 1) Holding Times			
2) Method References			
3) % Recoveries / RPD's			
4) Analytical Difficulties/Typos/CAR's Directed Note to PM: Yes / No			
Manual Calculation:			

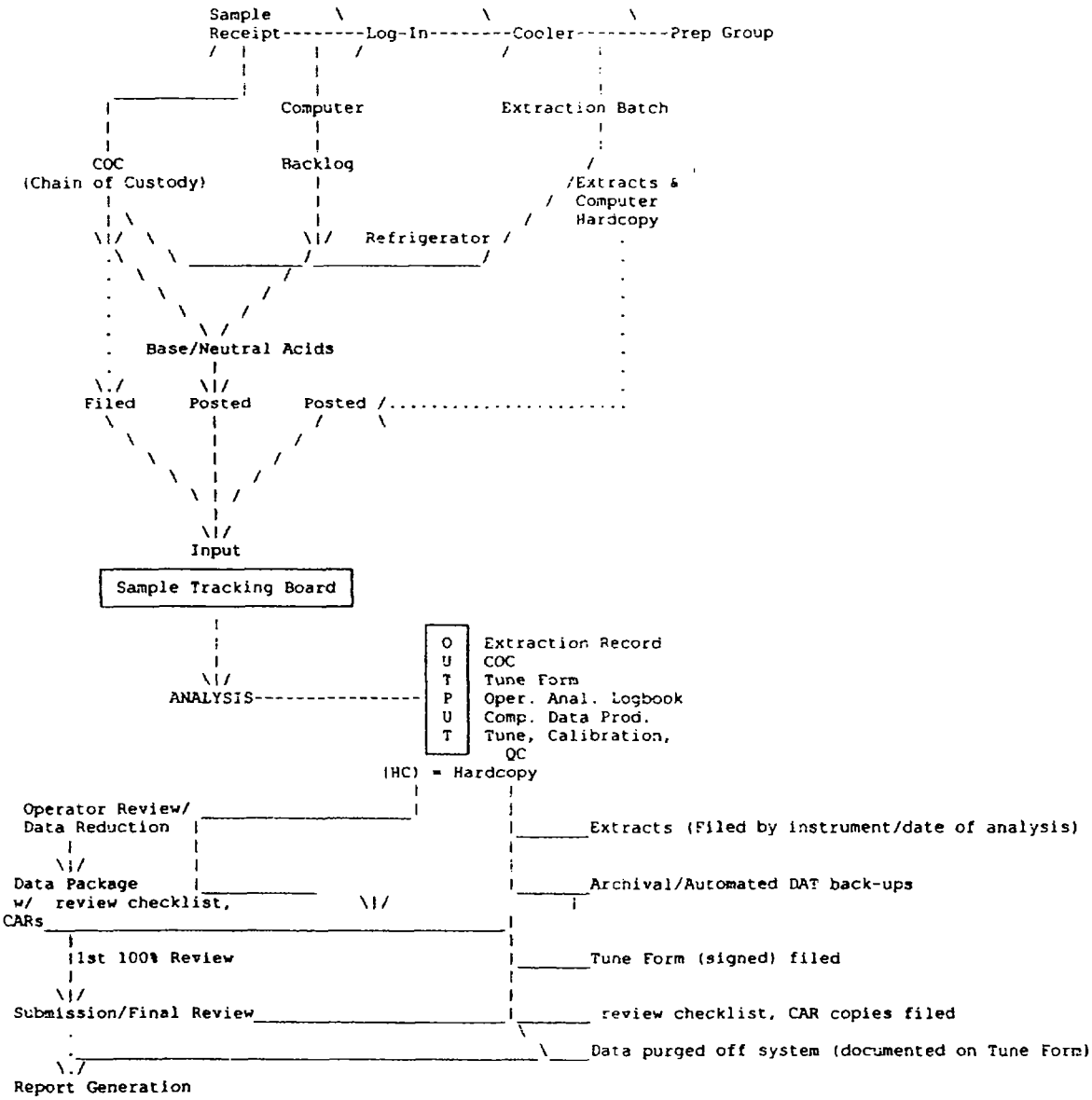
Additional Comments:

Attachment 10.
Analysis Scheme Flowchart

(Terms defined in the Section 6)

```
          PFTBA
            |
            |
            |
          DFTPP (Form 5)
          /  \ Every 12 hours
         /    \
        /      \
Initial Calibration-------Calibration verification
 (Form 6)  (Form 7)
                Every 12 hours
                     |
                     |
                    \|/
 [Extraction]----------------Analysis
                     |
                     |
                    \|/
         Operator Data Production/Reduction
                     |
                     |
                    \|/
         Operator Data Packaging/Review
                     |
                     |
                     |
                    \|/
         Final Review/Data Submission
                     |
                     |
                    \|/
            Report Generation
```

Sample Tracking Flowchart (for EACH unique STL batch #)



STL CHICAGO
LABORATORY STANDARD OPERATING PROCEDURE

SOP No.	Revision No.	Date	Page
UWC-002	04	10/19/01	1 of 15

TITLE: **WET CHEMISTRY**
Total Organic Carbon/Total Carbon/Total Inorganic Carbon in Soils, Sludges, and Sediments

Updated by:	Signature:	Date:
Donna J. McCarthy QA Specialist		10/19/01

Approved by:	Signature:	Date:
Diane L. Harper Section Manager, Wet Chemistry		10/19/01
Raymond J. Frederici Quality Manager		10/19/01

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COPY #: Uncontrolled

ISSUED TO: *Gloria Chojnacki, SEH*
Re: Ashland Project

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

project and client requirements. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory endeavors to keep reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported.

The low standard of the calibration curve is 20 ug of carbon. Sample reporting limits will vary with sample size, but are based on a detectable mass of 20 ug carbon.

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM, Revision 01).

1.2 Summary of Method

Samples are oxidized in a quartz combustion tube in an oxygen atmosphere at 800°C. The CO_2 produced is carried in the gas stream to a non-dispersive infrared detector that is specifically tuned to the absorptive wavelength of CO_2. The instrument microprocessor calculates the peak areas of each sample and compares them to the peak areas of the calibration standards in memory.

When only organic carbon (TOC) is required, pre-treatment with nitric acid followed by air drying eliminates interference from inorganic carbon. Total carbon is obtained by burning the sample without pre-treatment. Inorganic carbon requires analyzing a sample both with and without pre-treatment and is calculated as the difference between total and organic carbon.

2.0 INTERFERENCES

- Inorganic carbon is removed prior to oxidation in the instrument for TOC.
- Volatile organics may be lost in the decarbonation step resulting in a low bias.
- Bacterial decomposition and volatilization of organics are minimized by maintaining the samples at 4 ± 2°C and analyzing within 14 days of collection.

Gas flow is critical to successful operation and calibration of this instrument. Watch for the following:

- The tank regulator should be set between 20 and 30 psi, and tank pressure must be >500 psi. The regulator can be adjusted daily to achieve an in-control ICV. See below.
- The extension kit essentially dilutes the gas flow from 200 mL/min to 600 mL/min, which prevents the sensitive IR detector from being overwhelmed by up to 800 ug of carbon, theoretically.

5.3 LK Stock 1, 2000 mg/L I Y Y M S T L K 1 _
5.4 LK Stock 2, 2000 mg/L I Y Y M S T L K 2 _

On a balance capable of reading 0.1 mg, weigh 0.425 g of anhydrous potassium hydrogen phthalate (KHP) ($KHC_8H_4O_4$). Transfer to a 100 mL volumetric flask. Dissolve in Milli-Q water, acidify with 100 uL of H_2SO_4, and dilute to volume. *Stock 2 is prepared as Stock 1 **EXCEPT** an alternate stock source is used.

- Life of Reagent: one month
- Storage Requirements: refrigerate at 4 ± 2°C

5.5 Soil Standard Purchased from ERA.

- Life of Reagent: see manufacturer's label.
- Storage Requirements: refrigerate at 4 ± 2°C

6.0 CALIBRATION (NON-DAILY)

6.1 Calibration Curve

A multi-point calibration curve will be prepared and analyzed monthly according to the following table.

Volume of Stock Std. 1 (uL's)	ug Carbon
0	0
10	20
20	40
40	80
50	100
60	120
100	200
150	300
200	400

NOTE: The curve is verified daily with the ICV/CCVs. The life of the curve can be extended by adjusting the gas flow at the oxygen tank regulator. If the ICV is low (<85% recovery), the gas flow can be turned down by ~3 or 4 psi. If the ICV is too high (>115% recovery) the flow can be turned up a few psi, as long as it is in the 20-30 psi range.

Inject the known amount (see above) of Stock Std. 1 into the boat through the injection port. (The empty pre-burned boat, with only the quartz wool is used for the blank.) Click "Start" and wait for software to prompt the user with the statement "Push Boat in Now". Push boat into furnace. Click "OK". After peak reaches its height and it is descending,

of a small petri dish. After effervescence is complete, air dry or dry on a low setting on a hot plate. Samples can be stored in a desiccator overnight. Grind as possible to ensure homogeneity. Continue with Section 7.6.

7.3.2 Total Carbon (TC)

Analyze untreated air-dried sample, as above, for total carbon (TC). Continue with Section 7.6. Inorganic carbon (TIC) may be determined by difference.

7.4 Calibration / Standardization

7.4.1 Start-Up Operation

To access computer software, double click on TOC/TALK 3.0 icon within the Phoenix Soils window. Click on "set up", go to "instrument", then press "ready". Wait for initialization of instrument. Double click "Run" to open the analysis screen. In "Sample/Setup", the Method ID should always be "BOAT".

Turn on the furnace. Allow ~ 1 hour to for the furnace to reach the operating temperature (800°C). The green ready light will come on when the set temperature has been achieved.

Open the valve on the O_2 tank. The gas pressure should be about 20 to 30 psi. Turn on the Boat Gas. Fill the mist trap to just above the injection septum with 50% phosphoric acid.

Place a small piece of quartz wool in the sample boat.

Slide the boat into the furnace to bake off accumulated impurities. After the peak reaches its height and it's descending, move the boat from the furnace to the cooling area. Allow 30 seconds to cool.

7.4.2 Instrument Calibration

Click on "Setup" > "Calibration" > "Set Active" > "TC Curve". SoilCurve should be selected for range 0.002-0.1ppm. Click "OK". Click "Sample Setup". Change Sample Type to TC Standard. Click "OK" if range is 0.002 - 0.1ppm and select Standard ID needed. Click "Exit" > "Save/Use".

7.4.3 Initial and Continuing Calibration Verification

Click "Setup" > "Instrument". Select the option to automatically print the data when the analysis is done. Click "OK". Go to "Sample/Setup". Type in "Sample ID" and Change

7.7 Documentation

7.7.1 Data Cover Page

The analysis of samples and standards is documented by the instrument print-out and with a data cover page that provides standard curve data, standard traceability, and QC levels. An example of this cover page is in Attachment 2.

7.7.2 Traceability of Standards

Upon receipt or preparation, each chemical salt, solvent, acid, standard, or other reagent is entered into the laboratory's LabNet database and is issued a unique ID# based upon the type and sequential order in which the item was received. Further information entered into the database includes the manufacturer, lot # (if applicable), the date received or prepared, the expiration date, volume/weight received; concentration (if applicable); preparation details (if applicable), initials of the recording analyst, and the description of the item (i.e., XXXX Stock Solution – LCS/MS). Once the record is created, a unique label is printed and affixed to the appropriate standard/reagent container. The laboratory can print the standards/reagents traceability for any batch of samples.

7.7.3 Data Review

Analytical data goes through a 200% review cycle. The analyst and a trained data reviewer perform the reviews to ensure that all required QC samples are present and for proper laboratory documentation practices. The logbook is signed by both the analyst and peer reviewer.

7.7.4 Reporting Results

Without rounding, enter the raw data into the LabNet. Review the entries. The data book, instrument print-out, and LabNet spreadsheet must be reviewed by the analyst and a trained reviewer using the appropriate data review checklist prior to releasing the data for reporting purposes in LabNet.

8.0 QUALITY CONTROL

8.1 QC Summary

8.1.1 The MB and LCS will be included in each laboratory lot of 20 or fewer samples.

- check for instrument base-line drift;
- restandardize with existing standards, reanalyze;
- check reagents/solutions and prepare fresh if necessary; and
- prepare new stock and/or working standards and recalibrate.

8.2.3 Initial Calibration Blank (ICB)

- prepare a new ICB to verify proper preparation;
- verify that the instrument base-line is stable and/or perform necessary maintenance, cleaning, etc... to achieve stability; and
- determine the source of contamination by the process of elimination, correct the problem and reanalyze. (Carry over from a previous analysis or reagent contamination are two common sources).

8.2.4 Laboratory Control Sample (LCS)

- reanalyze LCS to verify that an out of control situation exists; and
- determine the source of error within the preparation procedure, correct the problem and repeat the sample set. (Sources of contamination could be either the reagents, the LCS, or the preparation area.)

8.2.5 Method Blank (MB)

- reanalyze MB to verify contamination at a level > Reporting Limit;
- determine the source of contamination and correct the problem; and
- all samples whose concentration is <10 times the MB level must be reprocessed and reanalyzed; any sample which is >10 times the MB level need not be reanalyzed. However, a corrective action report must be filled out and approval obtained.

8.2.6 Matrix Duplicate (MD)

- the sample must be reprocessed and reanalyzed unless the sample concentration is <5 times the Reporting Limit, then the ± Reporting Limit rule applies;
- if the reanalysis is within the control limits, the second value is reported; and
- if the reanalysis is still outside of the control limits, the data must be flagged and a CAR must be written and then approved by your section manager.

8.2.7 *Continuing Calibration Verification (CCV)*

- repeat CCV to verify proper preparation;
- prepare new CCV from original stock;
- check for instrument base-line drift;
- check reagents/solutions and prepare fresh if necessary;
- recalibrate with a new standard curve and repeat all samples since the previous in control CCV;
- never dispose of any samples until you are sure that all QC are within their designated control limits.

13.0 ATTACHMENTS

Attachment 1. Example: Maintenance Logbook
Attachment 2. Example: Data Cover Page

Historical Record:

Revision 00: 03/12/99
Revision 01: 09/17/99
Revision 02: 09/28/00
Revision 03: 05/02/01
Revision 04: 10/19/01

Reason for Change: Revision 04:

- Include reference to SW 846 Method 9060.
- Removal of LCS Duplicate (LCD)

U:\QC\SOP\WC\SOP-002.DOC

STL Chicago

TOC Maintenance Logbook
Instrument No. 4 (Phoenix 8000)

Page No._____

Date of Maintenance:_____ Analyst:_____

Check O_2 Supply: _____ Check Calibration / Level:_____

Check Carrier Flow (~200 cc/min): _____ Correlation Coefficient: _____

Check Acid Persulfate Levels:_____ System Status:_____

Comments:

_____

_____

_____

_____

_____

_____

Date of Maintenance:_____ Analyst:_____

Check O_2 Supply: _____ Check Calibration / Level:_____

Check Carrier Flow (~200 cc/min): _____ Correlation Coefficient: _____

Check Acid Persulfate Levels:_____ System Status:_____

mments:

_____

_____

_____

_____

_____

_____

Date of Maintenance:_____ Analyst:_____

Check O_2 Supply: _____ Check Calibration / Level:_____

Check Carrier Flow (~200 cc/min): _____ Correlation Coefficient: _____

Check Acid Persulfate Levels:_____ System Status:_____

Comments:

_____

_____

_____

_____

_____

_____

Reviewer Signature:_____ Date:_____

STL Chicago
Total Organic/Inorganic Carbon

Method:

Prep. Batch: _____
File: _____

EPA 415.1 _____
EPA 415.1, mod. for IC _____
SW 846 9060 _____
Lloyd Kahn _____

Instrument: Phoenix 8000 TOC 4

Matrix: _____ soil _____ water

Standard Curve:

Soils ug C	Waters ug C / 4 mL	measured, ug C
0	0	_____
20	4	_____
40	20	_____
80	40	_____
100	60	_____
120	80	_____
160	120	_____
200	160	_____

Corr. Coeff.: _____
y-intercept: _____
slope: _____

Calculations:

soils: mg/kg = $\frac{\text{ug C from instrument}}{\text{grams sample}}$

Soils are air dried, so do not correct for % solids

waters: mg/L = mg/L X dilution

Standards Traceability:

Stock 1 : Calibration and Curve : _____
Stock 2: LCS, ICV, CCV, Matrix spikes _____
Solid LCS : _____

Spiking Levels:

LCS	_____ ug C	_____ mg/L
ICV	_____ ug C	_____ mg/L
CCV	_____ ug C	_____ mg/L
MS/MSD		_____ mg/L

Analyst:_____ **Date of analysis:**_____

Reviewer:_____ **Date:**_____

Appendix E

Project Documentation

State of Wisconsin
Department of Natural Resources

Instructions
Soil Boring Log Information Forms
Form 4400-122, Form 4400-122A

General Instructions:

Fill out a Soil Boring Log Information Form for every boring drilled. Be sure to indicate the page number and boring number in the blanks at the top of each page. All applicable portions of the Soil Boring Log Information Form must be properly completed. The form must be signed. Form 4400-122A must only be used as an attachment to form 4400-122.

Routing:

Return this form to the project manager or plan reviewer for the Department program that required the boring. If the project manager/plan reviewer is in a Regional Office, send the original to the Regional Office and a copy to the Central Office in Madison. If the project manager/plan reviewer is in the Central Office, send the original form there and a copy to the Regional Office. If your project does not have a project manager or plan reviewer or you do not know who it is, send the form to the appropriate program in the Central Office. Check the appropriate box at the top of the form to assure proper routing once the form reaches the Department.

Facility/Project Name: List the name of the landfill, wastewater treatment facility, surface impoundment, spill or project.

License/Permit/Monitoring Number: The number assigned by the Department to the facility where the boring was drilled. If unknown, leave blank.

Boring Number: The site boring number or name (e.g., B-1).

Boring Drilled By: The name (first and last) of the drilling crew chief and the drilling firm name.

Date Drilling Started: The date the boring was started in month/day/year (mm/dd/yyyy) format.

Date Drilling Completed: The date the boring was completed in month/day/year (mm/dd/yyyy) format.

Drilling Method: List drilling method used: solid stem auger, hollow stem auger, rotary (air or mud), reverse rotary, cable tool, wash boring, vibratory, etc.

Wisconsin Unique Well Number: If a well is to be set in the boring, fill in the 2 alphabetic 3 numeric Wisconsin Unique Well Number (WUWN) on this form. In addition, attach a WUWN tag to the inside of the protective cover pipe and record that number on the Monitoring Well Construction Form 4400-113A and Monitoring Well Development Form 4400-113B. WUWN tags are available from the DNR Central or Regional Offices.

DNR Well ID Number: The 3 digit number assigned to the well by the Department.

Well Name: If a well is constructed, fill in common well name, such as B-11, OW-13A, or MW-5R. (Use the suffix "R" for a replacement well.)

Final Static Water Level: The static water level in the borehole in tenths (0.1) of feet above mean sea level prior to abandonment or well construction.

Surface Elevation: The surface elevation of the ground surface at the borehole in tenths (0.1) of feet above mean sea level referenced to the closest USGS benchmark.

Borehole Diameter: The diameter of the borehole in tenths (0.1) of inches.

Local Grid Origin or Boring Location: Check the appropriate box behind the Local Grid Origin or the Boring Location text. Locate the grid origin at a permanent feature near the waste or source of contamination. Give the location in State Plane Coordinates or Latitude and Longitude in degrees, minutes and seconds (using 1927 North American Datum). If State Plane Coordinates are used, circle the appropriate letter for south, central, or north zone. Alternately, an acceptable method for providing this information

without surveying is to locate the Grid Origin on a USGS 7.5 minute quadrangle map. The Location of the Grid Origin can then be interpolated (estimated) using standard cartographic techniques. If the Grid Origin location is estimated, check the estimated box.

The boring location can be determined by surveying or by Global Positioning System (GPS) (with processing to be accurate within 1 foot and reported with precision to hundredths of a second). If the exact location or the boring is given in State Plane Coordinates, then leave the Local Grid Location fields blank.

Section Location of Waste/Source: Enter the quarter quarter section, quarter section, section, township, range and range direction.

Local Grid Location: The location of the boring to the nearest foot, in relation to the grid origin established for the site. If the exact location or the boring is given in State Plane Coordinates, then leave these fields blank.

Facility ID: Fill in the Facility ID (FID) assigned to the site.

County: The county in which the boring is located.

County Code: The two-digit Department county code. (The code is based alphabetically with Adams County 01 and Wood County 72 and can be found on the map included with the Monitoring Well Construction form instructions.)

Civil Town/City/or Village: The municipality in which the boring is located.

Sample Number: The number used to identify the sample. Indicate the type of sampling apparatus used (i.e. split spoon/ss, Shelby tube/st, grab/gs, piston sampler/ps, core/cs, cuttings/cu). Note the diameter of the sampler in Comments column.

Sample Length Attempted and Recovered: The length of sample attempted and the length of sample recovered reported in inches.

Blow Counts: The number of blow counts per specified length.

Depth: Indicate the depth (below ground surface) of sample collection and depth of any changes in the soil or rock type encountered.

Soil/Rock Description and Geologic Origin: List visual characteristics of soil/rock noted during boring along with any pertinent descriptive remarks. Each major soil unit and bedrock formation shall be described using both subsurface investigations and regional information. Indicate likely geologic origin and Munsell color of the material.
USCS: Indicate the Unified Soil Classification System classification of any unconsolidated units or rock type encountered during boring.

Graphic Log: Graphically illustrate soil/rock types encountered through the depth of boring and provide a key for the symbols used. Indicate the total depth of the boring on the log.

Well Diagram: Graphically show the well casing, well screen length(s), and the location of the top of the filter pack(s) if the boring is converted into a well.

PID/FID: Measurements performed on samples using a Photo-Ionization Detector or a Flame Ionization Detector. Indicate in the Comments column the type of detector and the method used.

Soil Properties:

- **Compressive Strength** - Standard measurements in tons/ft. Indicate in the Comments column the type of test used.
- **Moisture Content** - Laboratory measurements of percent moisture content.
- **Liquid Limit** - Measurement in percent.
- **Plasticity Index** - Measurement in percent.
- **P 200** - Measurement of percentage of soils smaller than the #200 sieve.

RQD/Comments: Where boring penetrates bedrock, indicate the Rock Quality Designation of the sample. Otherwise, place all comments or remarks in this column and the adjacent margin.

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 _____ of _____

Facility/Project Name	License/Permit/Monitoring Number	Boring Number

Boring Drilled By: Name of crew chief (first, last) and Firm First Name: Last Name: Firm:	Date Drilling Started m m / d d / y y y y	Date Drilling Completed m m / d d / y y y y	Drilling Method

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 ☐ (estimated: ☐) or Boring Location ☐
State Plane _____ N, _____ E
_____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____

Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "

Local Grid Location
☐ N ☐ E
_____ Feet ☐ S _____ Feet ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
		_ _ _	

Sample Number and Type	Sample 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

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.

Sample		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					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	

DIGGERS HOTLINE FORM Date _____

1-800-242-8511

Caller ID 43865 Project Name: _____ Project # _____

Ticket # _____ Digger's Start Date: _____ Digger's Start Time: _____

Type of Call Being Placed:

☐ Excavation ☐ Planning Excavation ☐ Information on safe working clearance for overhead

Telephone Number: _____

Company Name: SEH Short Elliott Hendrickson Inc 421 Frenette Dr. Chippewa Falls, WI 54729

Callers Name: _____

Send Confirmation: _____

Field Representative or Alternate Contact Person: _____ Phone # _____

Start Date Requested: _____

Early Start ☐ Yes ☐ No

Use Explosives? ☐ Yes ☐ No

Near Overhead Line? ☐ Yes ☐ No

Nature of Work: _____

Work Being Done For: _____

County: _____ Place: _____

Street Address of Work Site: _____

Nearest Intersecting Road: _____

Distance/direction from nearest intersection: _____

Township: _____ Range: _____ Section: _____ Quarter: _____

Marking Instructions: _____

Area Staked: ☐ Yes ☐ No

Additional Comments: _____

Gas	Electric	Telephone	Cable	Other
☐ Wisconsin	☐ NSP	☐ Ameritech	☐ Marcus	☐ _____
☐ NSP	☐ _____	☐ _____	☐ Time Warner	☐ _____
☐ Northern Natural	☐ _____	☐ _____	☐ _____	☐ _____
☐ _____				

SEH

j \wmforms\diggrhl doc
3/99

DAILY FIELD REPORT

PROJECT NAME _____ DATE _____

PROJECT NO. _____ WEATHER _____

PROJECT LOCATION _____

CONTRACTOR'S EQUIPMENT _____

CONTRACTOR'S PERSONNEL _____

OBSERVATIONS _____

Time Arrived _____ Time Departed _____

Signature _____

PROJECT NAME _____ DATE _____ BY _____

SEH

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10/96

CONVERSATIONS

WHO/REPRESENTING _____

ACTION ITEMS _____

WHO/REPRESENTING _____

ACTION ITEMS _____

WHO/REPRESENTING _____

ACTION ITEMS _____

WHO/REPRESENTING _____

ACTION ITEMS _____

WHO/REPRESENTING _____

ACTION ITEMS _____

WHO/REPRESENTING _____

ACTION ITEMS _____

PHOTOGRAPHY LOG

Project Name _____ Project No. _____

Project Location _____

Photography Date(s) _____ Photographed by _____

Comments _____

_____

_____

Frame Number	Project Number	Date(s)	Description
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			

SEVERN TRENT SERVICES

STL Chicago
2417 Bond Street
University Park, IL 60466
Phone: 708-534-5200
Fax: 708-534-5211

Report To:

Contact: _____
Company: _____
Address: _____
Phone: _____
Fax: _____
E-Mail: _____

Contact: _____
Company: _____
Address: _____
Phone: _____
Fax: _____
PO#: _____ Quote: _____

Shaded Areas For Internal Use Only ___ of ___

Lab Lot#

Package Sealed	Samples Sealed
Yes No	Yes No
Received on Ice	**Samples Intact**
Yes No	Yes No

Temperature °C of Cooler

Sampler Name:

Signature:

Project Name:

Project Number:

Project Location:

Lab PM:

Date Required
Hard Copy: ___/___/___
Fax: ___/___/___

Within Hold Time	Preserv. Indicated
Yes No	Yes No NA
pH Check OK	**Res Cl_2 Check OK**
Yes No NA	Yes No NA

Sample Labels and COC Agree
Yes No COC not present

Laboratory ID	MS-MSD	Client Sample ID	Sampling Date	Sampling Time	Matrix	Comp/Grab	Refrg # / # / Cont. / Volume / Preserv										Additional Analyses / Remarks

RELINQUISHED BY	COMPANY	DATE	TIME	RECEIVED BY	COMPANY	DATE	TIME
RELINQUISHED BY	COMPANY	DATE	TIME	RECEIVED BY	COMPANY	DATE	TIME

Matrix Key
WW = Wastewater
W = Water
S = Soil
SL = Sludge
MS = Miscellaneous
OL = Oil
SE = Sediment
SO = Solid
DS = Drum Solid
DL = Drum Liquid
L = Leachate
WI = Wipe

Container Key
1. Plastic
2. VOA Vial
3. Sterile Plastic
4. Amber Glass
5. Widemouth Glass
6. Other

Preservative Key
1. HCl, Cool to 4°
2. H2SO4, Cool to 4°
3. HNO3, Cool to 4°
4. NaOH, Cool to 4°
5. NaOH/Zn, Cool to 4°
6. Cool to 4°

COMMENTS

Date Received ___/___/___

Courier:

Hand Delivered ☐

Bill of Lading

STL-Chicago.
Sample Bottle Label.

Company Name		20002434
Sample ID		
Project	Sample Date	Sample Time
Bottle Desc.		
Preservatives:		Filtered ____ Unfiltered ____
Analysis Requested Comments		

SEVERN
TRENT
SERVICES
303243

Custody Seal

DATE _____

SIGNATURE _____

SEVERN
TRENT
SERVICES
303243

STL-4145

dEx. Express *USA Airbill*

FedEx Tracking Number 826186860784

Please print and press hard.

Sender's FedEx Account Number [redacted]

Phone ( )

any SHORT ELLIOT & HENDRICKSON

ss 421 FRENETTE DR

Dept./Floor/Suite/Room

CHIPPEWA FALLS State WI ZIP 54729

Internal Billing Reference
characters will appear on invoice.

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- ☐ No
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Appendix F

SEH SOPs

STANDARD OPERATING PROCEDURE FOR SOIL HEADSPACE VAPOR MONITORING

Prepared by: John P. Gerll Date: 2-24-03
Environmental Geologist

Reviewed by: _____ Date: _____
Monitoring Section Chief

Approved by: _____ Date: _____
Quality Assurance Officer

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Procedures

1.0 Scope and Application

This Standard Operating Procedure is applicable to the monitoring of soil vapors using headspace methods during sediment sampling activities. This method is useful in determining the relative concentration of volatile organic compounds (VOCs) in the sediment samples collected during the investigation, measured in instrument units (IU).

2.0 Summary of Method

Soil vapor (headspace) measurements are made on sediment samples collected during sediment investigation activities. The instrument used is a portable Foxboro Toxic Vapor Analyzer (TVA) Model 1000 with simultaneous flame ionization detector (FID) and photoionization detector (PID) capabilities. The calibrated instrument's probe is inserted into a bagged portion of each sediment sample and the resultant reading is recorded.

3.0 Definitions

The following acronyms are used in this SOP:

EPA	Environmental Protection Agency
FID	Flame ionization detector
GPS	Global positioning system
HAZWOPER	Hazardous Waste Operations and Emergency Response
IU	Instrument units
OSHA	Occupational Safety and Health Administration
PID	Photoionization detector
QAPP	Quality assurance project plan
SOP	Standard operating procedure
TVA	Toxic vapor analyzer
VOCs	Volatile organic compounds

4.0 Health and Safety Warnings

When working with potentially hazardous materials, follow EPA, OSHA and specific health and safety procedures. The safety precautions for sampling through ice described in the site health and safety plan should be implemented during performance of head space monitoring.

5.0 Cautions and Interferences

Potential field conditions that could result in the invalidation of results or interfere with the accuracy of the final product include the presence of methane within sediment samples, and potential interference due to high moisture contents. If methane is encountered during sampling, a methane screen will be utilized with the FID to account for the portion of a given reading attributable to methane. If excessive moisture or humidity within a given sample causes interference during a reading, the photoionization portion of the instrument may be utilized as necessary to overcome the interference.

6.0 Personnel Qualifications

All personnel responsible for performance of field headspace vapor monitoring are required to have completed the 40-hour OSHA HAZWOPER safety training course and annual refresher courses prior to engaging in monitoring activities.

7.0 Equipment and Supplies

Equipment needed to perform field headspace vapor monitoring includes:

- Sediment sample collection equipment (Ponar dredge and Macrocore sampler);
- Stainless steel mixing bowls;
- Zipper locking plastic bags;
- Vehicle equipped with heater;
- 100 ppm isobutylene calibration gas;
- 100 ppm methane calibration gas;
- Compressed hydrogen;
- Global Positioning System (GPS);
- Portable Foxboro TVA-1000;
- Safety equipment;
- Survey stakes and flags;
- Decontamination equipment;
- Camera and film;
- Logbook, boring logs, and waterproof pens;
- Approved QAPP; and
- Approved field health and safety plan.

The Foxboro TVA-1000 has been laboratory calibrated. The calibration of the FID is verified in the field using 100 ppm methane, and the calibration of the PID is verified in the field using 100 ppm isobutylene prior to conducting soil vapor monitoring. The Foxboro TVA-1000 has the following standard specifications:

Accuracy	*PID Instrument* - ±25% of reading or ±2.5 ppm, whichever is greater, from 0.5 to 500 ppm. Accuracy listed is achieved using isobutylene with a 1-point calibration in the range of 100 to 300 ppm (including drift) at the temperature and humidity of the calibration. *FID Instrument* - ±25% of reading or ±2.5 ppm, whichever is greater, from 1.0 to 10,000 ppm. Accuracy listed is achieved using methane with a 1-point calibration in the range from 100 to 500 ppm (including drift) at the temperature and humidity of the calibration.
Repeatability	*PID Instrument* - ±1% at 100 ppm of isobutylene *FID Instrument* - ±2% at 100 ppm of methane
Dynamic Range	*PID Instrument* - ±0.5 to 2,000 ppm of isobutylene *FID Instrument* - ±1.0 to 50,000 ppm of methane
Linear Range	*PID Instrument* - ±0.5 to 500 ppm of isobutylene *FID Instrument* - ±1.0 to 10,000 ppm of methane

Minimum Detectable Level	The minimum detectable level is defined as two times the peak-to-peak noise. *PID Instrument* - 100 ppb of benzene *FID Instrument* - 300 ppb of hexane
Response Time Using Close Area Sampler	*PID Instrument* - Less than 3.5 seconds for 90% of final value, using 100 ppm of isobutylene *FID Instrument* - Less than 3.5 seconds for 90% of final value, using 10,00 ppm of methane
Response Time Using Charcoal Filter Adapter	*PID Instrument* - Less than 20 seconds for 90% of final value, using 100 ppm of isobutylene *FID Instrument* - Less than 20 seconds for 90% of final value, using 10,000 ppm of methane
Data Storage Rate	From 1 per second to 1 per 999 minutes, user selectable
Sample Flow Rate	1 liter/minute, nominal, at sample probe inlet
PID Lamp Life	Greater than 2,000 hours for 10.6 eV lamp, with normal cleaning
FID Life	Greater than 2,000 hours
Normal Operating Temperature	0 to +40° C (32° F to +104° F)

8.0 Procedure

8.1 Calibration

Prior to beginning each day's sampling activities, the Foxboro TVA-1000 will be calibrated to both methane and isobutylene standards described above. Each calibration gas will be placed in a tedlar bag, and then drawn into the TVA during calibration. The concentrations measured will be compared to the concentrations of the calibration gas, and the readout of the TVA will be adjusted as needed to the appropriate readout. Calibration activities will be documented each day in the field logbook.

8.2 Headspace Sample Collection and Handling

After a sediment sample has been collected for analysis and homogenized by SEH's field sampling personnel, a representative portion of the homogenized sample will be collected for field headspace vapor analysis. The representative portion of the sediment sample will be placed into a clean zipper-locking plastic bag and sealed shut leaving a significant air pocket at the top of the bag. The sample will be handled with clean nitrile sampling gloves during the transfer to the plastic bag. The zipper locking plastic bag will be labeled with the project name, date, sample ID number and depth, and sampler's initials so the sample is correctly identified during the headspace vapor monitoring or any subsequent observation of the sample.

8.3 Sample Preparation and Analysis

Upon completion of sample collection and handling, the bagged headspace samples will be placed in the heated cab of a vehicle and allowed to warm to room temperature (20 deg. C.) Once warmed appropriately, the probe of the TVA will be inserted into the top portion of the bag and the resultant reading will be recorded. If the reading exceeds

background concentrations, a charcoal filter adaptor (methane screen) will be installed on the TVA, and the headspace reading will be repeated. The actual reading using the FID will be the difference between the initial reading and the reading using the methane screen (the methane screen removes all VOCs, but not methane). PID readings (if necessary) will be taken without the use of a methane screen.

8.4 Troubleshooting

Calibration gas, compressed hydrogen, and battery charging equipment will be maintained on-site to address potential problems associated with the TVA. In the event an equipment problem cannot be corrected in the field, a backup TVA will be available for use on the project.

8.5 Data Acquisition and Calculations

The highest read out on the TVA during headspace analysis will be recorded. Methane concentrations will be subtracted from the reading using the methane screen as described above.

9.0 Data and Records Management

Daily equipment calibration results will be recorded in the field logbook. TVA headspace readings will be recorded both in the field logbook as well as on boring logs. When not in the field, these documents will be maintained in the project file.

10.0 Quality Control and Quality Assurance

Daily calibration activities and consistent monitoring methodology will provide quality assurance and quality control during the headspace vapor monitoring activities. In addition, headspace analyses will be performed on field QC samples required in the QAPP (e.g., replicate samples).

11.0 References

Site Health and Safety Plan

STANDARD OPERATING PROCEDURE FOR DECONTAMINATION OF FIELD EQUIPMENT

Prepared by: John P. Stell Date: 2-24-03
Environmental Geologist

Reviewed by: _____ Date: _____
Monitoring Section Chief

Approved by: _____ Date: _____
Quality Assurance Officer

U.S. ENVIRONMENTAL PROTECTION AGENCY
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Procedures

1.0 Scope and Application

This Standard Operating Procedure is applicable to the decontamination of nondisposable field equipment that will come into contact with samples during sediment sampling activities. This method is useful in minimizing the possibility of cross-contamination in the samples collected during the sediment investigation.

2.0 Summary of Method

Prior to mobilizing to the site, all downhole or underwater tools will be decontaminated using a high-pressure hot-water wash. Nondisposable sampling equipment that comes into contact with sediment samples will also be decontaminated prior to collection of each sample. The decontamination process will consist of washing each piece of equipment thoroughly in a solution of distilled water and Alconox® detergent, followed by three separate rinses with distilled water.

3.0 Definitions

The following acronyms are used in this SOP:

EPA	Environmental Protection Agency
HAZWOPER	Hazardous Waste Operations and Emergency Response
OSHA	Occupational Safety and Health Administration
PAHs	Polynuclear aromatic hydrocarbons
PPE	Personal protective equipment
QAPP	Quality assurance project plan
SOP	Standard operating procedure
VOCs	Volatile organic compounds

4.0 Health and Safety Warnings

When working with potentially hazardous materials, follow EPA, OSHA and specific health and safety procedures. The safety precautions for sampling through ice described in the site health and safety plan should be implemented during performance of equipment decontamination.

5.0 Cautions and Interferences

Potential field conditions that could result in the invalidation of results or interfere with the accuracy of the final product include the presence of residual contamination on sampling equipment after completion of decontamination. All sampling equipment will be observed in the field upon completion of decontamination and prior to the next sampling event for evidence of residual contaminants remaining on the equipment. In addition, one rinseate blank will be collected per day of sampling to document the absence of residual contamination on the sampling equipment.

6.0 Personnel Qualifications

All personnel responsible for performance of equipment decontamination are required to have completed the 40-hour OSHA HAZWOPER safety training course and annual refresher courses prior to engaging in decontamination activities.

7.0 Equipment and Supplies

Equipment needed to perform equipment decontamination includes:

- Sediment sample collection equipment (Ponar® dredge and Macrocore® sampler);
- Stainless steel mixing bowls;
- Clean plastic five gallon buckets;
- Sealable 55-gallon steel drums;
- Alconox® detergent;
- Distilled water;
- Clean new bristle brushes;
- Clean paper towels and rags;
- Appropriate labels for drummed residuals;
- Safety equipment;
- Cooler and ice;
- Laboratory clean sample bottles, tags, and labels;
- Chain of custody forms
- Camera and film;
- Logbook and waterproof pens;
- Approved QAPP; and
- Approved field health and safety plan.

8.0 Procedure

8.1 Initial Equipment Cleaning

Prior to beginning field sampling activities, all downhole and underwater equipment will be cleaned off-site using a high-pressure hot-water wash. In addition, any nondisposable equipment that will come into contact with samples will be initially decontaminated using the methodology described in Section 8.2 of this SOP.

8.2 Sampling Equipment Decontamination Process

After a sediment sample has been collected, homogenized, containerized, and preserved for analysis by SEH's field sampling personnel, the residual sediment will be placed in a drum for future disposal. Any equipment coming into contact with the sample will be decontaminated prior to the collection of the next sediment sample. The decontamination process will consist of disassembling and washing each piece of nondisposable sampling equipment that has contacted the sediments (e.g., Ponar® dredge, Macrocore® sampler, mixing tools) in a solution of Alconox® detergent and distilled water. A ratio of one ounce of detergent per gallon of distilled water will be used during the decontamination process. Once a piece of equipment has been thoroughly scrubbed in the solution using clean bristle brushes and no residual sediments are observable on the piece of equipment,

the piece will be rinsed three separate times with distilled water. The equipment will then be reassembled for the next sampling event.

8.3 Decontamination Waste Management

Decontamination waste products generated during the decontamination process (e.g., excess sediment samples, decontamination solution, decontamination water, disposable sampling equipment and PPE) will be placed in sealed steel drums and stored on the north side of the existing wastewater treatment plant pending off-site disposal. Off-site disposal method will be selected based on analytical sample results.

9.0 Data and Records Management

Daily documentation of equipment decontamination procedures and quality control sampling will be recorded in the field logbook. Quality control sampling will also be conducted in accordance with standard chain of custody procedures. When not in the field, these documents will be maintained in the project file.

10.0 Quality Control and Quality Assurance

One field rinseate sample will be collected for analysis during each day that sediment samples are collected for analysis. The field rinseate sample will be collected by pouring distilled water over representative decontaminated sampling equipment after the decontamination procedures are complete, and collecting the water in analytical bottles. The field rinseate samples will be analyzed for concentrations of VOCs and PAHs to document the effectiveness of the decontamination procedures.

11.0 References

Site Health and Safety Plan

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STANDARD OPERATING PROCEDURE FOR SEDIMENT SAMPLING

Prepared by: _____ Date: 2-24-03
Environmental Geologist

Reviewed by: _____ Date: _____
Monitoring Section Chief

Approved by: _____ Date: _____
Quality Assurance Officer

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Procedures

1.0 Scope and Application

This Standard Operating Procedure is applicable to collection of sediment samples in accordance with the requirements of the Field Sampling Plan (FSP). These methods will be used to provide sediment samples for field and laboratory analysis, and for field observation.

2.0 Summary of Method

For the purposes of this investigation, sediments will be collected while the site investigation area is covered with safely accessible ice. Samples will be collected through holes in the ice at the specified locations using either a Ponar® dredge, or a Macrocore® core sampler. The sediment samples will be brought to the surface, homogenized, and processed as necessary for the required field and laboratory analysis. Field observations at each sediment sampling location will be recorded.

3.0 Definitions

The following acronyms are used in this SOP:

EPA	Environmental Protection Agency
FID	Flame ionization detector
FSP	Field Sampling Plan
GPS	Global positioning system
HAZWOPER	Hazardous Waste Operations and Emergency Response
IU	Instrument units
OSHA	Occupational Safety and Health Administration
PID	Photoionization detector
QAPP	Quality assurance project plan
SOP	Standard operating procedure
TVA	Toxic vapor analyzer
VOCs	Volatile organic compounds
WAAS	Wide Area Augmentation System

4.0 Health and Safety Warnings

When working with potentially hazardous materials, follow EPA, OSHA and specific health and safety procedures. The safety precautions for sampling through ice described in the site health and safety plan should be implemented during performance of sediment sampling.

5.0 Cautions and Interferences

Potential field conditions that could result in the invalidation of results or interfere with the accuracy of the final product include cross contamination between sampling locations, inaccurate location of sampling locations, and indiscrete sampling depth intervals.

The potential for cross contamination will be minimized by utilizing the decontamination procedures described in the decontamination SOP. In addition, sample locations will be selected based on areas likely to be least contaminated, and moving to areas likely to be more

contaminated. Liners, catchers, gloves, and other disposable equipment will be used for collection of one discreet sample and disposed.

The latitude and longitude of each proposed sampling location will be determined prior to mobilization to the field, and stored in a Magellan Platinum Pro GPS receiver equipped with WAAS technology. The sampling locations will then be determined in the field, and marked with lathe and flagging. Testing with this brand of GPS receiver achieved a 95% confidence accuracy of less than one meter in open areas, and a 95% confidence accuracy of less than three meters under moderate tree cover (the proposed sampling area is an open area).

Discrete depth intervals will be maintained by selection of adequate sampling devices for the proposed activities. Surficial (0 to 6 inch) sediment samples will be collected with a Ponar® dredge modified so the jaws are opened and closed hydraulically. The depth of sample collection using this devise is typically zero to six inches. The modified jaws prevent objects (e.g., wood pieces) from getting wedged within the jaws and losing a portion of the sample through the resultant opening. Deeper samples will be collected using the Macrocore® sampler. This allows collection of a 1.5-inch diameter core from a discrete depth interval up to four feet in length. The tip of the Macrocore® sampler remains closed until it is advanced to the top of the desired sample interval. The tip is then opened from the surface, and the sampler advanced through the desired interval. This prevents collection of sediments from above the desired interval within the sampler during advancement.

6.0 Personnel Qualifications

All personnel responsible for performance of field sediment sampling and processing are required to have completed the 40-hour OSHA HAZWOPER safety training course and annual refresher courses prior to engaging in field activities.

7.0 Equipment and Supplies

Equipment needed to perform field sediment sampling includes:

- Sediment sample collection equipment (Hydraulic operated Ponar® dredge and Macrocore® sampler);
- Power ice auger or sled saw (long-barred chainsaw mounted to steel brackets for cutting large holes in ice);
- Stainless steel mixing bowls;
- Zipper locking plastic bags;
- Vehicle equipped with heater;
- Coolers, ice, sample labels and tags, and laboratory clean sample bottles;
- Sample preservatives;
- Foxboro Toxic Vapor Analyzer Model TVA-1000;
- Meridian Platinum Pro GPS receiver;
- Site map with proposed sampling points and corresponding GPS coordinates;
- Safety equipment;
- Survey stakes and flags;
- Decontamination equipment;

- Camera and film;
- Logbook, boring logs, and waterproof pens;
- Approved QAPP;
- Approved field health and safety plan;
- Chain of custody forms and seals; and
- Bobcat-mounted hydraulic probe (if ice access permits).

8.0 Procedure

8.1 Calibration

Prior to beginning each day's sampling activities, the Foxboro TVA-1000 used for headspace analysis and site safety monitoring will be calibrated to both methane and isobutylene standards as described in the Field Headspace Vapor Monitoring SOP. Calibration results will be recorded daily in the field logbook.

8.2 Surficial Sediment Sample Collection

Surficial sediment samples for the purposes of this investigation are defined as from zero to six inches below the lake bottom at a given sampling location. Collection of surficial sediment samples will be done with a pole mounted Ponar® dredge equipped with jaws that are opened and closed hydraulically. A sample will be collected at a given location after the location is identified with a GPS receiver, and a hole is cut in the ice large enough to permit the advance and withdrawal of the sampler. Depth to lake bottom will be measured prior to sample collection with a clean, weighted tape measure and recorded in the field logbook. The decontaminated Ponar® dredge will then be lowered to the lake bottom with jaws locked in the open opposition. The jaws will be seated into the sediments by pushing on the rods, and then the jaws will be closed hydraulically. The sample will then be brought to the surface. Excess water will be decanted off and placed in a drum, and the sampler will be opened over a steel mixing bowl. The sample will then be scraped from the sides of the sampler into the mixing bowl for homogenization.

8.3 Sediment Core Sampling

Vertical extent of contamination will be defined by collection and analysis of core samples to depths of up to 12 feet below existing lake bottom. The core samples will be collected using a Macrocore® sampler. The Macrocore® consists of a four-foot long steel tube into which sample dedicated acetate liners and plastic catchers are inserted. Once assembled, the sampler is lowered to the lake bottom on a string of drilling rods, and advanced through the desired sample interval by either pounding by hand, or by use of a hydraulic probe. The Macrocore® collects a 1.5-inch diameter core from a discrete sample interval of up to four feet long by opening the closed end of the sampler at the top of the desired sample interval, and then driving the sampler through that interval. The sampler is then extracted, brought to the surface, and opened. The sample is removed from the steel outer tube while still contained in the sample discrete acetate liner. The sample is either then removed from the liner for processing, or is retained in a capped liner for future observation.

8.4 Sample Handling

The sediment samples selected for laboratory analysis will be homogenized in the field in a stainless steel mixing bowl. Rocks and detritus greater than one-half inch in diameter will be removed from the sample during the homogenization process. The sample will be mixed in the bowl until uniform in consistency.

8.5 Sample Preparation, Preservation and Analysis

Representative portions of each sample will then be placed in the appropriate laboratory clean sample containers, tagged and labeled in accordance with the sample identification system, and preserved as necessary. The containers will then be sealed and placed on ice in coolers for eventual transport to the analytical laboratory. SEH field personnel will serve as custodians of the samples from the time they are collected until they are air-billed through the overnight delivery system. Laboratory analysis of sediment samples will be performed by Severn Trent Laboratories of Chicago, Illinois, who will assume custody of samples upon their delivery. Field analysis will be limited to headspace vapor monitoring as described in the headspace vapor monitoring SOP.

8.6 Troubleshooting

Replacement parts for the two samplers and an assortment of hand tools will be kept onsite during the field sampling program. Calibration gas, compressed hydrogen, and battery charging equipment will be maintained on-site to address potential problems associated with the TVA. In the event an equipment problem cannot be corrected in the field, backup sampling equipment will be available for use on the project.

9.0 Data and Records Management

Sediment sample locations, depths, and requested analytes will be recorded on sample tags labels, and chain-of-custody forms in accordance with the field sampling plan. Field observations and sample lithologic descriptions will be recorded in the field logbook and/or on boring logs. Daily equipment calibration results will be recorded in the field logbook. When not in the field, the field documents will be maintained in the project file.

10.0 Quality Control and Quality Assurance

Quality control samples will be collected and analyzed to assess sample integrity.. Quality control samples will include field duplicates, matrix spike and matrix spike duplicates, field blanks, trip blanks, and possibly methanol blanks. Field instrumentation will be calibrated daily and results recorded in the field logbook. Quality control sampling, daily calibration activities, and consistent monitoring methodology will provide quality assurance and quality control during the sediment sampling activities.

11.0 References

Decontamination SOP
Headspace Vapor Monitoring SOP
Site Health and Safety Plan

Appendix G

SEH Site Health and Safety Plan

SITE HEALTH AND SAFETY PLAN

Site Name:	Ashland/NSP Lakefront Site OU #4 Winter 2003 Sediment Sampling	Site Contact:	James R. Dunn
Address:	Sec. 33, T48N, R4W, Ashland County *Ashland, WI 54806*	Phone:	715.635.4049

I. Site Coordination

Site Supervisor/Safety Officer	John Guhl	Phone # (work)	715.720.6225
		(home)	715.72.2379
Project Manager	Cyrus W. Ingraham, P.E.	Phone # (work)	715.720.6231
		(home)	715.723.0552
Health & Safety Administrator	Gloria Chojnacki, CHMM	Phone # (work)	608.274.2020
		(home)	920.648.2222

II. Emergency Information

A. Emergency Contacts

Fire Department	911	Poison Control Center	608.262.3702
Police Department	911	24 LUST Hotline	608.266.3232
Sheriff Department	715.682.7023	Chemtrec	800.424.9300
Ashland County Crisis Center	715.682.9565	Coast Guard	715.779.3950
Ambulance	911	AT&F (Explosives Info)	800.424.9555
Hospital	Memorial Medical Center, 1615 Maple Lane, Ashland, WI, 715.682.1153		

*Directions to Hospital: Leave the sediment sampling area and proceed southeast on Ellis Avenue. Ellis Avenue becomes STH 13 beyond the intersection of Ellis Avenue and USH 2. Continue approximately one mile on STH 13 and turn southwest (right) on 11th Street. Go approximately one mile to Beaser Avenue and turn southeast (left). Continue approximately one mile to Maple Lane and turn west. Memorial Medical Center is located at 1615 Maple Lane.

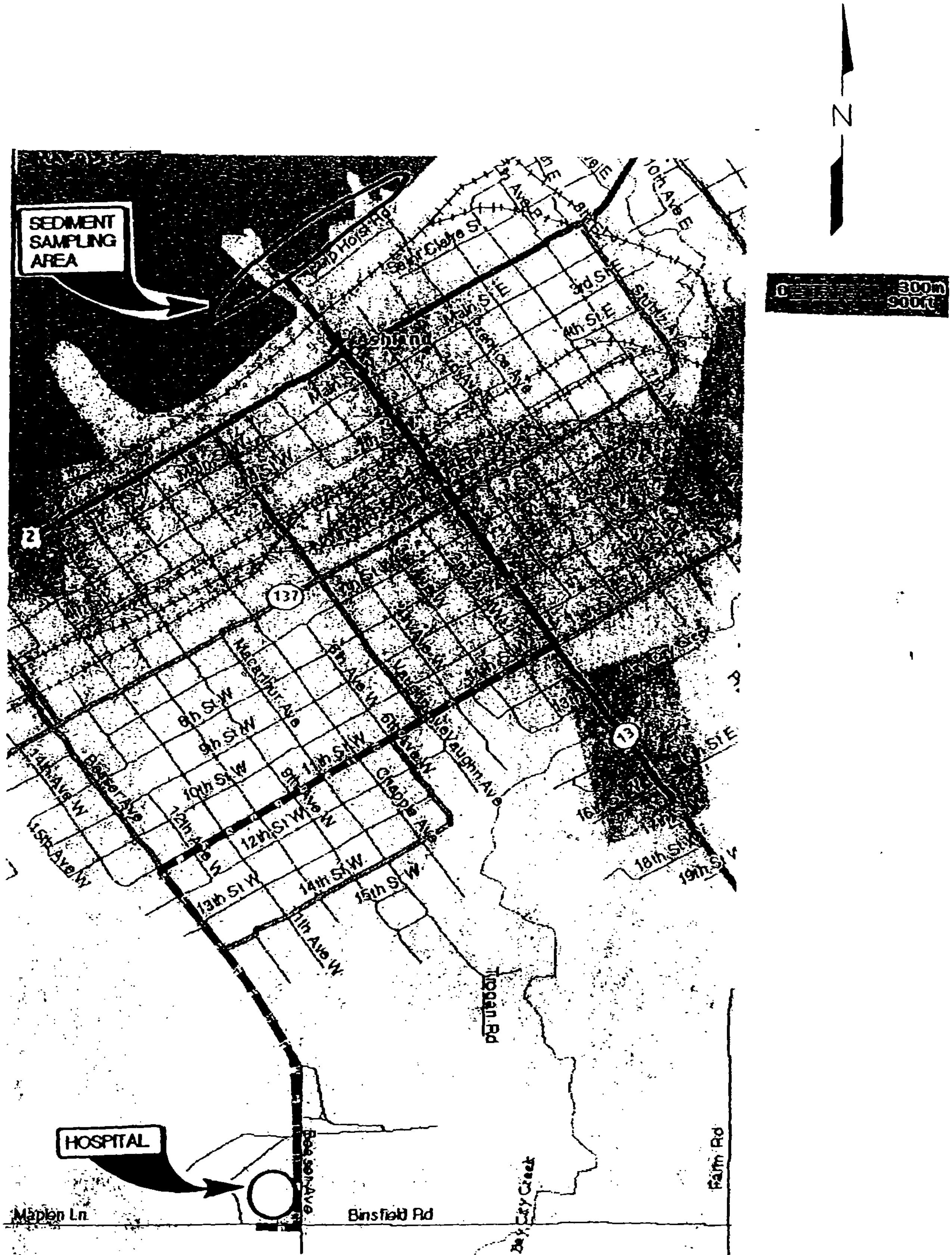
*See map on next page for detailed instructions.

B. Emergency Response

Refer to the SOP for Emergency Response Procedures which can be found in Attachment A.

C. Site Evacuation

The evacuation signal for the site is three short blasts of a horn, either on a motor vehicle or an air horn.



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NO.	DATE	ISSUE/REVISIONS	DRAWN BY		DESIGN	FIELD REVIEW	QC CHECK
1	02/11/03		RJH	02/03			

SEH	ASHLAND/NSP LAKEFRONT SITE	HOSPITAL ROUTE MAP	PROJ. NO. WIDNR9401 DATE 02/11/03	1 / 1

E:\WASTE\WDNR\SEDIMENT INVESTIGATION WORKPLAN\HOSPITAL

Evacuation routes and assembly points to be determined at the site. Preferably the meeting place should be upwind of the work activities and at a safe distance. In the event of an evacuation, the following must be observed:

- Employees in the immediate vicinity should shut down all operating equipment and disconnect electrical and gasoline or diesel combustion power sources to machinery unless their well-being is in imminent danger.
- Immediately after personnel are alerted, they will evacuate the facility via the nearest escape route.
- All evacuated personnel will assemble at the predetermined meeting place.
- The Site Safety Officer will ensure all employees have evacuated before departing.
- Employees should move quickly and calmly without panic.
- Employees should not smoke.
- Once assembled, employees should remain calm and quiet until the Site Safety Officer assesses the situation. Each employee must report to the Site Safety Officer until everyone is accounted for and evacuation is complete.

D. First Aid

Refer to the SOP for First Aid found in Attachment B.

III. Applicability

The purpose of this Site Health and Safety Plan (SHSP) is to assign responsibilities, establish personal protection standards and safety practices and procedures, and provide for contingencies that may arise during site operations.

The provisions of the plan are required for all onsite SEH personnel who are engaged in hazardous material management activities including, but not limited to, initial site reconnaissance, preliminary field investigations, mobilization, project operations, and demobilization. This plan complies with Occupational Safety and Health Administration (OSHA) standards 29 Code of Federal Regulations (CFR) 1910.120.

SEH personnel working at this site meet the training requirements of 29 CFR 1910.120: Hazardous Waste Operations and Emergency Response (HAZWOPER). Documentation of this training can be obtained upon written request to the SEH COWM Health and Safety Administrator, 421 Frenette Drive, Chippewa Falls, Wisconsin 54729.

The health and safety procedures set forth in this SHSP are based on the site conditions and chemical hazards known or expected to be present using site data available at the time this SHSP was written. This SHSP is intended solely for SEH personnel to use for the activities described herein. This SHSP is subject to revision by the Site Safety Officer when deemed necessary by actual site conditions encountered during field activities.

This SHSP does not supersede or in any way relieve subcontractors of their obligations under any applicable OSHA regulations including: 29 CFR 1910, Occupational Safety and Health Standards; and 29 CFR 1926, Health and Safety Regulations for Construction. Before field activities begin, all contractors and subcontractors must develop their own SHSP. A copy of this SHSP will be provided upon request, but this is not a substitute for an independent plan by the contractor or subcontractor.

IV. Project Objectives

1) Collect sediment and NAPL samples below the ice on Chequamegon Bay for analysis. Data will be used for the contaminant delineation and source identification.

V. Hazard Evaluation

A. Scope of Work

Sediment and NAPL sampling through ice for laboratory analysis.

B. Potential Hazards

The following waste types may be encountered at the site:

Contaminated Sediment
Contaminated Wood Waste
Contaminated Surface Water

C. Chemical/Physical Hazard Summary

List information for each contaminant or class of contaminants which could potentially be present at each location.

Location	Matrix	Compound*	Max. Sediment Concentrations[1] (0-4') (mg/kg)	Route of Exposure	Symptoms
Borings	Sediment/ Wood Waste	Benzene	1.2	Inhalation, ingestion, skin/eye contact	Dizziness, pallor, excitation, weakness, headache, breathlessness
		n-Butylbenzene	0.12	Ingestion	--
		Ethylbenzene	0.66	Inhalation, ingestion, skin/eye contact	Dizziness, depression, eye/nose irritant, blisters, corneal injury
		Isopropylbenzene (Cumene)	0.073	Ingestion, skin/eye contact, inhalation	Skin/eye irritant, CNS depression, narcotic
		p-Isopropyltoluene (p-Cymene)	0.24	Inhalation, ingestion, skin/eye contact	Incoordination, headache, skin/eye/mouth/stomach irritant
		Methylene Chloride (dichloromethane)	0.083	Inhalation, ingestion, skin/eye contact	Skin/eye/nose irritant, nausea, dizziness, anesthetic effects, drunkenness
		Naphthalene	770	Inhalation, ingestion, skin/eye contact	Headache, dizziness, nausea, skin/eye/nose/throat irritant
		n-Propylbenzene	0.026	Inhalation, ingestion, skin/eye contact	Skin/eye/nose/throat irritant, dizziness, breathing difficulty
		Toluene	0.042	Inhalation, ingestion, skin/eye contact	Headache, dizziness, vomiting, diarrhea
		1,2,4-Trimethylbenzene	0.43	Ingestion, inhalation, skin/eye contact	Eye/nose/respiratory irritant, dermatitis, nausea, headache, dizziness, narcosis
		1,3,5-Trimethylbenzene	0.15	Ingestion, inhalation, skin/eye contact	Eye/nose/respiratory irritant, dermatitis, nausea, headache, dizziness, narcosis
		Total Xylenes	0.67	Ingestion, inhalation, skin/eye contact	Headache, dizziness, skin/eye irritant, cough, pulmonary edema, nausea, vomiting, cramps
		Acenaphthene	19	Inhalation, ingestion	Skin/eye/nose irritant, vomiting
		Acenaphthylene	3.8	Inhalation, ingestion, skin/eye contact	--
		Anthracene	160	Ingestion, inhalation, skin/eye contact	Eye/nose/throat irritant
		Benzo(a)Anthracene	45	Ingestion, inhalation, skin/eye contact	Weak carcinogen
		Benzo(a)Pyrene	35	Ingestion, inhalation, skin/eye contact	Possible carcinogen, skin irritant, swelling, flaking, warts, coloration
		Benzo(b)Fluoranthene	16	Inhalation, ingestion, skin/eye contact	Carcinogen
		Benzo(ghi)Perylene	16	Ingestion, skin/eye contact	--
		Benzo(k)Fluoranthene	23	Ingestion, skin/eye contact	--
		Carbazole	5.1	Inhalation, ingestion, skin/eye contact	GI/skin/eye/respiratory tract irritation, nausea, vomiting, cancer
		Chrysene	36	Inhalation, ingestion, skin contact	Carcinogen, skin rash, coloration
		Dibenzo(a,h)Anthracene	3	Inhalation, ingestion	Carcinogen
		Fluoranthene	97	Ingestion, skin/eye contact	Cocarcinogen
		Fluorene	100	Ingestion, skin/eye contact	--
		Indeno(1,2,3-cd)Pyrene	14	Inhalation, ingestion, skin/eye contact	Carcinogen
		1-Methyl Naphthalene	12	Inhalation, ingestion, skin/eye contact	Skin/eye irritant, skin photosensitization, liver/kidney damage
		2-Methyl Naphthalene	470	Ingestion, skin/eye contact	--
		Phenanthrene	340	Ingestion, skin/eye contact	--

Location	Matrix	Compound*	Max. Sediment Concentrations[1] (0-4') (mg/kg)	Route of Exposure	Symptoms
Borings	Sediment/ Wood Waste	Pyrene	68	Inhalation, ingestion, skin/eye contact	Skin irritant
		Arsenic	1.3	Ingestion, skin/eye contact	Gastritis, gastroenteritis, skin/eye irritant, dermatitis, vomiting, cough, giddiness, headache, weakness, neuritis
		Cadmium	0.1	Ingestion, skin/eye contact	Nose/throat/eye irritant, chest pain, cough, breathing difficulty, headache, chills, nausea, vomiting, diarrhea
		Chromium	7.3	Ingestion, skin/eye contact	Lung allergy, flu-like illness, eye irritant, chills, aches, fever, cough
		Copper	3.9	Ingestion, skin/eye contact	Skin/eye/respiratory irritant, nausea
		Lead	3.3	Ingestion, skin/eye contact	Fatigue, headache, aching bones/muscle, abdomen pain, constipation, skin/eye irritant, anemia
		Nickel	5.5	Ingestion, skin/eye contact	Carcinogen, skin allergy, itching, rash, asthma, cough, shortness of breath, fluid in lungs
		Zinc	12	Ingestion, skin/eye contact	Eye/respiratory irritant

* = Compound information for each substance can be found in Attachment C.
[1] = Max. Sediment Concentrations based on analytical results reported in the "Ashland Lakefront Property - Contaminated Sediments, Ecological Risk Assessment," prepared by SEH dated October 1998
-- = unknown

D. Exposure Limits and Recognition Qualities

Compound	Compound Class*	Exposure Standards			Recognition Qualities	
		PEL/TLV (ppm)	STEL (ppm)**	IDLH (ppm)	Odor Threshold (ppm)	LEL/UEL (%)
Benzene	VOC	1	5 ppm	500	4.68	1.2/7.8
n-Butylbenzene		--	--	--	--	--
Ethylbenzene		100	--	800	140	0.8/6.7
Isopropylbenzene (Cumene)		50	--	900	1.2	0.9/5.9
Isopropyltoluene (p-Cymene)		--	--	--	--	0.9/5.9
Methylene Chloride (Dichloromethane)		100	500 ppm/30 minutes	5,000	205-307	12/19
Naphthalene		10	15	250	--	0.9/5.9
n-Propylbenzene		--	--	--	--	0.8/6
Toluene		200	500 ppm/10 minutes	500	0.17	1.1/7.1
1,2,4-Trimethylbenzene		--	--	--	--	0.9/6.4
1,3,5-Trimethylbenzene		--	--	--	--	--
Total Xylenes		100	150	900	0.5	0.9/7
Acenaphthene	PAH	--	--	--	--	--
Acenaphthylene		--	--	--	--	--
Anthracene		0.2 mg/m^3	--	--	--	0.6/--
Benzo(a)Anthracene		0.2 mg/m^3	--	--	--	--
Benzo(a)Pyrene		0.2 mg/m^3	--	--	--	--
Benzo(b)Fluoranthene		0.2 mg/m^3	--	--	--	--
Benzo(ghi)Perylene		0.2 mg/m^3	--	--	--	--
Benzo(k)Fluoranthene		0.2 mg/m^3	--	--	--	--
Carbazole		--	--	--	--	--
Chrysene		0.2 mg/m^3	--	--	--	--
Dibenzo(a,h)Anthracene		0.2 mg/m^3	--	--	--	--
Fluoranthene		0.2 mg/m^3	--	--	--	--
Fluorene		0.2 mg/m^3	--	--	--	--
Indeno(1,2,3-cd)Pyrene		0.2 mg/m^3	--	--	--	--
1-Methyl Naphthalene		--	--	--	0.023	--
2-Methyl Naphthalene		--	--	--	--	--
Phenanthrene		0.2 mg/m^3	--	--	--	--
Pyrene		0.2 mg/m^3	--	--	--	--

* = Compound classes include: VOCs, explosive gas, dusts, etc.
** = Maximum 15 minute exposure unless specified.
-- = Unknown

E. Additional Concerns

Fire Protection/Fire Prevention: Operations involving the potential for fire hazards shall be conducted in a manner as to minimize the risk. Non-sparking tools and fire extinguishers shall be used or available as appropriate. Sources of ignition shall be removed. When necessary, explosion-proof instruments and/or bonding and grounding will be used to prevent fire or explosion.

Utilities: Overhead and underground utility hazards shall be identified and/or inspected prior to conducting operations involving potential contact. Diggers Hotline will be notified at least 3 working days prior to beginning field activities when applicable.

Weather Condition Restrictions: The Site Safety Officer has the authority, should severe weather threaten, to place site activities on standby, cease operations and/or evacuate Site as deemed necessary.

Weather conditions onsite cannot be controlled. Site personnel are to be aware of the warnings of impending severe weather and the precautions that are to be taken when severe weather threatens. Refer to the SOP for Severe Weather found in Attachment D.

Temperature Stress: Hot or cold weather is generally a consideration at any site and cannot be controlled. Site workers need to be aware of engineering controls which can reduce temperature stress, the signs and symptoms of temperatures stress and first aid measures for victims of temperature stress. Refer to the SOP for First Aid found in Attachment B.

General Site Health and Safety Rules: Some general safe work practices apply to all sites. Refer to the SOP for General Site Health and Safety Rules found in Attachment E.

Ice Safety Issues: A minimum of 16 inches of solid ice thickness is needed to support any work vehicles going out on the ice. Walking/working on the ice without heavy equipment and/or vehicles can be done safely with a minimum of 6 inches of solid ice. Ice conditions can deteriorate rapidly in warm or rainy weather conditions. The recommended ice thickness may not be adequate to support equipment or personnel if the ice is not solid (i.e. if it has honeycombed). An indication that honeycombing may be occurring is when melted snow-ice water is no longer puddling on the surface of the ice. Heavy equipment should be removed from the ice at this time regardless of remaining ice thickness. Be aware that conditions in open areas such as those found out on the ice may make workers more susceptible to frost bite due to wind chill effects. Be vigilant of changing weather/wind conditions.

Be aware that contaminated water and sediments from the site can be quite slick and become a slip and fall hazard if spilled on the ice surface. In addition, these conditions also present a health and safety concern for those coming into contact with the contaminants due to inhalation and dermal absorption. Please refer to detailed waste handling procedures found in the Sediment Sampling Work Plan.

VI. Site Control

A. Present Site Security

None.

B. Site Security Upgrades Needed

None.

C. Zone of Contamination

Zone boundaries do not need to be marked. Generally, the area within 20 feet of field operations is considered the Exclusion Zone and requires the use of applicable personal protection equipment (PPE).

D. Entry Restrictions

Only authorized personnel are permitted within the Exclusion Zone.

VII. Ambient Air Monitoring

A. General

Continuous monitoring will be performed for the hazards presented in Section V, D, "Exposure Limits and Recognition Qualities," to ensure proper selection of engineering controls, work practices, and personal protective equipment. Continuous monitoring will be conducted during invasive field activities. The appropriate level of protection will be selected based on the monitoring results and the corresponding action levels shown on the table in Section VII, B, "Monitoring Requirements."

B. Monitoring Requirements

Location	Compound	Equipment	Action Level*	Protective Level
Worker Breathing Zone	VOCs, PAHs	FID	≤ Background	D
			≤5 Units Above Background	C
			>5 Units Above Background	Cease Operation, Re-evaluate Work Plan
*All ambient measurements taken to evaluate employee exposures must be taken in the individuals breathing zone and must be fairly constant for at least 30 seconds.				

Before any field activities commence, the background levels of the site must be measured and noted. Daily background readings must be conducted away from areas of potential contamination to obtain accurate results.

All site readings along with the date, time, background level, weather conditions, wind direction and speed, and the location where the background level was recorded must be noted in the field book or on an Air Monitoring Form.

C. Instrument Calibration and Maintenance

Field instruments will be calibrated according to the manufacturers recommendations. Photoionization detectors (PIDs) and flame ionization detectors (FIDs) will be calibrated with the appropriate calibration gas (i.e., isobutylene for PIDs and methane for FIDs). The instruments will be calibrated with the following frequency:

1. At the beginning of each day.
2. After any significant changes in humidity or temperature (more than 15 degrees F).
3. After any repairs to the instrument are performed.

Maintenance on field instruments will be done according to the manufacturer's recommendations.

VIII. Personal Protective Equipment (PPE)

All field activities will be performed at the appropriate level of protection for the action levels specified in Section VII, B. The following table describes the equipment required for various levels of protection.

		Protection Level			
Equipment Need	**Type/Material**	**A**	**B**	**C**	**D**
Thermal Work Clothes				X	X
Boots with Steel Toe and Shank				X	X
Hard Hat				X	X
Safety Glasses				X	X
Disposable Boot Covers	Rubber or Tyvek			X	X
Hearing Protection				X	X
Chemical-Resistant Coveralls	Polyethylene Coated Tyvek			X	X
Chemical-Resistant Inner/Outer Gloves	Nitrile/Nitrile			X	X
Chemical-Resistant Boot Covers					
Two-way Radio Communication					
Air-Purifying Respirator with Cartridges[2]	Full-Face or Half-Face, Organic Vapor			X	
Escape Respirator					
Positive Pressure SCBA					
Fully-Encapsulating, Chemical-Resistant Suit					
Personal Flotation Device				X	X

IX. Decontamination

Use the SOP for Personal and Equipment Decontamination at the highest protection level used onsite each day. See Attachment F for Decontamination SOP.

X. Confined Space Entry

Confined space entry is not allowed in the scope of this SHSP. Should a confined space entry situation be encountered, the Project Manager and Health and Safety Administrator must be notified and provisions for confined space entry must be added to this SHSP.

JEG/ls/

XI. Site Safety Plan Review

This document shall be signed by each employee who visits the site.

I have read and understand the contents of this SHSP, have been given opportunity to discuss contents with the Project Manager and Site Safety Officer, and will comply with its provisions, requirements and restrictions.

Site: Ashland/NSP Lakefront Site OU #4 Winter 2003 Sediment Sampling

Location: Sec. 33, T48N, R4W, Ashland County, Ashland, WI 54806

Pre-Entry Briefing Date: _____

Name (print)	Signature	Date	Attended Briefing? Y/N
John Guhl			
Brian Kent			
Cyrus Ingraham			
Gloria Chojnacki			

ATTACHMENT A

Field Emergency Response Procedures

ATTACHMENT A

Field Emergency Response Procedures

Based on the type of potential hazards that may be present, the Project Manager and Health and Safety Administrator are to determine if a site specific emergency response plan is necessary prior to the beginning of work. If a site specific plan is necessary, it is to be attached to the Site Health and Safety Plan (SHSP).

General

In the event of an emergency situation, SEH employees will provide useful information regarding the incident to emergency response personnel. Stick to helpful facts and avoid placing blame or judgement.

At a safe distance and at the appropriate time, write down all that is remembered regarding the incident. This information may be important later when facts are sorted out.

- How did it happen?
- Who was doing what?
- What did you see?
- What did you hear?

Small Fires

Even a minor fire can become a serious problem, particularly when adjacent to flammable or combustible materials. The first few minutes after discovery of a fire are the most critical in preventing a larger emergency. Take the following actions immediately.

1. In case of a fire or explosion, immediately shut down possible ignition sources and stop any work in progress. Give priority to assisting injured persons.
2. Alert other personnel in the vicinity and send someone for assistance.
3. If it is a small fire - one that can be extinguished within 30 seconds or with one fire extinguisher - attempt to extinguish the blaze if:
   - Conditions are safe
   - You are not alone
   - You have the proper class of fire extinguisher
   - You have been properly trained to use a fire extinguisher
4. A combination (ABC) extinguisher can be used against the following classes of fires:
   - Class A fires - ordinary combustible solids such as paper, wood, coal, rubber and textiles
   - Class B fires - petroleum hydrocarbons (diesel fuel, motor oil and grease) and volatile flammable solvents
   - Class C fires - electrical equipment

   Note: ABC extinguishers are not effective against Class D fires which include combustible or reactive metals (such as sodium and potassium), metal hydrides or organometallics. Special Class D extinguishers are required.
5. Avoid entrapment by a fire; always fight from a position accessible to an exit.
6. If there is any chance that the fire cannot be controlled by locally available personnel and equipment, the following action should then be taken:
   - Activate the emergency alarm system (if available) and notify the local fire department.
   - Confine the emergency to prevent further spread of the fire.

- Assist injured personnel and provide first aid or transportation to medical assistance, if necessary.

7. Next, notify the client if the client is in close proximity to the fire.
8. If the fire department is contacted, be prepared to tell them:
   - Who you are
   - Your location (reference site hospital route map)
   - Type of fire (i.e., electrical, chemical, combustible solids, vapor)
   - If the fire is extinguished
   - The need for medical assistance
   - Other potential hazards in the area (i.e., proximity to bulk tanks, downed electrical lines, poor access)
   - What you will be doing after you hang up the phone and where they can find or reach you

9. Upon arrival of the local fire department, turn over command to them and explain the situation. Contact the Project Manager and Health and Safety Administrator.

Large Fire or Explosion

1. If the fire is too large to extinguish within 30 seconds, immediately notify people in the area and then call the local fire department. Be prepared to tell them:
   - Who you are
   - Your location
   - Type of fire (i.e., electrical, chemical, combustible solids, vapor)
   - If the fire is extinguished
   - The need for medical assistance
   - Other potential hazards in the area (i.e., proximity to bulk tanks, downed electrical lines, poor access)
   - What you will be doing after you hang up the phone and where they can find you or reach you

2. Upon arrival of the fire department, turn over command to them and explain the situation. Contact the Project Manager and Health and Safety Administrator.

Flammable/Combustible Liquid Spills

1. If a spill of a flammable or combustible liquid occurs, all possible sources of ignition should be extinguished or removed immediately.
2. Use Material Safety Data Sheets (MSDSs), analytical information from laboratory personnel, and any other available sources of information, together with your own expertise to determine if spill control and cleanup can be safely accomplished with the personnel and materials available onsite.
3. The following general spill cleanup procedures can be utilized, but more specific techniques might be required for certain chemicals and, if necessary, will be included in Section XI of this SHSP.
   - Vermiculite or suitable absorbent may be used to solidify free liquids.
   - Both spilled liquids and solid residues must be contained in drums.
   - If a spill occurs on soil, it must be scraped and contained.
   - The appropriate state agency must also be notified immediately when a spill occurs to the environment.

ATTACHMENT B

First Aid

ATTACHMENT B
First Aid

A. Bites

Animal Bites: Thoroughly wash the wound with soap and water. Flush the area with running water and apply a sterile dressing. Control bleeding and immobilize the affected part until the victim has been attended by a physician. See that the animal is kept alive and in quarantine. Obtain name and address of the owner of the animal.

Insect Bites: Remove "stinger" if present. Keep affected part down below the level of the heart. Apply ice bag. For minor bites and stings apply soothing lotions, such as calamine. Watch for sign of an allergic reaction.

Spider/Tick Bites: Wash the wound with soap and water. If the spider is suspected to be poisonous (i.e. Brown Recluse or Black Widow), call the Poison Control Center for instruction on immediate care and seek medical attention immediately.

B. Burns and Scalds

Care for burns and scalds using the following three basic steps.

1. Stop the Burning
   - Put flames out.
   - Remove the victim from the source of the burn.
2. Cool the Burn
   - Use large amounts of cool water to cool the burned area.
   - Do not use ice or ice water other than on superficial burns.
   - Use tub, shower, or garden hose to immerse burned areas.
   - Used soaked towels or other wet cloths to cool a burned face or other areas that cannot be immersed.
   - Keep cloths cool by adding more water.
3. Cover the Burn
   - Use dry, sterile dressings or a clean cloth and loosely bandage them in place.
   - Covering the burn helps keep air out and prevents infection.

Note: Do not apply vaseline or grease to any burn. Follow the guidelines listed below for the different types of burns.

Minor Burns: Do not break blisters or remove tissue. Seek medical attention.

Severe Burns: Do not remove adhered particles of clothing. Keep burned feet or legs elevated. Seek medical attention immediately.

Chemical Burns: Wash away the chemical with large amounts of water. Remove the victim's chemical-soaked clothing. If dry lime, brush away before flushing. Seek medical attention.

C. Cramps

Symptoms: Cramps in muscles of abdomen and extremities. Heat exhaustion may also be present.

Treatment: Same as for heat exhaustion in Subpart I of this attachment.

D. Cuts

Apply pressure with sterile gauze dressing, and elevate the area until bleeding stops. If bleeding persists, apply pressure to a pressure point. Apply a bandage and seek medical attention.

E. Eyes

Foreign Objects: Keep the victim from rubbing their eye. Flush the eye with water. If flushing fails to remove the object, apply a dry, protective dressing to both eyes to limit movement of the affected eye. Seek medical attention immediately.

Chemicals: Flood the eye thoroughly with water for 15 minutes. Cover both eyes with a dry pad and seek medical attention.

F. Fainting

Keep the victim lying down. Loosen tight clothing. If vomiting occurs, roll victim onto their side and turn head to the side. If necessary wipe out their mouth. Maintain an open airway. Bathe their face gently with cool water. Unless recovery is prompt, seek medical attention.

G. Fractures

Deformity of an injured part usually means a fracture. If fracture is suspected, splint the body part. **DO NOT ATTEMPT TO MOVE THE FRACTURED BODY PART.** Seek medical attention immediately.

H. Frostbite

Symptoms: Just before frostbite occurs, skin may be flushed, then change to white or grayish-yellow. Pain may be felt early, then subside. Blisters may appear. Affected part feels very cold and numb.

Treatment: Bring victim indoors, cover the frozen area using extra clothing and blankets. Warm frozen area quickly by immersion in warm water (100-105 degrees F) – **NOT HOT WATER. DO NOT RUB THE PART.** Seek medical attention immediately.

I. Heat Exhaustion

Caused by overexposure to heat, either sun or indoors.

Symptoms: Near normal body temperature, skin is pale and clammy. Profuse sweating, tiredness, weakness, headache, perhaps cramps, nausea, dizziness, and possible fainting.

Treatment: Keep victim lying down and raise victim's feet. Loosen clothing, apply cool wet cloths. If conscious, give sips of cool water or liquids with electrolytes like diluted Gatorade over a period of one hour. If vomiting occurs, discontinue liquids. Seek medical attention immediately.

J. Sunstroke

Symptoms: Body temperature is high (106 F or higher). Skin is hot, red and dry. Pulse is rapid and strong. Victim may be unconscious.

Treatment: Keep victim lying down with head elevated. Remove clothing and repeatedly sponge the bare skin with cool water or rubbing alcohol. Seek medical attention immediately.

K. Poisoning

Call the Poison Control Center for instruction on immediate care. If victim becomes unconscious, keep the airway open. If breathing stops, give rescue breathing and monitor pulse. If pulse stops, begin cardiopulmonary resuscitation (CPR). Seek medical attention immediately.

L. Poison Ivy or Poison Oak

Remove contaminated clothing; wash all exposed areas thoroughly with soap and water, followed by rubbing alcohol. If rash is mild, apply calamine or other soothing skin lotion. If a severe reaction occurs, seek medical attention immediately.

M. Puncture Wounds

If puncture wound is deeper than skin surface, seek medical attention. Serious infection can arise unless proper treatment is received.

N. Sprains

Elevate injured part and apply ice bag or cold packs. **DO NOT SOAK IN HOT WATER.** If pain and swelling persist, seek medical attention.

O. Unconsciousness

Seek medical attention immediately. Never attempt to give food or drink. Keep victim lying flat, maintain open airway. If victim is not breathing, begin rescue breathing and monitor pulse. If pulse stops, begin CPR.

P. General Sequence for Treatment of Exposures to Unknown Chemicals

1. Check the victim's condition.
2. Immediately notify the appropriate emergency contacts listed on page 1 of this SHSP.
3. Quickly protect yourself from exposure before attempting to rescue the victim.
4. Decontaminate the victim.
5. Treat cessation of breathing first.
6. If the victim has no pulse, perform CPR.
7. Treat eye injuries next.
8. Treat skin contact.
9. Treat shock.

Preliminary Assessment

Make a quick assessment of the likely routes of exposure by examining the eyes, mouth, nose and skin of the victim for signs of the chemical itself or damage it has caused such as swelling, redness, bleeding, burns, discharge of fluid or mucous or pallor.

- Drooling, difficult swallowing, or distended and painful or hard, rigid abdomen all indicate possible ingestion of a corrosive or caustic substance.
- If respirations are rapid, shallow, noisy or labored, suspect inhalation.
- If the face has been splashed with chemical, eye contact is likely.

Poisoning by Inhalation

1. Immediately notify the appropriate emergency contacts listed on page 1 of this SHSP.
2. Remove the victim from the contaminated area while protecting yourself from exposure using a self-contained breathing apparatus (SCBA).
3. Remove contaminated clothing and equipment from the victim while wearing protective equipment.
4. If breathing has stopped, open airway, begin rescue breathing using a disposable resuscitator. **DO NOT** use direct mouth-to-mouth resuscitation.
   - Check the victim's condition.
   - Call for medical assistance.
   - Maintain an open airway.
   - Monitor breathing.
   - Monitor the pulse.
   - Continue your efforts until help arrives or the victim begins breathing on their own.
   - Keep the victim warm and quiet.

5. If the victim is unconscious but breathing:
   - Lay the victim on their back. If the victim is vomiting, turn them on their side.
   - Clear the airway and loosen tight clothing.
   - Keep victim warm and quiet.
   - Do not leave the victim unattended.
   - Never give an unconscious person anything to drink.

6. If the victim is conscious:
   - Lay the victim down, cover the victim with a blanket and keep them quiet.
   - Loosen tight clothing.

Poisoning by Ingestion

1. Remove the victim from exposure while protecting yourself from exposure.
2. Call the Poison Control Center phone number listed on page 1 of this SHSP.
3. Notify an emergency medical service of the nature of the exposure and arrange for transport to a medical facility.
4. Consult the MSDS to determine whether to offer victim water to drink or to induce vomiting and by what means. (The Poison Control Center may be able to provide this information.)
5. If the victim is conscious:
   - Have the victim rinse out his mouth with water.
   - If there are no signs of burns, swallowing difficulty or abdominal problems and victim is conscious and if so advised by a physician or Poison Control Center:
     - Induce vomiting by giving two teaspoons of Syrup of Ipecac. Follow with at least one cup of water. **DO NOT** use milk. If you do not have Syrup of Ipecac, induce vomiting by asking the victim to touch the back of the throat with a finger, spoon handle or blunt instrument.
     - Have the victim sit up or lean forward while vomiting.
     - Give the victim one to two cups of water after vomiting has ceased.

6. If the victim is unconscious:
   - Lay the victim on their left side, bending her right hip. Loosen their collar and belt.
   - Maintain an open airway.
   - **DO NOT** give an unconscious person anything to drink.
   - Arrange for transport to the nearest medical facility.
   - Stand by to administer rescue breathing and CPR if needed. Be sure to wipe or rinse all traces of chemical from in and around the victim's mouth before starting rescue breathing. Always use disposable resuscitators. **DO NOT** use direct mouth-to-mouth resuscitation.
   - If breathing has stopped, begin rescue breathing using a disposable resuscitator and avoid mouth-to-mouth contact.

7. If the victim vomits, save the vomitus and send it to the medical facility for analysis.
8. If the victim shows signs of shock (a weak, rapid pulse; pale clammy skin; cold hands and feet), elevate the victim's feet eight to twelve inches and cover the victim with a blanket.
9. **DO NOT** give someone who is convulsing anything to drink.
10. **DO NOT** leave the victim alone except to call for emergency assistance.

Poisoning by Skin Contact

1. Remove the victim from the contaminated area, being careful to protect your lungs, skin and eyes.
2. Notify a physician, emergency room, or poison control center of the accident and obtain advice.
3. Remove the victim's clothing, shoes and jewelry from the affected areas, cutting them off if necessary. Do this under a shower or while flushing with water.
4. Continue to flush with water until all traces of the chemical are gone and any slippery feeling has disappeared. Rinse for at least 15 minutes.
5. Cover the victim with a blanket or dry clothing.
6. In case of inflammation, burns, blisters or pain, loosely apply a dry, sterile dressing or a clean, dry cloth.
7. If the victim is in shock:
   - Lay the victim down on his side and cover him with a blanket.
   - Elevate the victim's feet eight to twelve inches.
   - Notify an emergency medical service of the nature of the exposure.

DO NOT break open blisters or remove skin. If clothing is stuck to the skin after flushing with water, do not remove it.

DO NOT rub or apply pressure to the affected area.

DO NOT apply any oily substance to the affected skin.

DO NOT use hot water.

DO NOT leave the victim alone.

Poisoning by Eye Contact

Remove the victim from the contaminated area, being careful to protect your lungs, skin and eyes. Immediately:

1. Flush the victim's eye(s) with clean tepid water for at least 15 minutes.
2. Have the victim lie or sit down and tilt head back.
3. Hold eyelid(s) open and pour water slowly over the eyeball(s) starting at the inner corners by the nose allowing the water to flow to the outer corners of the eye.
4. The victim may be in great pain and want to keep eyes closed or rub them but you must rinse the chemical out of the eye(s) in order to prevent possible permanent damage.
5. Ask the victim to look up, down and side to side as you rinse.
6. Call an emergency medical service and arrange for transport to the nearest facility for examination and treatment as soon as possible. Even if there is no pain and vision is good, a physician should examine the eye(s) since delayed damage may occur.
7. If the eye(s) is(are) painful:
   - Cover loosely with gauze or a clean, dry cloth
   - Maintain verbal and physical contact with the victim

ATTACHMENT C

Potential Contaminants/Compounds

ACENAPHTHYLENE

Water Pollution Standard - Proposed (EPA)(6) (Kansas)(61).
Hazardous Substance (EPA)(RQ = 5000/2270)(4)
Priority Toxic Pollutant (EPA)(6)
Cited in U.S. State Regulations: Kansas (W), Pennsylvania (G)

Description: $C_{12}H_8$ is a solid melting at 80°-83°C. It is a polynuclear aromatic hydrocarbon (PAH).

Code Numbers: CAS 208-96-8 RTECS AB1254000

Synonyms: Cyclopenta(de)naphthalene

Potential Exposure: In coal tar processing.

Incompatibilities: Ozone and chlorinating agents.

Permissible Exposure Limits in Air: No standard set.

Determination in Air: See NIOSH methods (18) as follows: 5506 (HPLC) and 5515 (GC).

Permissible Concentration in Water: See the entry on "Polynuclear Aromatic Hydrocarbons." Note: Kansas (61) has set a guideline for drinking water of 0.03 µg/ℓ.

Determination in Water: Extraction then HPLC/UV. (EPA Method 610).

Routes of Entry: Ingestion, inhalation, skin contact.

Harmful Effects and Symptoms: See Polynuclear Aromatic Hydrocarbons entry. Acenaphthylene does not test positively as a mutagen (11).

Medical Surveillance: Preplacement and regular physical examination indicated.

Personal Protective Methods: Good particulate emission controls are the indicated engineering control scheme.

Shipping: The DOT has not set forth any specific label requirements or maximum shipping quantities for acenaphthylene.

Spill Handling: Contain and isolate spill to limit spread. Construct bentonite-lined dam.

Disposal Method Suggested: Product residues and sorbent media may be packaged in epoxy-lined drums then destroyed by incineration, permanganate oxidation or microwave plasma treatment.

References

Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report 4*, No. 2, 35-37 (1984).

B(a) A

no direct evidence is available for absorption of B[a] A via the lungs. Following oral absorption, B[a] A is distributed to several tissues and accumulates preferentially in the adipose and mammary tissues. It is metabolized to conjugated derivatives and eliminated. It is expected that absorbed B[a] A will be excreted predominantly in the feces, as is true for other PAHs.

B[a] A is metabolized to reactive derivatives that are thought to be responsible for its mutagenic activity in experimental systems. B[a] A is a weak experimental carcinogen by the dermal route of exposure. There is some evidence that it is carcinogenic by the oral route as well. Its carcinogenicity by the inhalation route has not been studied. Mutation is thought to be a necessary (although insufficient) step for the carcinogenic acticity of B[a] A.

There is no information on other toxic effects of B[a] A in humans and experimental animals following inhalation, oral, and dermal exposures.

First Aid: *Skin Contact* — Flood all areas of body that have contacted the substance with water. Don't wait to remove contaminated clothing; do it under the water stream. Use soap to help assure removal. Isolate contaminated clothing when removed to prevent contact by others.

Eye Contact — Remove any contact lenses at once. Immediately flush eyes well with copious quantities of water or normal saline for at least 20-30 minutes. Seek medical attention.

Inhalation — Leave contaminated area immediately; breathe fresh air. Proper respiratory protection must be supplied to any rescuers. If coughing, difficult breathing or any other symptoms develop, seek medical attention at once, even if symptoms develop many hours after exposure.

Ingestion — Contact a physician, hospital or poison center at once. If the victim is unconscious or convulsing, do not induce vomiting or give anything by mouth. Assure that his airway is open and lay him on his side with his head lower than his body and transport immediately to a medical facility. If conscious and not convulsing, give a glass of water to dilute the substance. Vomiting should not be induced without a physician's advice.

Respirator Selection:

NIOSH
at any detectable concentration. SCBAF:PD,PP/
SAF:PD,PP:ASCBA
Escape: GMFHiEOV/SCBAE

Storage: Store in a cool, dry place.

Shipping: Poisonous solids, n.o.s. require a "Poison" label. In Packing Group II, the limit on passenger aircraft or railcar shipment is 25 kg; on cargo aircraft shipment is 100 kg. The UN/DOT Hazard Class is 6.1 (19,20).

Disposal Method Suggested: Atomize into incinerator with a flammable liquid (22).

References

Agency for Toxic Substance and Disease Registry, U.S. Public Health Service, "Toxicological Profile for Benz[a] Anthracene," Atlanta, Georgia, ATSDR (October 1987).
Sax, N.I., Ed., *"Dangerous Properties of Industrial Materials Report,"* 5, No. 1, 32-37, (1985).

BENZENE

BN

Common Synonyms			
Benzol Benzene	Watery liquid	Colorless	Gasoline-like odor

Floats on water. Flammable. Irritating vapor is produced. Freezing point is 42°F.

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to knock down vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Restrict access

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: C_6H_6
3.3 IMO/UN Designation: 3.2/1114
3.4 DOT ID No.: 1114
3.5 CAS Registry No.: 71-43-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene.
5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.
5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen.
5.4 Threshold Limit Value: 10 ppm
5.5 Short Term Inhalation Limits: 75 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Leukemia
5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 4.68 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 12°F C.C.
6.2 Flammable Limits in Air: 1.3%-7.9%
6.3 Fire Extinguishing Agents: Dry chemical foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 1007°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 6.0 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity:
5 ppm/6 hr/minnow/lethal/distilled water
20 ppm/24 hr/sunfish/TL_m/tap water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity:
Industrial pure ____.99 + %
Thiophene-free ____.99 + %
Nitration ____.99 + %
Industrial 80% ____.85 + %
Reagent ____.99 + %
9.2 Storage Temperature: Open
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations:
Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 78.11
12.3 Boiling Point at 1 atm:
176°F = 80.1°C = 353.3°K
12.4 Freezing Point:
42.8°F = 5.5°C = 278.7°K
12.5 Critical Temperature:
552.0°F = 288.8°C = 562.1°K
12.6 Critical Pressure:
710 psia = 48.3 atm = 4.89 MN/m²
12.7 Specific Gravity:
0.879 at 20°C (liquid)
12.8 Liquid Surface Tension:
28.9 dynes/cm = 0.0289 N/m at 20°C
12.9 Liquid-Water Interfacial Tension:
35.0 dynes/cm = 0.035 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 2.7
12.11 Ratio of Specific Heats of Vapor (Gas): 1.081
12.12 Latent Heat of Vaporization:
169 Btu/lb = 94.1 cal/g = 3.94 X 10⁴ J/kg
12.13 Heat of Combustion: −17,480 Btu/lb = −9698 cal/g = −406.0 X 10⁴ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.45 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.22 psia

NOTES

Properties: White or slightly yellow, waxy solid having a faint characteristic odor; melting range 48-63C; not naturally water-soluble but can be made so by special treatment. Freely soluble in alcohol and propylene glycol. Combustible.
Grade: FCC, water-soluble.
Hazard: Toxic by ingestion. Use in foods restricted; consult FDA regulations.
Use: Antioxidant for fats and oils; food packaging.

butylated hydroxytoluene. See 2,6-di-tert-butyl-p-cresol.

n-butylbenzene. (1-phenylbutane).
CAS: 104-51-8. $C_6H_5C_4H_9$.
Properties: Colorless liquid, bp 183.2C, fp −87.9C, d 0.860 (20C), refr index 1.489 (20C), flash p 160F (71.1C) (OC). Combustible, autoign temperature 774F (412C).
Grade: Technical, pure, research.
Hazard: Toxic by ingestion.
Use: Organic synthesis, especially of insecticides.

sec-butylbenzene. (2-phenylbutane).
CAS: 135-98-8. $C_6H_5C(CH_3)C_2H_5$.
Properties: Colorless liquid, bp 170.65C, vap press 15 mm Hg (60C), fp −75.68C, d 0.8618 (204C), wt/gal 7.2 lb (20C), refr index 1.4901 (20C), flash p 145F (62.7C) (OC), combustible, autoign temperature 784F (417C).
Grade: Technical 95%, pure, research.
Hazard: Toxic by ingestion.
Use: Solvent for coating compositions, organic synthesis, plasticizer, surface-active agents.

tert-butylbenzene. (2-methyl-2-phenylpropane).
CAS: 98-06-6. $C_6H_5C(CH_3)_3$.
Properties: Colorless liquid, insoluble in water, soluble in alcohol, bp 169.1C, fp −57.8C, d 0.866 (20C), refr index 1.492 (20C), flash p 140F (60C) (OC). Combustible. Autoign temperature 842F (450C).
Grade: Technical, pure, research.
Hazard: Toxic by ingestion.
Use: Organic synthesis, polymerization solvent, polymer linking agent.

butylbenzenesulfonamide. (n,n-butylbenzenesulfonamide). $C_6H_5SO_2NHC_3H_9$.
Properties: Liquid, pleasant odor, amber to straw color, d 1.148 (25/25C), refr index 1.5235 (25C), bp 189-190C (4.5 mm Hg).
Hazard: Toxic by ingestion.
Use: Synthesis of dyes, pharmaceuticals, other organic chemicals, in resin manufacturing, as plasticizer for some synthetic polymers.

butyl benzoate. (n-butyl benzoate).
$C_6H_5COOC_4H_9$.
Properties: Colorless, oily liquid; insoluble in water; miscible with alcohol or ether; d 1.00 (20C); bp 247.3C; fp −22C; flash p 225F (107C) (OC). Combustible.
Grade: Technical.
Use: Solvent for cellulose ether, plasticizer, perfume ingredient, dyeing of textiles.

N-tert-butyl-2-benzothiazolesulfenamide.
$C_6H_4NCS(SNH)C_4H_9$.
Properties: Light buff powder or flakes (sometimes colored blue), mp 104C min, d 1.29 at 25C. Soluble in most organic solvents. Combustible.
Use: Rubber accelerator.

butylbenzyl phthalate. (BBP).
$C_4H_9OOCC_6H_4COOC_7H_7$.
Properties: Clear, oily liquid; slight odor; d 1.113-1.121 (25/25C); flash p 390F (198C). Combustible.
Grade: Technical.
Use: Plasticizer for polyvinyl and cellulosic resins, organic intermediate.

butylbenzyl sebacate.
$C_4H_9OOC(CH_2)_8COOC_7H_7$.
Properties: Light straw-colored liquid, bp 245-285C (10 mm Hg), d 1.023 (25C), wt/gal 8.6 lb, flash p 395F (201C). Combustible.
Use: Plasticizer for resins.

butyl borate. See tributyl borate.

n-butyl bromide. (1-bromobutane).
CAS: 109-65-9. C_4H_9Br.
Properties: Colorless liquid, d 1.279 (20/20C), bp 101.6C, fp −112.4C, flash p 75F (23.9C) (OC). Autoign temperature 509F (265C), insoluble in water, soluble in alcohol and ether.
Grade: 99%.
Hazard: Flammable, dangerous fire risk.
Use: Alkylating agent.

sec-butyl bromide. (2-bromobutane).
CAS: 78-76-2. $CH_3CHBrCH_2CH_3$.
Properties: Clear, colorless liquid with pleasant odor; bp 91.2C; fp −112C; d 1.2425 (25/25C); refr index 1.4320-1.4344 (25C); flash p 70F (21.1C) (OC); soluble in alcohol and ether; insoluble in water.
Hazard: Narcotic in high concentration. Flammable, dangerous fire risk.
Use: Synthesis, alkylating agent.

butyl butanoate. See n-butyl butyrate.

n-butyl butyrate. (butyl butanoate).
CAS: 109-21-7. $CH_3(CH_2)_2COOC_4H_9$.
Properties: Colorless liquid, d 0.8721 (20/20C), refr index 1.4059 (20C), fp −91.5C, bp 165.7C (736 mm Hg), flash p 128F (53.5C) (OC), insol-

Long Term Exposure: Continued exposure to low levels of cadmium in air may cause irreversible lung injury, abnormal lung function and kidney disease. Other consequences of cadmium exposures are inflammation of the nose and throat, open sores in the nose, soreness, bleeding and reduced nose size, loss of sense of smell, damage to the olfactory nerve, yellow cadmium stains on teeth, sleeplessness, nausea, lack of appetite, weight loss, anemia, lung distention with scar formation, and liver damage. May cause bone disease characterized by softening, bending and reduction in bone size. Difficulty walking, pain in back and extremities, and spontaneous fractures may result. Inhalation of 0.06 mg/m^3 - 0.68 mg/m^3 for 4 to 8 years may cause throat irritation, cough, chest pain, upset stomach and fatigue. Exposure to levels of 3.0 - 15.0 mg/m^3 of fumes or dust over a period of 20 years has caused lung distention, anemia, protein in urine and kidney dysfunction. Studies indicate that there is an increased incidence of prostatic cancer and possible kidney and respiratory cancer in cadmium workers. Cadmium causes birth defects in rats, mice and hamsters; whether it does so in humans is not known.

Points of Attack: Respiratory system, lungs, kidneys, prostate, blood.

Medical Surveillance: In preemployment physical examinations emphasis should be given to a history of, or actual presence of, significant kidney disease, smoking history, and respiratory disease. A chest x-ray and baseline pulmonary function study is recommended. Periodic examinations should emphasize the respiratory system, including pulmonary function tests, kidneys and blood.

A low molecular weight proteinuria may be the earliest indication of renal toxicity. The trichloroacetic acid test may pick this up, but more specific quantitative studies would be preferable. If renal disease due to cadmium is present, there may also be increased excretion of calcium, amino acids, glucose, and phosphates.

First Aid: *For Cadmium Dust* — If this chemical gets into the eyes, remove any contact lenses at once and irrigate immediately. If this chemical contacts the skin, wash with soap. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and do induce vomiting. Do not make an unconscious person vomit.

For Cadmium Fume — If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration.

Personal Protective Methods: *For Cadmium Dust* — Wear eye protection to prevent any possibility of eye contact with $CdCl_2$. Employees should wash daily at the end of each work shift. Work clothing should be changed daily if it is possible that clothing is contaminated. Provide eyewash if $CdCl_2$ is involved.

Respirator Selection:

For Cadmium Dust —

NIOSH
at any detectable concentration:
SCBAF:PD,PP/
SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

For Cadmium Fume —

NIOSH
at any detectable concentration:
SCBAF:PD,PP/
SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Storage: Prior to working with Cadmium you should be trained on its proper handling and storage. A regulated, marked area should be established where Cadmium is handled, used, or stored. Cadmium must be stored to avoid contact with Sulfur, Selenium, Tellurium, Ammonium Nitrate, and Hydrazoic Acid since violent reactions occur. Store in tightly closed containers in a cool, well-ventilated area away from Oxidizers (such as Perchlorates, Peroxides, Permanganates, Chlorates, and Nitrates). Sources of ignition such as smoking and open flames are prohibited where Cadmium is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Shipping: Cadmium metal and dust are not specifically cited in DOT's Performance Oriented Packaging Standards (19).

Spill Handling: Restrict persons not wearing protective equipment from area of spill until clean-up is complete. Remove all ignition sources.

Fire Extinguishing: Cadmium is a flammable powder. Toxic fumes are produced in a fire. Use dry chemicals appropriate for extinguishing metal fires. Do not use water.

Disposal Method Suggested: With cadmium compounds in general, precipitation from solution as sulfides, drying and return of the material to suppliers for recovery is recommended. Cadmium may be recovered from battery scrap as an alternative to disposal. (22).

References

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U.S. Public Health Service, "Toxicological Profile for Cadmium," Agency for Toxic Substances and Disease Registry (November 1987).

CALCIUM

CAM

Common Synonyms	Solid	Silvery to grayish white	Odorless
	Sinks in water. Reacts slowly with water		

Avoid contact with solid and dust. Keep people away.
Wear rubber overclothing (including gloves).
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Extinguish with dry graphite, soda ash, or other inert powder.
DO NOT USE WATER, FOAM, CARBON DIOXIDE OR VAPORIZING LIQUIDS ON FIRE.

Exposure

CALL FOR MEDICAL AID.
SOLID
Will burn skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Disperse and flush

2. LABEL

2.1 Category: Flammable solid
2.2 Class: 4

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not applicable
3.2 Formula: Ca
3.3 IMO/UN Designation: 4.3/1401
3.4 DOT ID No.: 1401
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: Silvery; turns to grayish-white on exposure to air.
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Goggles and rubber gloves.
5.2 Symptoms Following Exposure: Contact with eyes or skin produces caustic burns.
5.3 Treatment of Exposure: Flush with water
5.4 Threshold Limit Value: Not pertinent
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: Data not available
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Not pertinent
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: Not pertinent

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent (flammable solid)
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Dry graphite, soda ash, powdered sodium chloride, or appropriate metal fire extinguishing dry powder.
6.4 Fire Extinguishing Agents Not to be Used: Water, halogenated hydrocarbons, dry chemical, carbon dioxide, foam
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Burns violently, especially if finely divided.
6.7 Ignition Temperature: 1454 ± 18°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts to form flammable hydrogen gas, which may ignite. The reaction is not violent.
7.2 Reactivity with Common Materials: Reacts with moist air to form skin of hydroxide. The reaction is not hazardous.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water
7.5 Polymerization: Stable
7.6 Inhibitor of Polymerization: Stable
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: See Calcium hydroxide (CaH_2)
8.2 Waterfowl Toxicity: See Calcium hydroxide (CaH_2)
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial, 99.5%; redistilled 99.9%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Sealed containers must be in a ventilated area.

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
II-RIR

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable solid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	1
Reactivity (Yellow)	2
	W

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 40.1
12.3 Boiling Point at 1 atm: 2,714°F = 1,490°C = 1,763°K
12.4 Freezing Point: 1,562°F = 850°C = 1,123°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.55 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: −6790 Btu/lb = −3,770 cal/g = −150 X 10^6 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 55.7 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

Carbazole, 99% (UV-Vis)
ACROS95433

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Carbazole, 99% (UV-Vis)
Catalog Numbers:
AC403950000, AC403950250, AC403951000, AC403955000
Synonyms:
9-Azafluorene; Dibenzopyrrole; Diphenylenimine; 9H-Carbazole.
Company Identification (Europe): Acros Organics N.V.
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium
Company Identification (USA): Acros Organics
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800 ACROS-01
For information in Europe, call: 0032(0) 14575211
For emergencies in the US, call CHEMTREC: 800-424-9300
For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
86-74-8	9H-Carbazole	99	201-696-0

Hazard Symbols: XN
Risk Phrases: 40

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: tan.
Caution! May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause cancer based on animal studies.
Target Organs: None.

Potential Health Effects
Eye:
May cause eye irritation.
Skin:
May cause skin irritation.
Ingestion:
May cause gastrointestinal irritation with nausea, vomiting and diarrhea.
Inhalation:
May cause respiratory tract irritation.
Chronic:
May cause cancer according to animal studies.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin:
Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an

unconscious person. Get medical aid immediately.

Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Treat symptomatically and

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:
In case of fire use water spray, dry chemical, carbon dioxide, or chemical foam. Use agent most appropriate to extinguish fire.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Vacuum or sweep up material and place into a suitable disposal container. Reduce airborne dust and prevent scattering by moistening with water. Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with skin and eyes. Avoid ingestion and inhalation.

Storage:
Store in a cool, dry place. Store in a tightly closed container.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
9H-Carbazole	none listed	none listed	none listed

OSHA Vacated PELs:
9H-Carbazole:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin

exposure.

Clothing:
Wear appropriate protective clothing to minimize contact with skin.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Powder
Appearance:	tan
Odor:	Not available.
pH:	Not available.
Vapor Pressure:	400 mm Hg @ 323
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	355 deg C
Freezing/Melting Point:	244 deg C
Autoignition Temperature:	Not applicable.
Flash Point:	428 deg F (220.00 deg C)
NFPA Rating:	(est.) Health: 1; Flammability: 0; Reactivity: 0
Explosion Limits, Lower:	Not available.
Upper:	Not available.
Decomposition Temperature:	Not available.
Solubility:	Insoluble in water.
Specific Gravity/Density:	1.1
Molecular Formula:	C12H9N
Molecular Weight:	167.0697

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, dust generation, excess heat.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Nitrogen oxides, carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 86-74-8: FE3150000
LD50/LC50:
Not available.
Carcinogenicity:
9H-Carbazole -
California: carcinogen; initial date 5/1/96
IARC: Group 3 carcinogen
Epidemiology:
No information available.
Teratogenicity:
No information available.
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:

otr-rat-orl:504 mg/kg/6W
Other Studies:
No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
log Pow:3.72 Trout, bluegill sunfish and goldfish exposed to 5 ppm died within 7 hr. Test conditions: temperature 30øC, dissolved oxygen 7.5 ppm; total hardness (soap method) 300 ppm; alkalinity 310 ppm (methyl orange); free carbon dioxide 5 ppm [Wood, E.M. - The Toxicity of 3400 Chemicals to Fish - 1987, Part 1] EC50 (5,15,30 min) Photobacterium phosphoreum 11.6 ppm Microtox test [Kaiser, K.L.E. et al - Water Pollut. Res. J. Can. - 1991, 26

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classif as a hazardous waste.
US EPA guidelines for the classification determination are listed in 40 CFR Part Additionally, waste generators must consult state and local hazardous waste regu ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 86-74-8 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 86-74-8: Effective Date: March 7, 1986; Sunset Date: March 7, 199 6
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
None of the chemicals in this material have an RQ.
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
Section 313
No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

9H-Carbazole can be found on the following state right to know lists: California.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains 9H-Carbazole, a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN

Risk Phrases:

R 40 Possible risks of irreversible effects.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 86-74-8: 2

United Kingdom Occupational Exposure Limits

Canada

CAS# 86-74-8 is listed on Canada's DSL/NDSL List.

This product has a WHMIS classification of D2A.

CAS# 86-74-8 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 2/08/1999 Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

CHROMIUM AND COMPOUNDS

Carcinogen (NTP) (10)
Banned or Severely Restricted (Many countries, many categories) (UN) (35)
Air Pollutant Standard Set (ACGIH) (1) (HSE) (33) (OSHA) (58) (Others) (35) (UNEP) (43) (Several States) (60)
Water Pollution Standard Proposed (EPA) (6) (EEC, WHO) (35) (Maine, Minnesota) (61)
Hazardous Substance (EPA) (RQ = 1.0/0.454) (4)
Priority Toxic Pollutant (EPA) (6)
Toxic Chemical (EPA) (8)
Cited in U.S. State regulations: Alaska (G), Connecticut (A), Florida (G), Illinois (G), Maine (G,W), Maryland (G), Massachusetts (G,A), Michigan (G), Minnesota (W), Montana (A), Nevada (A), New Hampshire (G), New Jersey (G), New York (G,A), North Carolina (A), North Dakota (A), Pennsylvania (G,A), Rhode Island (G,A), Virginia (A), West Virginia (G).

Description: Chromium may exist in one of three valence states in compounds, +2, +3, and +6. Chromium (elements) is a steel-gray lustrous metal.

Code Numbers:

Elemental Cr	CAS 7440-47-3	RTECS GB4200000

Potential Exposures: Chronium metal is used for greatly increasing resistance and durability of metals and for chrome plating of other metals.

Incompatibilities: Chromium metal and insoluble salts: Strong oxidizers.

Permissible Exposure Limits in Air: ACGIH (1) has set a TWA for trivalent chromium of 0.5 mg/m^3 but no STEL value, as has HSE (33) and OSHA (58). For hexavalent chromium, ACGIH (1) and HSE (33) have set TWA values of 0.05 mg/m^3 and OSHA a value of 0.1 mg/m^3.

Sweden (35) has this same limit. However, Czechoslovakia has a TWA of 0.05 mg/m^3. Germany and Japan have set no MAK's, simply classifying chromium as a carcinogen.

The USSR/UNEP joint project (43) has set a limit (both momentary and daily average) of 0.0015 mg/m^3 for ambient air in residential areas.

In addition, a number of states have set guidelines or standards for chromium in ambient air (60) ranging from zero (North Carolina) to 0.00009 $\mu g/m^3$ (Rhode Island) to 0.068 $\mu g/m^3$ (Massachusetts) to 0.07 - 0.39 $\mu g/m^3$ (Montana) to 0.12 $\mu g/m^3$ (Pennsylvania) to 0.167 $\mu g/m^3$ (New York) to 0.5 $\mu g/m^3$ (Virginia) to 2.5 $\mu g/m^3$ (Connecticut) to 5.0 $\mu g/m^3$ (North Dakota) to 12.0 $\mu g/m^3$ (Nevada).

Determination in Air: For chromium metal and both insoluble and soluble salts: collection on a filter followed by acid workup and analysis by atomic absorption; see NIOSH Method 7024 for Chromium and OSHA Methods ID121 and ID125 (58).

Permissible Concentration in Water: For the protection of freshwater aquatic life: Trivalent chromium: not to exceed e [1.08 ln (hardness) + 3.48] $\mu g/\ell$. Hexavalent chromium: 0.29 $\mu g/\ell$ as a 24 hour average, never to exceed 21.0 $\mu g/\ell$. For the protection of saltwater aquatic life: Trivalent chromium: 10,300 $\mu g/\ell$ on an acute toxicity basis. Hexavalent chromium: 18 $\mu g/\ell$ as a 24 hour average, never to exceed 1,260 $\mu g/\ell$. To protect human health: Trivalent chromium: 170 $\mu g/\ell$; hexavalent chromium 50 $\mu g/\ell$ according to EPA (6).

EPA (49) has set a long-term health advisory for adults of 0.84 mg/ℓ and a lifetime health advisory of 0.12 mg/ℓ (120 $\mu g/\ell$) for chromium. EPA has recently proposed a maximum drinking water level of 0.1 mg/ℓ (62).

Germany has set a limit of 0.05 mg/ℓ in drinking water, as has the EEC and WHO (35).

The states of Maine and Minnesota have set guidelines for chromium in drinking water (61) of 50 $\mu g/\ell$ for Maine and 120 $\mu g/\ell$ for Minnesota.

Determination in Water: Total chromium may be determined by digestion followed by atomic absorption or by colorimetry (diphenylcarbazide) or by inductively coupled plasma (CP) optical emission spectrometry. Chromium (VI) may be determined by extraction and atomic absorption or colorimetry (using diphenylhydrazide). Dissolved total Cr or Cr(VI) may be determined by 0.45 μ filtration followed by the above-cited methods (49).

Routes of Entry: Inhalation, ingestion, and eye and skin contact.

Harmful Effects and Symptoms: Chromium can affect you when breathed in. Chromium metal ore has been reported to cause lung allergy. Chromium fumes can cause "metal fume fever," a flu-like illness lasting about 24 hours with chills, aches, cough and fever. Chromium particles can irritate the eyes.

The above cautions apply to chromium metal. Since chromium is a reasonably reactive metal, thought must be given to the actions of combined chromium and particularly to the presence or absence of carcinogenic effects in various chromium compounds.

A table of differentiation between noncarcinogenic and carcinogenic chromium (VI) compounds has been presented by NIOSH as shown below.

NIOSH has not conducted an in-depth study of the toxicity of chromium metal or compounds containing chromium in an oxidation state other than chromium(VI). NIOSH recommends that the permissible exposure limit for carcinogenic chromium(VI) compounds be reduced to 0.001 mg/m^3 and that these compounds be regulated as occupational carcinogens. NIOSH also recommends that the permissible exposure limit for noncarcinogenic chromium(VI) be reduced to 0.025 mg/m^3 averaged over a workshift of up to 10 hours per day, 40 hours per week, with a ceiling level of 0.05 mg/m^3 averaged over a 15-minute period. It is recommended further that chromium (VI) in the workplace be considered carcinogenic, unless it has been demonstrated that only the noncarcinogenic chromium (VI) compounds mentioned below are present. The NIOSH Criteria Documents for Chromic Acid and Chromium (VI) should be consulted for more detailed information.

Noncarcinogens

Evident	Inferred
Sodium bichromate	Lithium bichromate
Sodium chromate	Lithium chromate
Chromium(VI) oxide	Potassium bichromate
	Potassium chromate
	Rubidium bichromate
	Rubidium chromate
	Cesium bichromate
	Cesium chromate
	Ammonium bichromate
	Ammonium chromate

Carcinogens

Evident	Inferred
Calcium chromate	Alkaline earth chromates and bichromates
Sintered calcium chromate	Chromyl chloride
Alkaline lime-roasting process residue	tert-Butyl chromate
Zinc potassium chromate	Other chromium(VI) materials not listed in this table.
Lead chromate	

Points of Attack:

Chromium metal and insoluble salts: respiratory system and lungs

Medical Surveillance: Preemployment physical examinations should include: a work history to determine past exposure to chromic acid and hexavalent chromium compounds, exposure to other carcinogens, smoking history, history of skin or pulmonary sensitization to chromium, history or presence of dermatitis, skin ulcers, or lesions of the nasal mucosa and/or perforation of the septum, and a chest x-ray. On periodic examinations an evaluation should be made of skin and respiratory complaints especially in workers who demonstrate allergic reactions. Chest x-rays should be taken yearly for workers over age 40, and every five years for younger workers. Blood, liver, and kidney function should be evaluated periodically.

First Aid: If this chemical gets into the eyes, remove any contact lenses at once and irrigate immediately. If this chemical contacts the skin, flush with water and wash with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: Respirators should be used in areas where dust, fumes or mist exposure exceeds Federal standards of where brief concentrations exceed the TWA, and for emergencies. Dust, fumes and mist filter-type respirators or supplied air respirators should be supplied all workers exposed, depending on concentration of exposure.

Respirator Selection: Since Chromium exists in so many compounds in different oxidation states, the respirator requirements for various chromium compounds (in addition to chromium metal) will be reviewed here:

Chromic Acid and Chromates

NIOSH
0.5 mg/m³: DMXSQ/SA/SCBA
1.25 mg/m³: PAPRHiE/SA:CF
2.50 mg/m³: HiEF/SCBAF/SAF/PAPRTHiE
30 mg/m³: SAF:PD,PP
Emergency or planned entry in unknown concentration or
IDLH conditions: SCBAF:PD,PP/SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Carcinogenic Cr (VI)–Insoluble

NIOSH
at any detectable concentration: SCBAF:PD,PP/SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Noncarcinogenic Cr (VI)–Insoluble

0.25 mg/m³: SA/SCBA/DMXSQ
0.625 mg/m³: PAPRHiE/SA:CF
1.25 mg/m³: HiEF/PAPRTHiE/SCBAF/SAF
25 mg/m³: SA:PD,PP
50 mg/m³: SAF:PD,PP
Emergency or planned entry in unknown concentration or
IDLH conditions: SCBAF:PD,PP/SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Soluble Chromic and Chromous Salts

OSHA
2.5 mg/m³: DMXS
5 mg/m³: DMXSQ/SA:SCBA
12.5 mg/m³: PAPRDM/SA:CF
25 mg/m³: HiEF/PAPRTHiE/SCBAF/SAF
250 mg/m³: SAF:PD,PP
Emergency or planned entry in unknown concentration or
IDLH conditions: SCBAF:PD,PP/SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Storage: A regulated, marked area should be established where Chromium is handled, used, or stored. Chromium must be stored to avoid contact with Strong Oxidizers (such as Chlorine, Bromine, and Fluorine) since violent reactions occur. Sources of ignition such as smoking and open flames are prohibited where Chromium is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Shipping: Chromium metal is not specifically cited in DOT's Performance-Oriented Packaging Standards (19).

Spill Handling: Restrict persons not wearing protective equipment from area of spill until clean-up is complete. Collect powdered material in the most convenient and safe manner and deposit in sealed containers.

Fire Extinguishing: Chromium metal is a combustible dust/powder. The powder may even explode in the air.

Disposal Method Suggested: Recovery and recycle is a viable alternative to disposal for chromium in plating wastes, tannery wastes, cooling tower blowdown water and chemical plant wastes.

References

National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Chromic Acid*, NIOSH Publication No. 73-11021 (1973).

National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Chromium (VI)*, NIOSH Document No. 76-129 (1976).

National Institute for Occupational Safety and Health, *Information Profiles on Potential Occupational Hazards: Inorganic Chromium Compounds*, Report PB-276,678, pp 136-142, Rockville, MD (October 1977).

U.S. Environmental Protection Agency, *Chromium: Ambient Water Quality Criteria*, Washington, DC (1980).

U.S. Environmental Protection Agency, *Chromium*, Health and Environmental Effects Profile No. 51, Office of Solid Waste, Washington, DC (April 30, 1980).

Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, *1*, No. 1, 40-41 (1980) and *3*, No. 3, 65-68 (1983).

New Jersey Department of Health, "Hazardous Substance Fact Sheet: Chromium," Trenton, NJ (January 1986).

New York State Department of Health, "Chemical Fact Sheet: Chromium Metal," Albany, NY, Bureau of Toxic Substance Assessment (January 1986).

U.S. Public Health Service, "Toxicological Profile for Chromium," Atlanta, Georgia, Agency for Toxic Substances and Disease Registry (October 1987).

CHRYSENE

Carcinogen (Animal Positive) (IARC) (9) (Suspected Human) (ACGIH) (1) (DFG) (3)
Air Pollutant Standard Set (ACGIH) (1) (DFG) (3) (North Dakota, Virginia) (60)
Water Pollution Standard Proposed (EPA) (6) (Kansas) (61)
Hazardous Substance (EPA) (RQ=1.0/0.454) (4)
Hazardous Waste (EPA-RCRA) (#U-050) (5)
Priority Toxic Pollutant (EPA) (6)
Cited in U.S. State regulations: Alaska (G), Florida (G), Kansas (G,W), Louisiana (G), Maine (G), Massachusetts (G), New Hampshire (G), New Jersey (G), North Dakota (A), Pennsylvania (G), Rhode Island (G), Vermont (G), Virginia (G,A), Washington (G), Wisconsin (G).

Description: Chrysene, $C_{18}H_{12}$, is a polynuclear aromatic hydrocarbon which forms red, blue, fluorescent crystals. They are odorless and melt at 254°C.

Code Numbers: CAS 218-01-9 RTECS GC0700000

Synonyms: 1,2-Benzophenanthrene; 1,2,5,6-dibenzonaphthalene.

Potential Exposure: Chrysene is found in gasoline and diesel exhaust as well as in cigarette smoke and in coal tar. It is used in organic synthesis.

Permissible Exposure Limits in Air: ACGIH sets no numerical limits but simply lists chrysene as a suspected human carcinogen. DFG (3) also sets no limit but simply notes chrysene to be a proven animal carcinogen and a possible human carcinogen.

Guidelines for chrysene concentration in ambient air (60) have been set at zero by North Dakota and at 3.0 $\mu g/m^3$ by Virginia.

Determination in Air: See NIOSH analytical methods for polynuclear hydrocarbons #5506 (GLC) and 5515 (G.C).

Permissible Concentration in Water: In view of the carcinogenicity of polynuclear aromatic, the concentration in water is preferably zero as noted by EPA (6). Kansas (61) gives a guideline for chrysene in drinking water of 0.029 $\mu g/\ell$.

Determination in Water: Extraction with methylene chloride may be followed by measurement by ultraviolet or by HPLC/flame spectrometry or by gas chromatography and mass spectrometry as reviewed in the ATSDR document referenced below.

Routes of Entry: Inhalation, skin contact, ingestion.

Harmful Effects and Symptoms: Chrysene can affect you when breathed in and by passing through your skin. Chrysene should be handled as a carcinogen – with extreme caution. Skin contact may cause a rash. If skin is exposed to sunlight, a "sunburn" can occur. Sunlight exposure on skin contaminated with coal tar chemicals such as chrysene can cause rash and later, pigment changes. Persons who smoke cigarettes may be at increased lung cancer risk with this chemical. This can be significantly reduced by stopping smoking as well as by reducing exposures.

Medical Surveillance: Monthly, carefully look at any skin areas that are exposed. Any growth (like a mole) that increases in size or shows changes in color should be examined by a physician. Skin cancer is curable when detected early.

First Aid: *Eye Contact* – Immediately remove any contact lenses and flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact – Remove contaminated clothing as promptly as possible. Wash thoroughly with large amounts of soap and water.

Personal Protective Methods: *Clothing* – Avoid skin contact with Chrysene. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.

All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection – Eye protection is included in the recommended respiratory protection.

Respirator Selection: At any exposure level, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in the positive pressure mode or with a full facepiece, hood, or helmet in the continuous flow mode, or use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

Storage: Prior to working with Chrysene you should be trained on its proper handling and storage. Store in tightly closed containers in a cool, well-ventilated area.

Shipping: Chrysene is not specifically cited in DOT's Performance-Oriented Packaging Standards (19).

Spill Handling: Restrict persons not wearing protective equipment from areas of spills until clean-up is complete. Collect spilled material in the most convenient and safe manner and deposit in sealed containers for reclamation or for disposal in an approved facility. Absorb liquid containing Chrysene in vermiculite, dry sand, earth, or similar material.

Fire Extinguishing: Extinguish fire using an agent suitable for type of surrounding fire. Chrysene itself burns only with difficulty.

Disposal Method Suggested: Chrysene may be destroyed by permanganate oxidation, by high temperature incinerator with scrubbing equipment or by microwave plasma treatment.

COAL TAR PITCH VOLATILES

Carcinogen (Animal and Human Positive) (IARC) (9) (ACGIH) (1) (DFG) (3)
Banned or Severely Restricted (Coal Tar Oils) (UN) (35)
Air Pollutant Standard Set (ACGIH) (1) (DFG) (3) (HSE) (33) (OSHA) (58) (Several States) (60)
Water Pollution Standard Proposed (EPA) (6)
Hazardous Substance (EPA) (RQ=1.0/0.454) (4)
Hazardous Waste (EPA-RCRA) (Creosote=U-051) (5)
Priority Toxic Pollutant (EPA) (6)
Cited in U.S. State regulations: Alaska (G), Connecticut (A), Illinois (G), Kansas (G,A), Louisiana (G), Maine (G), Massachusetts (G), Nevada (A), New Hampshire (G), New Jersey (G), North Carolina (A), Pennsylvania (G,A), Rhode Island (G), Vermont (G), Virginia (G,A), Washington (G), West Virginia (G), Wisconsin (G).

Description: The term "coal tar products," as used by NIOSH, includes coal tar and two of the the fractionation products of coal tar, creosote and coal tar pitch, derived from the carbonization of bituminous coal. Coal tar, coal tar pitch, and creosote derived from bituminous coal often contain identifiable components which by themselves are carcinogenic, such as benzo[a] pyrene, benzanthracene, chrysene, and phenanthrene. Other chemicals from coal tar products, such as anthracene, carbazole, fluoranthene, and pyrene may also cause cancer, but these causal relationships have not been adequately documented. Coal tar pitch has a flash pt. of 207°C. Creosote oil has a flash pt. of 74°C.

Code Numbers:

Coal tar	CAS 8007-45-2	RTECS GF8600000	UN 1999
Coal tar pitch	CAS 65996-93-2	RTECS GF8655000	—
Coal tar distillate	CAS 65996-92-1	RTECS GF8617500	UN 1136 and UN 1137
Coal tar creosote	CAS 8001-58-9	RTECS 8615000	UN 1993

Synonyms: None.

Potential Exposures: The coke-oven plant is the principal source of coal tar. The hot gases and vapors produced during the conversion of coal to coke are collected by means of a scrubber, which condenses the effluent into ammonia, water, crude tar, and other by-products. Crude tar is separated from the remainder of the condensate for refining and may undergo further processing.

Employees may be exposed to pitch and creosote in metal and foundry operations, when installing electrical equipment, and in construction, railway, utility, and briquette manufacturing.

Incompatibilities: Strong oxidizers.

Permissible Exposure Limits in Air: The ACGIH (1988/89) and OSHA (58) have set a TWA value of 0.2 mg/m^3 for benzene soluble with the notation that these materials are confirmed human carcinogens. The HSE (33) has set the same TWA value but the DFG (3) has set no MAK value, simply indicating that coal tar, coal tar pitch and coal tar oils are proven human carcinogens.

Several states have set guidelines or standards for coal tar pitch volatiles in ambient air (60) ranging from zero (North Carolina) to 0.0161 μg/m^3 (Kansas) to 0.48 μg/m^3 (Pennsylvania) to 2.0 μg/m^3 (Connecticut and Virginia) to 5.0 μg/m^3 (Nevada).

Determination in Air: Collection on a filter, extraction, column chromatography, spectrophotometric measurement. Benzene solubles may be determined by collection of particulates on a filter, ultrasonic extraction with benzene, evaporation and gravimetric determination. (See NIOSH Method 5023.)

Permissible Concentrations in Water: See "Polynuclear Aromatic Hydrocarbons."

Determination in Water: See "Polynuclear Aromatic Hydrocarbons."

Routes of Entry: *Inhalation and skin and eye contact.*

Harmful Effects and Symptoms: Based on a review of the toxicologic and epidemiologic evidence presented, it has been concluded that some materials contained in coal tar pitch,and, therefore, in coal tar, can cause lung and skin cancer, and perhaps cancer at other sites. Based on a review of experimental toxicologic evidence, it is also concluded that creosote can cause skin and lung cancer. While the evidence on creosote is not so strong as that on pitch (in part because of difficulties in chemical characterization of such mixtures), the conclusion on the carcinogenic potential of creosote is supported by information on the presence of polynuclear aromatic hydrocarbons and imputations and evidence of the carcinogenicity of such hydrocarbons.

The overwhelming scientific evidence in the record supports the finding that coke oven emissions are carcinogenic. This finding rests on epidemiological surveys as well as animal studies and chemical analyses of coke oven emissions. Coke oven workers have an increased risk of developing cancer of the lung and urinary tract. In addition, observations of animals and of human populations have shown that skin tumors can be induced by the products of coal combustion and distillation. Chemical analyses of coke oven emissions reveal the presence of a large number of scientifically recognized carcinogens as well as several agents known to enhance the effect of chemical carcinogens especially on the respiratory tract.

Points of Attack: Respiratory system, lungs, bladder, kidneys, skin.

Medical Surveillance: Medical surveillance shall be made available, as specified below, to all employees occupationally exposed to coal tar products.

Preplacement Medical Examinations — These examinations shall include:

- Comprehensive initial medical and work histories, with special emphasis directed toward identifying preexisting disorders of the skin, respiratory tract, liver, and kidneys.
- A physical examination giving particular attention to the oral cavity, skin, and respiratory system. This shall include posteroanterior and lateral chest x-rays (35 x 42 cm). Pulmonary function tests, including forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV 1.0), and a sputum cytology examination shall be offered as part of the medical examination of exposed employees. Other tests, such as liver function and urinalysis, should be performed as considered appropriate by the responsible physician. In addition, the mucous membranes of the oral cavity should be examined.
- A judgement of the employee's ability to use positive pressure respirators.

Periodic Examinations — These examinations shall be made available at least annually and shall include:

- Interim medical and work histories.
- A physical examination as outlined above.

Initial Medical Examinations — These examinations shall be made available to all workers as soon as practicable after the promulgation of a standard based on these recommendations.

Pertinent Medical Records — These records shall be maintained for at least 30 years after termination of employment. They shall be made available to medical representatives of the government, the employer or the employee.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, wash with soap. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration.

Personal Protective Methods: Employers shall use engineering controls when needed to keep the concentration of airborne coal tar products at, or below, the specified limit. Employers shall provide protective clothing and equipment impervious to coal tar products to employees whenever liquid coal tar products may contact the skin or eyes. Emergency equipment shall be located at well-marked and clearly identified stations and shall be adequate to permit all personnel to escape from the area or to cope safely with the emergency on reentry. Protective equipment shall include: eye and face protection; protective clothing; and respiratory protection as spelled out in detail by NIOSH.

Respirator Selection:

NIOSH
at any detectable concentration: SCBAF:PD,PP/
SAF:PD,PP:ASCBA
Escape: GMFHiEOV/SCBAE

Storage: A regulated, marked area should be established where Coal Tar Creosote is handled, used, or stored. Entry into areas containing Coal Tar Creosote is to be controlled by permit only. Store in tightly closed containers in a cool, well-ventilated area away from strong oxidizers (such as Chlorine, Bromine, and Fluorine). Sources of ignition such as smoking and open flames are prohibited where Coal Tar Creosote is used, handled, or stored in a manner that could create a potential fire or explosion hazard. Metal containers involving the transfer of 5 gallons or more of Coal Tar Creosote should be grounded and bonded. Drums must be equipped with self-closing valves, pressure vacuum bungs, and flame arresters.

Shipping: Coal tar distillates, flammable fall in Hazard Class 3 and Packaging Group III. Such materials require a "Flammable Liquid" label. The limit on passenger aircraft or railcar shipment is 60 liters; on cargo aircraft shipment is 220 liters.

Spill Handling: Restrict persons not wearing protective equipment from area of spill or leak until clean-up is complete. Remove all ignition sources. Keep Coal Tar Creosote out of a confined space, such as a sewer because of the possibility of an explosion, unless the sewer is designed to prevent the build-up of explosive concentrations.

Fire Extinguishing: Coal Tar Creosote is a combustible liquid. Use dry chemical, CO_2, water spray, or foam extinguishers.

Disposal Method Suggested: Incineration (22).

References

National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Coal Tar Products*, NIOSH Document No. 78-107, Washington, DC (September 1977).

U.S. Environmental Protection Agency, *Creosote*, Health and Environmental Effects Profile No. 53, Office of Solid Waste, Washington, DC (April 30, 1980).

New Jersey Department of Health, "Hazardous Substance Fact Sheet: Coal Tar Creosote," Trenton, NJ (January 1986).

COPPER

Harmful Effects and Symptoms: *Local* — Copper salts act as irritants to the intact skin causing itching, erythema, and dermatitis. In the eyes, copper salts may cause conjunctivitis and even ulceration and turbidity of the cornea. Metallic coppes may cause keratinization of the hands and soles of the feet, but it is not commonly associated with industrial dermatitis.

Systemic — Industrial exposure to copper occurs chiefly from fumes generated in welding copper-containing metals. The fumes and dust cause irritation of the upper respiratory tract, metallic taste in the mouth, nausea, metal fume fever, and in some instances discoloration of the skin and hair. Inhalation of dusts, fumes, and mists of copper salts may cause congestion of the nasal mucous membranes, sometimes of the pharynx, and on occasions ulceration with perforation of the nasal septum. If the salts reach the gastrointestinal tract, they act as irritants producing salivation, nausea, vomiting, gastric pain, hemorrhagic gastritis, and diarrhea. It is unlikely that poisoning by ingestion in industry would progress to a serious point as small amounts induce vomiting, emptying the stomach of copper salts.

Chronic human intoxication occurs rarely and then only in individuals with Wilson's disease (hepatolenticular degeneration). This is a genetic condition caused by the pairing of abnormal autosomal recessive genes in which there is abnormally high absorption, retention, and storage of copper by the body. The disease is progressive and fatal if untreated.

Points of Attack: For copper dusts and mists: respiratory system, lungs, skin, liver, including risk with Wilson's disease, kidneys. For copper fume: respiratory system, skin, eyes, and risk with Wilson's disease.

Medical Surveillance: Consider the skin, eyes, and respiratory system in any placement or periodic examinations.

First Aid: For copper dusts and mists: If this chemical gets into the eyes, remove any contact lenses at once and irrigate immediately. If this chemical contacts the skin, wash with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

For copper fume: If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration.

Personal Protective Methods: For copper dusts or mists: Wear appropriate clothing to prevent repeated or prolonged skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash promptly when skin is contaminated. Work clothing should be changed daily if clothing is contaminated. Remove nonimpervious clothing promptly if contaminated.

Respirator Selection:

Copper dusts and mists:

OSHA
5 mg/m^3: DMXS
10 mg/m^3: DMXSQ/SA/SCBA
25 mg/m^3: PAPRDM/SA:CF
50 mg/m^3: HiEF/SCBAF/SAF/PAPRTHiE
1000 mg/m^3: SA:PD,PP
2000 mg/m^3: SAF:PD,PP
Emergency or planned entry in unknown concentration or IDLH conditions: SCBAF:PD,PP/SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Copper fume:

OSHA
1mg/m^3: DMFu/SA/SCBA
2.5 mg/m^3: PAPRDMFu/SA:CF
5 mg/m^3: HiEF/PAPRTHiE
SCBAF/SAF/SAT:CF
100 mg/m^3: SA:PD,PP
200 mg/m^3: SAF:PD,PP
Emergency or planned entry in unknown concentration or IDLH conditions: SCBAF:PD,PP/SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Storage: Store to avoid conditions which create fumes or fine dusts. Also store to avoid contact with oxidizers.

Shipping: Copper is not specifically cited in DOT's Performance-Oriented Packaging Standards (19).

Spill Handling: Warn other workers of spill. Put on proper protective equipment and clothing. Sweep or vacuum up solids being careful not to raise dust levels.

Fire Extinguishing: Use powdered dolomite, sodium chloride (common salt) or graphite. Do not use water.

Disposal Methods Suggested: Copper-containing wastes can be concentrated through the use of ion exchange, reverse osmosis, or evaporators to the point where copper can be electrolytically removed and sent to a reclaiming firm. If recovery is not feasible, the copper can be precipitated through the use of caustics and the sludge deposited in a chemical waste landfill (22).

References

U.S. Environmental Protection Agency, *Toxicology of Metals, Vol. II: Copper*, Report-EPA-600/1-77-022, pp 206-221, Research Triangle Park, NC (May 1977).

U.S. Environmental Protection Agency, *Copper: Ambient Water Quality Criteria*, Washington, DC (1980).

National Academy of Sciences, *Medical and Biologic Effects of Environmental Pollutants: Copper*, Washington, DC (1977).

Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report, 1, No. 5, 48-49, New York, Van Nostrand Reinhold Co.* (1981). (Copper).

New Jersey Department of Health, "Hazardous Substance Fact Sheet: Copper," Trenton, NJ (April 1986).

New York State Department of Health, "Chemical Fact Sheet: Copper," Albany, NY, Bureau of Toxic Substance Assessment (January 1986 and Version 3).

Isopropylbenzene

CUMENE

CUM

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Cumol Isopropylbenzene	Floats on water		

Stop discharge if possible. Keep people away
Call fire department
Avoid contact with liquid.
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Combustible
Extinguish with water, dry chemical, foam or carbon dioxide
Cool exposed containers with water

Exposure

CALL FOR MEDICAL AID.
LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Floating to shoreline.
May be dangerous if it enters water intakes
Notify local health and pollution control officers.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_6H_5CH(CH_3)_2$
3.3 IMO/UN Designation: 3.3/1918
3.4 DOT ID No.: 1918
3.5 CAS Registry No.: 98-82-8

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Strong, slightly irritant, fragrant, aromatic.

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: As necessary to avoid skin exposure. If concentration in air is greater than 50 ppm, use self-contained breathing apparatus.
5.2 Symptoms Following Exposure: Narcotic action with long-lasting effects; depressant to central nervous system.
5.3 Treatment of Exposure: INHALATION: move patient immediately to fresh air, administer artificial respiration or oxygen if necessary; seek medical attention. SKIN OR EYES: wash exposed skin surfaces thoroughly; flush eyes thoroughly with water for 15 min.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 3, LD_{50} 50 to 500 mg/kg
5.7 Late Toxicity: None reported
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 1.2 ppm
5.11 IDLH Value: 8,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 111°F C.C.
6.2 Flammable Limits in Air: 0.9%-6.5%
6.3 Fire Extinguishing Agents: Foam, water, carbon dioxide or dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 797°F
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: 5.0 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 110 ppm/24 hr/Brine Shrimp/TL_m
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 40% of theoretical in 5 days, fresh water
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade; pure grade; technical grade
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	2
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 120.19
12.3 Boiling Point at 1 atm: 306.3°F = 152.4°C = 425.6°K
12.4 Freezing Point: −140.9°F = −96.1°C = 177.1°K
12.5 Critical Temperature: 676.2°F = 357.9°C = 631.1°K
12.6 Critical Pressure: 465.5 psia = 31.67 atm = 3.208 MN/m²
12.7 Specific Gravity: 0.866 at 15°C (liquid)
12.8 Liquid Surface Tension: 28.2 dynes/cm = 0.0282 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 54.6 dynes/cm = 0.0546 N/m at 22.7°
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.050
12.12 Latent Heat of Vaporization: 134 Btu/lb = 74.6 cal/g = 0.12×10^6 J/kg
12.13 Heat of Combustion: −17,710 Btu/lb = −9840 cal/g = -412.0×10^6 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.5 psia

NOTES

CYANIDES

Banned or Severely Restricted (In Agriculture) (Germany) (In Consumer Products) (US) (13)
Air Pollutant Standard Set (ACGIH) (1) (DFG) (HSE) (33) (OSHA) (58) (Several States) (60)
Water Pollution Standard Proposed (EPA) (6) (49) (Other Countries) (35) (USSR) (43) (Several States) (61)
Extremely Hazardous Substance (EPA-SARA) (TPQ = 100) (KCN and NaCH)
Hazardous Substance (EPA) (RQ = 10/4.54) (4)
Hazardous Waste (EPA-RCRA) (#P-030) (5)
Priority Toxic Pollutant (EPA) (6)
Toxic Chemical (EPA) (Cyanide Compounds) (8)
Cited in U.S. State Regulations: Alaska (G), Arizona (W), Connecticut (A), Florida (G,A), Illinois (G), Kansas (G,W), Louisiana (G), Maine (G), Maryland (G), Massachusetts (G), Michigan (G), Nevada (A), New Hampshire (G), New Jersey (G), New York (A), North Dakota (A), Oklahoma (G), Pennsylvania (G), Rhode Island (G), South Carolina (A), South Dakota (A), Vermont (G), Virginia (G,A), Washington (G), West Virginia (G), Wisconsin (G)

Description: KCN and NaCN are white solids with a faint almond odor. See the separate entries for potassium cyanide and sodium cyanide also.

Code Numbers:

Cyanide Ion	CAS 57-12-5	RTECS GS7175000	UN 1588
KCN	CAS 151-50-8	RTECS TS8750000	UN 1680
NaCN	CAS 143-33-9	RTECS VZ7525000	UN 1689

Synonyms: KCN = potassium cyanide; NaCN = sodium cyanide.

Potential Exposures: Sodium and potassium cyanides are used primarily in the extraction of ores, electroplating, metal treatment, and various manufacturing processes.

Incompatibilities: Strong oxidizers such as nitrates, chlorates, acids, acid salts.

Permissible Exposure Limits in Air: ACGIH (1), DFG (3), HSA (33) and OSHA (58) have recommended 5 mg/m^3 as a TWA. There is no STEL value. The IDLH level is 50 mg/m^3. ACGIH adds the notation "skin" indicating the possibility of cutaneous absorption as of 1988/89. The USSR-UNEP/IRPTC project (43) has set an MAC in workplace air of 0.3 mg/m^3. Further, they have set MAC values for ambient air in residential areas of 0.009 mg/m^3 on a momentary basis and 0.004 mg/m^3 on an average daily basis.

Several states have set guidelines or standards for cyanides in ambient air (60) ranging from 16.7 µg/m^3 (New York) to 50.0 µg/m^3 (Florida and North Dakota) to 80.0 µg/m^3 (Virginia) to 100 µg/m^3 (Connecticut and South Dakota) to 125 µg/m^3 (South Carolina) to 119.0 µg/m^3 (Nevada).

Determination in Air: Collection with a filter and impinger, workup with NaOH, measurement by ion-specific electrode. See NIOSH Method 7904 (18).

Permissible Concentration in Water: In 1976 the EPA criterion was 5.0 µg/ℓ for freshwater and marine aquatic life and wildlife. As of 1980, the criteria are: To protect freshwater aquatic life: 3.5 µg/ℓ as a 24-hour average, never to exceed 52.0 µg/ℓ. To protect saltwater aquatic life: 30.0 µg/ℓ on an acute toxicity basis; 2.0 µg/ℓ on a chronic toxicity basis. To protect human health: 200 µg/ℓ. The allowable daily intake for man is 8.4 mg/day (6).

On the international scene, the South African Bureau of Standards has set 10 µg/ℓ, the World Health Organization (WHO) 10 µg/ℓ and the Federal Republic of Germany 50 µg/ℓ as drinking water standards.

Other international limits (35) include an EEC limit of 50 µg/ℓ; Mexican limits of 200 µg/ℓ in drinking water and 1.0 µg/ℓ in coastal waters and a Swedish limit of 100 µg/ℓ. The USSR-UNEP/IRPTC project (43) has set an MAC of 100 µg/ℓ in water bodies used for domestic purposes and 50 µg/ℓ in water for fishery purposes.

The U.S.E.P.A. (49) has determined a no-observed-adverse-effect-level (NOAEL) of 10.8 mg/kg/day which yields a lifetime health advisory of 154 µg/ℓ. States which have set guidelines for cyanides in drinking water (61) include Arizona at 160 µg/ℓ and Kansas at 220 µg/ℓ.

Determination in Water: Distillation followed by silver nitrate titration or colorimetric analysis using pyridine pyrazolone (or barbituric acid).

Routes of Entry: Inhalation; skin absorption; ingestion; eye, skin contact.

Harmful Effects and Symptoms: Weakness, headaches; confusion; nausea, vomiting; eye and skin irritation; slow gasping respiration.

Points of Attack: Liver, kidneys, skin, cardiovascular system, central nervous system.

Medical Surveillance: Consider the points of attack in preplacement and periodic physical examinations.

First Aid: If this chemical gets into the eyes, remove any contact lenses at once and irrigate immediately. If this chemical contacts the skin, wash with soap immediately. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit. Use Amyl Nitrite Pearls.

Personal Protective Methods: Wear appropriate clothing to prevent any possibility of skin contact. Wear eye protection to prevent any possibility of eye contact. Employees should wash immediately when skin is wet or contaminated. Work clothing should be changed daily if it is possible that clothing is contaminated. Remove nonimpervious clothing immediately if wet or contaminated. Provide emergency showers and eyewash.

Respirator Selection:

NIOSH
50 mg/m^3: SA/SCBA
Emergency or planned entry in unknown concentration or
IDLH conditions: SCBAF:PD,PP/
SAF:PD,PP:ASCBA
Escape: GMFSHIE/SCBAE

Storage: Protect against physical damage. Store in cool dry place. Separate from other storage and protect from acids and oxidizing materials.

Shipping: Cyanides, inorganic, n.o.s. require a "Poison" label. They fall in Hazard Class 6.1 and in Packing Group II. The limit on passenger aircraft or railcar shipment is 25 kg; on cargo aircraft shipment is 100 kg.

Spill Handling: Avoid contact with solids, dusts or solutions. Wear chemical protective suit with self-contained breathing apparatus. Isolate and remove the spilled material.

Fire Extinguishing: Cyanides such as KCN and NaCN are not combustible themselves but contact with acid releases highly flammable hydrogen cyanide. Water may be used to fight cyanide fires.

Disposal Method Suggested: Add strong alkaline hypochlorite and react for 24 hours. Then flush to sewer with large volumes of water. (22).

References

U.S. Environmental Protection Agency, *Cyanides: Ambient Water Quality Criteria*, Washington, DC (1980).
National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Hydrogen Cyanide and Cyanide Salts*, NIOSH Document No. 77-108, Washington, DC (1977).
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p-Isopropyltoluene

p-CYMENE

CMP

Common Synonyms			
p-Isopropyltoluene 1-Methyl-4-isopropylbenzene Cymol Methylpropylbenzene Isopropylcresol	Liquid Floats on water	Colorless	Mild pleasant odor

Stop discharge if possible. Keep people away.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemicals, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Floating to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Have warning-water contaminant
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $p\text{-}CH_3C_6H_4CH(CH_3)_2$
3.3 IMO/UN Designation: 3.3/2046
3.4 DOT ID No.: 2046
3.5 CAS Registry No.: 99-87-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Mild, pleasant, aromatic, solvent-type

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained or air-line breathing apparatus; solvent-resistant rubber gloves; chemical splash goggles.
5.2 Symptoms Following Exposure: Inhalation causes impairment of coordination, headache. Contact with liquid causes mild irritation of eyes and skin. Ingestion causes irritation of mouth and stomach.
5.3 Treatment of Exposure: INHALATION: remove victim from contaminated area; administer artificial respiration if necessary; call physician. EYES: flush with water for 15 min.; call a physician. SKIN: wipe off liquid; wash well with soap and water. INGESTION: induce vomiting; get medical attention.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 2; oral rat LD_{50} 4,750 mg/kg. Oral human TD_{Lo} 86 mg/kg (affects central nervous system)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors are noticeable to eyes and throat.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 140°F O.C.; 117°F C.C.
6.2 Flammable Limits in Air: 0.7%–5.6%
6.3 Fire Extinguishing Agents: Foam, dry chemical, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 817°F
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: 6.1 mm/min
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: 95+%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	2
Health	
Vapor Irritant	0
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	1
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 134.2
12.3 Boiling Point at 1 atm: 351°F 177°C 450°K
12.4 Freezing Point: −90.2°F −67.9°C 205.3°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.857 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.09 dynes/cm 0.02809 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.41 dynes/cm 0.03641 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 122 Btu/lb 67.8 cal/g 2.84×10^5 J/kg
12.13 Heat of Combustion: −18,900 Btu/lb −10,400 cal/g -43.7×10^6 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 17.10 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Low

NOTES

Methylene chloride

DICHLOROMETHANE

DCM

Common Synonyms	Watery liquid	Colorless	Sweet, pleasant odor
Methylene chloride Methylene dichloride	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.
Wear goggles and self-contained breathing apparatus.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea and dizziness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
In the EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and pollution control officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Dispose and flush

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated Hydrocarbon
3.2 Formula: CH_2Cl_2
3.3 IMO/UN Designation: 6.0/1593
3.4 DOT ID No.: 1593
3.5 CAS Registry No.: 75-09-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (at shipment): Liquid
4.2 Color: Colorless
4.3 Odor: Pleasant, aromatic; like chloroform, sweet, ethereal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic vapor canister mask, safety glasses, protective clothing.
5.2 Symptoms Following Exposure: INHALATION: anesthetic effects, nausea and drunkenness. CONTACT WITH SKIN AND EYES: skin irritation, irritation of eyes and nose.
5.3 Treatment of Exposure: INHALATION: remove from exposure. Give oxygen if needed. INGESTION: no specific antidote. CONTACT WITH SKIN AND EYES: remove contaminated clothing; wash skin or eyes if affected.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2, LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 205-307 ppm
5.11 IDLH Value: 5,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable under conditions likely to be encountered.
6.2 Flammable Limits in Air: 13%-58%
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Decomposition products generated in a fire may be irritating or toxic.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 1184°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 30

8. WATER POLLUTION

8.1 Aquatic Toxicity: Not pertinent
8.2 Waterfowl Toxicity: Not pertinent
8.3 Biological Oxygen Demand (BOD): Not pertinent
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Aerosol grade, technical grade
9.2 Storage Temperature: Data not available
9.3 Inert Atmosphere: Inerted
9.4 Venting: Data not available

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-P-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: CFR4-A
11.2 NAS hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	1
Aesthetic Effect	2
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	0
Reactivity (Yellow)	1

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 84.93
12.3 Boiling Point at 1 atm: 104°F = 39.8°C = 312.9°K
12.4 Freezing Point: −142°F = −96.7°C = 176.3°K
12.5 Critical Temperature: 472°F = 245°C = 518°K
12.6 Critical Pressure: 885 psig = 60.8 atm = 6.17 MN/m²
12.7 Specific Gravity: 1.322 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 2.9
12.11 Ratio of Specific Heats of Vapor (Gas): 1.189
12.12 Latent Heat of Vaporization: 142 Btu/lb = 78.7 cal/g = 3.30 X 10⁵ J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: 14.69 cal/g
12.18 Limiting Value: Data not available
12.19 Solid Vapor Pressure: 13.8 psia

NOTES

2,6-DINITROTOLUENE

DNL

Common Synonyms	Solid or heated liquid	Yellow to red	Slight
2, 6-DNT Toluene, 2, 6-Dinitro-	Liquid solidifies. Solid and liquid sink in water.		

AVOID CONTACT WITH LIQUID AND SOLID. Keep people away.
Wear goggles, self-contained breathing apparatus and rubber overclothing (including gloves).
Stop discharge if possible.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

COMBUSTIBLE.
POISONOUS GASES MAY BE PRODUCED IN FIRE.
Containers may explode in fire.
Evacuate surrounding area.
Wear goggles and self-contained breathing apparatus.
Combat fires from safe distance or protected location.
Cool exposed containers with water.
Extinguish with water spray.

Exposure

CALL FOR MEDICAL AID.

LIQUID OR SOLID.
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
Will burn skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS, OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison, water contaminant
Restrict access
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $(NO_2)_2C_6H_3CH_3$
3.3 IMO/UN Designation: 6.1/2038
3.4 DOT ID No.: 2038
3.5 CAS Registry No.: 606-20-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: Yellow
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Safety glasses with side shields and face shield, self-contained breathing apparatus or air line masks, butyl rubber gloves, boots and protective clothing.
5.2 Symptoms Following Exposure: INHALATION, INGESTION OR SKIN ABSORPTION: Headache, weakness, nausea or dizziness, cyanosis, drowsiness, shortness of breath and collapse. Can burn eyes and skin.
5.3 Treatment of Exposure: Call a doctor. INHALATION: Remove from exposure. If cyanotic, oxygen can be administered. EYES: Flush with copious amounts of water. SKIN: Remove all contaminated clothing. Wash with lukewarm water and soap. INGESTION: Induce vomiting. Administer gastric lavage.
5.4 Threshold Limit Value: 1.5 mg/m³; skin contact contributes significantly to overall exposure. tributes significantly to overall exposure.
5.5 Short Term Inhalation Limits: 5 mg/m³
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50-500 mg/kg
5.7 Late Toxicity: Caused methemoglobinemia and anemia. Damaged spleen and liver. Brain damage was observed as was testicular atrophy.
5.8 Vapor (Gas) Irritant Characteristics: Not pertinent
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: 0.1 ppm in water.
5.11 IDLH Value: 200 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: (est.) 404°F C.C.
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Water, Carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Emits toxic fumes of oxides of nitrogen
6.6 Behavior in Fire: May explode when exposed to heat or flame.
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Solid
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 10-100 ppm/96 hr/fin fish/TL_m
8.2 Waterfowl Toxicity: Not pertinent
8.3 Biological Oxygen Demand (BOD): Not pertinent
8.4 Food Chain Concentration Potential: Not pertinent

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical mixtures such as 80-20 mix of 2, 4- and 2, 6-isomers available. Hazard properties are the same.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

H

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-E
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 182.13
12.3 Boiling Point at 1 atm: Not pertinent-decomposes
12.4 Freezing Point: 140.9°F = 60.5°C = 333.7°K
12.5 Critical Temperature: Data not available
12.6 Critical Pressure: Data not available
12.7 Specific Gravity: 1.283 at 111°C
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: 6.28
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Data not available
12.13 Heat of Combustion: —8080 Btu/lb = —4490 cal/g = —188.3 X 10^6 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

ETHYLBENZENE

ETB

Common Synonyms			
Phenylethane EB	Liquid	Colorless	Sweet, gasoline-like odor

Floats on water. Flammable, irritating vapor is produced.

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Floating to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic hydrocarbon
3.2 Formula: $C_6H_5CH_2CH_3$
3.3 IMO/UN Designation: 3.3/1175
3.4 DOT ID No.: 1175
3.5 CAS Registry No.: 100-41-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles.
5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.
5.3 Treatment of Exposure: INHALATION: If ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: Induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 Odor Threshold: 140 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 60°F O.C.; 55°F C.C.
6.2 Flammable Limits in Air: 1.0%-6.7%
6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating vapors are generated when heated.
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.
6.7 Ignition Temperature: 860°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 0.3 mm/min.
6.10 Adiabatic Flame Temperature: Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Ratio (Required to Produce): Data Not Available
7.8 Reactivity Groups: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 20 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 2.0% (Theor.), 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade: 99.99%; pure grade: 99.9%; technical grade: 99.5%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.17
12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 409.4°K
12.4 Freezing Point: −139°F = −95°C = 178°K
12.5 Critical Temperature: 651.3°F = 343.0°C = 617.1°K
12.6 Critical Pressure: 523 psia = 35.6 atm = 3.61 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.2 dynes/cm = 0.0292 N/m at 20°C
12.9 Liquid-Water Interfacial Tension: 35.40 dynes/cm = 0.0354 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35 × 10⁵ J/kg
12.13 Heat of Combustion: −17,700 Btu/lb = −9877 cal/g = −413.5 × 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: Data Not Available
12.18 Limiting Value: Data Not Available
12.19 Reid Vapor Pressure: 0.4 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

FLUORANTHENE

Water Pollution Standard Proposed (EPA) (6) (Kansas) (61)
Hazardous Substance (EPA) (RQ = 1.0/0.454) (4)
Hazardous Waste (EPA-RCRA) (#U-120) (5)
Priority Toxic Pollutant (EPA) (6)
Cited in U.S. State Regulations: Illinois (G), Kansas (G), Louisiana (G), New Hampshire (G), Pennsylvania (G), Vermont (G), Virginia (G), Washington (G), Wisconsin (G)

Description: Fluoranthene, $C_{16}H_{10}$, is a polycyclic hydrocarbon. It is a colorless crystalline solid which melts at 111°C. It boils at 375°C.

Code Numbers: CAS 206-44-0 RTECS LL4025000 UN none

Synonyms: Idryl; benzo[jk]fluorene; 1,2-benzacenaphthene; 1,2-(1,8-naphthylene)benzene.

Potential Exposure: Fluoranthene, a polynuclear aromatic hydrocarbon, is produced from the pyrolytic processing of organic raw materials such as coal and petroleum at high temperatures. It is also known to occur naturally as a product of plant biosynthesis. Fluoranthene is ubiquitous in the environment and has been detected in U.S. air, in foreign and domestic drinking waters and in food-stuffs. It is also contained in cigarette smoke.

Individuals living in areas which are heavily industrialized, and in which large amounts of fossil fuels are burned, would be expected to have greatest exposure from ambient sources of fluoranthene. In addition, certain occupations (e.g., coke oven workers, steelworkers, roofers, automobile mechanics) would also be expected to have elevated levels of exposure relative to the general population. Exposure to fluoranthene will be considerably increased among tobacco smokers or those who are exposed to smokers in closed environments (i.e., indoors).

Permissible Exposure Limits in Air: No standards set.

Determination in Air: Collection on a filter, extraction with benzene, chromatographic separation, spectrophotometric analysis. See NIOSH Methods 5506 (HPLC) and 5515 (GC) for polynuclear aromatic hydrocarbons.

Permissible Concentration in Water: The only existing standard which takes fluoranthene into consideration is a drinking water standard for PAHs. The 1970 World Health Organization European Standards for Drinking Water recommends a concentration of PAHs not exceeding 0.2 µg/ℓ. This recommended standard is based upon the analysis of six PAHs in drinking water as follows: fluoranthene; benzo[a]pyrene; benzo[ghi]perylene; benzo[b]fluoranthene; benzo[k]fluoranthene; and indeno[1,2,3-cd]pyrene.

More recently EPA has established (6) ambient water criteria as follows: To protect freshwater aquatic life: 3,980 µg/ℓ based on acute toxicity. To protect saltwater aquatic life: 40 µg/ℓ based on acute toxicity and 16 µg/ℓ based on chronic toxicity. To protect human health: 42 µg/ℓ. Kansas (61) has set a guideline of 0.029 µg/ℓ for fluoranthene in drinking water.

Determination in Water: Methylene chloride extraction followed by high pressure liquid chromatography with fluorescence as UV detection; or gas chromatography (EPA Method 610), or gas chromatography plus mass spectrometry (EPA Method 625).

Harmful Effects and Symptoms: There is concern about the toxicity of fluoranthene because it is widespread in the human environment and belongs to a class of compounds (polynuclear aromatic hydrocarbons) that contain numerous potent carcinogens. Experimentally, fluoranthene does not exhibit properties of a mutagen or primary carcinogen but it is a potent cocarcinogen. In the laboratory, fluoranthene has also demonstrated toxicity to various freshwater and marine organisms. This finding, coupled with the cocarcinogenic properties of the compound, points out the need to protect humans and aquatic organisms from the potential hazards associated with fluoranthene in water.

Spill Handling: Contain and isolate spill to limit spread. Construct clay/bentonite swale to divert uncontaminated portion of watershed.

Disposal Method Suggested: Incineration (22).

References

U.S. Environmental Protection Agency, *Fluoranthene: Ambient Water Quality Criteria*, Washington, DC (1980).

U.S. Environmental Protection Agency, *Fluoranthene*, Health and Environmental Effects Profile No. 103, Office of Solid Waste, Washington, DC (April 30, 1980).

Sax, N.I., Ed., "Dangerous Properties of Industrial Materials Report," 7, No. 2, 80-84 (1987).

SECTION 1. - - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -
NAME: FLUORENE, 98%
SECTION 2. - - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -
CAS #: 86-73-7
MF: C13H10
EC NO: 201-695-5
SYNONYMS
O-BIPHENYLENEMETHANE * O-BIPHENYLMETHANE * DIPHENYLENEMETHANE * 9H-FLUORENE * 2,2'-METHYLENEBIPHENYL *
SECTION 3. - - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - - -
DATA NOT AVAILABLE
SECTION 4. - - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES.
IN CASE OF CONTACT, IMMEDIATELY WASH SKIN WITH SOAP AND COPIOUS AMOUNTS OF WATER.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.
SECTION 5. - - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -
EXTINGUISHING MEDIA
WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
SPECIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
SECTION 6. - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.
AVOID RAISING DUST.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - -
REFER TO SECTION 8.
SECTION 8. - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -
CHEMICAL SAFETY GOGGLES.
RUBBER GLOVES.
NIOSH/MSHA-APPROVED RESPIRATOR.
SAFETY SHOWER AND EYE BATH.
MECHANICAL EXHAUST REQUIRED.
DO NOT BREATHE DUST.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
WASH THOROUGHLY AFTER HANDLING.
KEEP TIGHTLY CLOSED.
STORE IN A COOL DRY PLACE.
SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -
APPEARANCE AND ODOR
WHITE CRYSTALLINE POWDER
PHYSICAL PROPERTIES
BOILING POINT: 298 C
MELTING POINT: 114 C TO 116 C
SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -
INCOMPATIBILITIES
STRONG OXIDIZING AGENTS
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE
SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -
ACUTE EFFECTS
MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION.
MAY CAUSE EYE IRRITATION.
MAY CAUSE SKIN IRRITATION.
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND

```
    TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.
  RTECS #: LL5670000
    FLUORENE
  TOXICITY DATA
    IPR-MUS LD50:>2 GM/KG                          PCJOAU 19,326,85
    ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES
    (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR
    COMPLETE INFORMATION.
SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - - -
    DATA NOT YET AVAILABLE.
SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - - -
    DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A
    CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
    OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.
SECTION 14. - - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - - -
    CONTACT THE MANUFACTURER FOR TRANSPORTATION INFORMATION.
SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - - -
  REVIEWS, STANDARDS, AND REGULATIONS
    OEL=MAK
    IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE IMEMDT 32,365,83
    IARC CANCER REVIEW:HUMAN NO ADEQUATE DATA     IMEMDT 32,365,83
    IARC CANCER REVIEW:GROUP 3                    IMSUDL 7,56,87
    NOES 1983: HZD X3867; NIS 3; TNF 227; NOS 6; TNE 2912; TFE 1504
    EPA GENETOX PROGRAM 1988, NEGATIVE: HISTIDINE REVERSION-AMES TEST
    EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
    ON EPA IRIS DATABASE
    EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, OCTOBER 1995
    NIOSH ANALYTICAL METHOD, 1994: POLYNUCLEAR AROMATIC HYDROCARBONS BY
     HPLC, 5506; BY GC, 5515
SECTION 16. - - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - - - -
    THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO
    BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE.  THE MANUFACTURER
    SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING
    OR FROM CONTACT WITH THE ABOVE MATERIAL.
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To go back to the Material Safety Data Sheet Directory for the University of California, San Diego; Department of Chemistry & Biochemistry, Undergraduate Teaching Laboratory

Check here for a large list of terms and acronyms used on material safety data sheets

For *Chemistry Safety Links*.

Other Safety Resources can be found on the internet.

INDENO(1,2,3-cd)PYRENE

Carcinogen (Animal Positive) (IARC) (9) (DFG) (3)
Air Pollutant Standard Set (ACGIH) (1) (HSE) (33) (OSHA) (58)
Water Pollution Standard Proposed (EPA) (6) (Kansas) (61)
Hazardous Substance (EPA) (RQ = 1.0/0.454) (4)
Hazardous Waste (EPA-RCRA) (#U-137) (5)
Priority Toxic Pollutant (EPA) (6)
Cited in U.S. State Regulations: California (G), Florida (G), Illinois (G), Kansas (G,W), Louisiana (G), Maine (G), Massachusetts (G), Pennsylvania (G), Vermont (G), Virginia (G), Washington (G), West Virginia (G), Wisconsin (G)

Description: $C_{22}H_{12}$ is a polycyclic aromatic hydrocarbon. It is a crystalline solid melting at 162.5 to 164°C.

Code Numbers: CAS 193-39-5 RTECS NK9300000

Synonyms: o-phenylpyrene, 2,3-o-phenylenepyrene, IP

Potential Exposure: Found in internal combustion engine exhausts, cigarette smoke condensate, soot, coal tar pitch.

Permissible Exposure Limits in Air: The coal tar pitch volatile category would apply here. A TLV of 0.2 mg/m^3 as benzene solubles has been assigned by ACGIH (1). HSE (33) and OSHA (58) have set the same limits.

Permissible Concentration in Water: A drinking water standard for PAH as a class has been developed. The 1970 World Health Organization European Standards for Drinking Water recommends a concentration of PAH not to exceed 0.2 µg/ℓ. This recommended standard is based on the composite analysis of six PAHs in drinking water: fluoranthene, benzo[a] pyrene, benzo[ghi] perylene, benzo[b] fluoranthene, benzo[k] fluoranthene, and indeno[1,2,3-cd] pyrene.

The US EPA addressed PAHs as one of the 65 priority toxic pollutants (6). They found that there was insufficient data to propose a criterion for the protection of freshwater or of saltwater aquatic life. For the protection of human health, the concentration is preferably zero. An additional lifetime cancer risk of 1 in 100,000 is posed by a concentration of 0.028 µg/ℓ. Kansas (61) has set a guideline for drinking water of 0.029 µg/ℓ.

Determination in Water: Methylene chloride extraction followed by high performance liquid chromatography (HPLC) with fluorescence or UV detection or gas chromatography (EPA Method 610), or by gas chromatography plus mass spectrometry (EPA Method 625).

Routes of Entry: Ingestion, inhalation and skin contact.

Harmful Effects and Symptoms: Indeno[1,2,3-cd] pyrene is a complete carcinogen and an initiator for skin carcinogenesis in the mouse. Subcutaneous injections in mice produce local sarcomas. Other routes in the mouse and other animal species had not been tested as of 1973. No human data were available at that time.

First Aid: *Eye Contact* — Immediately remove any contact lenses at once and flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact — Remove contaminated clothing as promptly as possible. Wash thoroughly with large amounts of soap and water.

Personal Protective Methods: *Clothing* — Avoid skin contact. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation. All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day and put on before work.

Eye Protection — Eye protection is included in the recommended respiratory protection.

Respirator Selection: At any exposure level, use an MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in the positive pressure mode or with a full facepiece, hood, or helmet in the continuous flow mode, or use an MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

Storage: Prior to working with IP you should be trained on its proper handling and storage. Store in tightly closed containers in a cool, well-ventilated area.

Shipping: IP is not specifically cited in DOT's performance-oriented packaging standards (19).

Spill Handling: Restrict persons not wearing protective equipment from areas of spills until clean-up is complete. Collect spilled material in the most convenient and safe manner and deposit in sealed containers for reclamation or for disposal in an approved facility. Absorb liquid containing IP in vermiculite, dry sand, earth, or similar material.

Fire Extinguishing: Extinguish fire using an agent suitable for type of surrounding fire. IP itself burns only with difficulty.

Disposal Method Suggested: Indeno-pyrene may be destroyed by permanganate oxidation, by high-temperature incineration with scrubbing equipment or by microwave plasma treatment.

IRON

Air Pollutant Standard Set (ACGIH) (1) (HSE) (33) (OSHA) (58) (Several States) (60)

Water Pollution Standard Proposed (USSR) (43) (Illinois, Kansas) (61)

Cited in U.S. State Regulations: Alaska (G), Connecticut (A), Illinois (G,W), Kansas (W), Maine (G), New Hampshire (G), New York (G), North Dakota (A), Rhode Island (G), Virginia (A)

Description: Iron, Fe, is a malleable, silver-gray metal or a gray powder.

Code Numbers: CAS 7439-89-6 RTECS NO4565500

Potential Exposure: Iron is alloyed with carbon to produce steel. The addition of other elements (e.g., manganese, silicon, chromium, vanadium, tungsten, molybdenum, titanium, niobium, phosphorus, zirconium, aluminum, copper, cobalt, and nickel) imparts special characteristics to the steel. Occupational exposures occur during mining, transporting, and preparing of ores and during the production and refining of the metal and alloys. In addition, certain workers may be exposed while using certain iron-containing materials—welders, grinders, polishers, silver finishers, metal workers and boiler scalers.

Permissible Exposure Limits in Air: ACGIH (1) has set a TWA for soluble iron salts as Fe of 1.0 mg/m^3. OSHA (58) seconds this value. HSE (33) gives 1.0 mg/m^3 as an 8-hour TWA and adds 2.0 mg/m^3 as an STEL. Several states have set guidelines or standards for iron in ambient air (60) ranging from 10 μg/m^3 (North Dakota) to 16 μg/m^3 (Virginia) to 20 μg/m^3 (Connecticut).

Determination in Air: See OSHA Method ID-121.

Permissible Concentration in Water: The USSR-UNEP/IRPTC project (43) has set an MAC in water bodies used for domestic purposes of 0.5 mg/ℓ and in sea water used for fishery purposes of 0.05 mg/ℓ. A standard of 1000 μg/ℓ has been set by Illinois (61) for drinking water; Kansas has set a guideline of 300 μg/ℓ.

Harmful Effects and Symptoms: Short Term Exposure: *Inhalation* — Iron dust and fresh iron oxide fumes may cause respiratory irritation and metal fume fever, characterized by metallic taste, dry irritated throat, coughing, shortness of breath, weakness, fatigue, fever, chills, sweating and pain in the muscles and joints. Onset may be delayed up to 12 hours and symptoms may last for up to 48 hours.

Skin — Hot metal may cause burns and irritation.

Eyes — Dust may cause irritation and inflammation.

Ingestion — May cause drowsiness, sluggishness, paleness, increased heart and respiration rates, shock, bloody vomiting and diarrhea. Ingestion of 1/2 ounce may cause death in an adult.

Long Term Exposure: Excessive intake of iron compounds may result in increased accumulation of iron in body, especially the liver, spleen and lymphatic system. Inhalation of dusts may cause mottling of the lung.

First Aid: *Inhalation* — Remove person from exposure. Give artificial respiration or oxygen as required. Seek medical attention, if necessary.

Skin — Flush affected area with large amounts of cold water for at least 5 minutes. Seek medical attention for severe burns.

Eyes — Wash with large amounts of water for at least 15 minutes. Seek medical attention, if necessary.

Ingestion — Give eggs or milk. See a doctor immediately.

Note to Physician — Gastric lavage only beneficial if done within one hour of ingestion. Deferoxamine may be beneficial in reducing systemic levels. Serum iron levels may be useful in determining severity of exposure if measured during acute phase of intoxication.

Personal Protective Methods: Wear protective clothing as needed such as goggles, leather gauntlets, welding masks, steel-toed shoes.

Respirator Selection: To prevent exposure to dusts, wear a dust mask. When welding, wear a proper welding mask. If welding fumes become excessive or exposures are to iron oxide fumes use the following respiratory equipment: For levels up to 100 mg/m^3 use fume respirator high efficiency particulate filter respirator, or a supplied-air respirator, or a self-contained breathing apparatus. For up to 500 mg/m^3 use any of the above (except fume respirator) with a full facepiece. For up to 5,000 mg/m^3 use a powered air-purifying respirator with a high efficiency particulate filter or a Type C supplied-air respirator operated in a positive pressure mode. For levels above 5,000 mg/m^3 or entry and escape from an area of unknown concentration use a self-contained breathing apparatus with a full facepiece operated in a positive pressure mode or a combination Type C supplied-air respirator with a full facepiece and an auxiliary self-contained air supply both operated in a positive pressure mode.

Disposal Method Suggested: Landfilling.

References

Nat. Inst. for Occup. Safety and Health, *Information Profiles on Potential Occupational Hazards, Iron and Its Compounds*, Report No. PB 276-678, Rockville, MD, pp. 143-156 (October 1977).

Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 1, No. 6, 73-74 (1981).

New York State Department of Health, "Chemical Fact Sheet: Iron," Albany, NY, Bureau of Toxic Substance Assessment (March 1986).

LEAD—METALLIC AND INORGANIC

Banned or Severely Restricted (Many Countries, Esp. in Food) (UN) (35)
Air Pollutant Standard Set (ACGIH) (1) (OSHA) (58) (Other Countries) (35) (Several States) (60)
Water Pollution Standard Proposed (EPA) (6) (Other Countries) (35) (Maine, Minnesota) (61)
Hazardous Substance (EPA) (RQ = 1.0/0.454) (4)
Hazardous Waste Constituent (EPA)
Priority Toxic Pullutant (EPA) (6)
Toxic Chemical (EPA) (8)
Cited in U.S. State Regulations: Alaska (G), Connecticut (A), Florida (G), Illinois (G), Kansas (G,A), Louisiana (G), Maine (G,W), Maryland (G), Massachusetts (G,A), Michigan (G), Minnesota (W), Nevada (A), New Hampshire (G), New Jersey (G), New York (G), North Dakota (A), Oklahoma (G), Pennsylvania (G,A), Rhode Island (G), Vermont (G), Virginia (G,A), Washington (G), West Virginia (G), Wisconsin (G)

Description: Pb, inorganic lead, includes lead oxides, metallic lead, lead salts, and organic salts such as lead soaps, but excludes lead arsenate and organic lead compounds. Lead is a blue-grey metal which is very soft and maleable.

Code Numbers: Lead metal—CAS 7439-92-1 RTECS OF7525000

Synonyms: None.

Potential Exposures: Metallic lead is used for lining tanks, piping, and other equipment where pliability and corrosion resistance are required such as in the chemical industry in handling corrosive gases and liquids used in the manufacture of sulfuric acid; in petroleum refining; and in halogenation, sulfonation, extraction, and condensation processes; and in the building industry.

It is also used as an ingredient in solder, a filler in the automobile industry, and a shielding material for x-rays and atomic radiation; in manufacture of tetraethyllead and organic and inorganic lead compounds, pigments for paints and varnishes, storage batteries, flint glass, vitreous enameling, ceramics as a glaze, litharge rubber, plastics, and electronic devices. Lead is utilized in metallurgy and may be added to bronze, brass, steel, and other alloys to improve their characteristics. It forms alloys with antimony, tin, copper, etc. It is also used in metallizing to provide protective coatings and as a heat treatment bath in wire drawing.

Exposures to lead dust may occur during mining, smelting, and refining, and to fume, during high temperature (above 500°C) operations such as welding or spray coating of metals with molten lead. There are numerous applications for lead compounds, some of the more common being in the plates of electric batteries and accumulators, as compounding agents in rubber manufacture, as ingredients in paints, glazes, enamels, glass, pigments, and in the chemical industry.

In addition to these usual levels of exposure from environmental media, there exist miscellaneous sources which are hazardous. The level of exposure resulting from contact is highly variable. Children with pica for paint chips or for soil may experience elevation in blood lead ranging from marginal to sufficiently great to cause clinical illness. Certain adults may also be exposed to hazardous concentrations of lead in the workplace, notably in lead smelters and storage battery manufacturing plants. Again, the range of exposure is highly variable. Women in the workplace are more likely to experience adverse effects from lead exposure than men due to the fact that their hematopoietic system is more lead-sensitive than men's.

Incompatibilities: Strong oxidizers, hydrogen peroxide, active metals-sodium, potassium.

Permissible Exposure Limits in Air: There are a variety of TWA limits set around the world. ACGIH (1988/89) (1) has set 0.15 mg/m^3 and OSHA (58) has set 50 μg/m^3 (0.05 mg/m^3). Other TWA values (35) are as follows (all in mg/m^3):

Argentina 0.15	Japan 0.10
Brazil 0.01	USSR 0.007
Czechoslovakia 0.05	Sweden 0.10 (total)
Germany 0.10	Sweden 0.05 (respirable)
EEC 0.15	WHO 0.03–0.06
U.K. 0.15	

Standards for ambient air in residential areas have been set by USSR at 0.3 μg/m^3 on a daily average basis and by Czechoslovakia at 0.7 μg/m^3 on a daily average basis; the Czechs at 2.0 μg/m^3 on a momentary basis. Several states have set guidelines or standards for lead in ambient air (60) ranging from 0.068 μg/m^3 (Massachusetts) to 0.357 to 1.5 μg/m^3 (North Dakota and Pennsylvania) to 2.5 μg/m^3 (New York) to 3.0 μg/m^3 (Connecticut) to 4.0 μg/m^3 (Nevada).

Determination in Air: Collection on a filter, workup with nitric acid, analysis by atomic absorption spectrometry. See NIOSH Method 7082 (18).

Permissible Concentration in Water: To protect freshwater aquatic life—
$e^{[2.35 \ln (\text{hardness}) - 9.48]}$ never to exceed $e^{[1.22 \ln (\text{hardness}) - 0.47]}$
To protect saltwater aquatic life–668 µg/ℓ on an acute toxicity basis and 25 µg/ℓ on a chronic basis. To protect human–50 µg/ℓ (USEPA) (6).

Various organizations worldwide have set other standards for lead in drinking water as follows (35) (all in mg/ℓ):

Argentina	0.01	Japan	0.10
Czechoslovakia	0.05	Mexico	0.05
Germany	0.04	USSR	0.03
EEC	0.05	WHO	0.10

The states of Maine and Minnesota have set guidelines for lead in drinking water (61) at the level of 20 µg/ℓ.

Determination in Water: Digestion followed by atomic absorption or by colorimetric (dithizone) analysis or by inductively coupled plasma (ICP) optical emission spectrometry. That gives total lead; dissolved lead may be determined by 0.45 micron filtration prior to such analysis.

Routes of Entry: Ingestion of dust; inhalation of dust or fume, skin and eye contact.

Harmful Effects and Symptoms: Short Term Exposure: *Note* — Lead is a cumulative poison. Increasing amounts can build up in the body eventually reaching a point where symptoms and disability occur. Lead dust carried home on contaminated clothing can result in exposure and symptoms in other family members. Standards only protect for inhalation exposure. Extra precautions should be taken if skin exposure also occurs.

Inhalation — The effects of exposure to fumes and dusts of inorganic lead may not develop quickly. Symptoms may include decreased physical fitness, fatigue, sleep disturbance, headache, aching bones, and muscles, constipation, abdominal pains and decreased appetite. These effects are reported to be reversible if exposure ceases. Inhalation of large amounts of lead may lead to seizures, coma and death.

Skin — May cause irritation.

Eyes — May cause irritation.

Ingestion — See effects listed for inhalation. Ingestion of large amounts of lead may lead to seizures, coma and death.

Long Term Exposure: Lead can accumulate in the body over a period of time. Therefore, long term exposures to lower levels can result in a build up of lead in the body and more severe symptoms. These may include anemia, pale skin, a blue line at the gum margin, decreased hand-grip strength, abdominal pain, severe constipation, nausea, vomiting, and paralysis of the wrist joint. Prolonged exposure may also result in kidney damage. If the nervous system is affected, usually due to very high exposures, the resulting effects include severe headache, convulsions, coma, delirium and death. In non-fatal cases, recovery is slow and not always complete. Alcohol ingestion and physical exertion may bring on symptoms. Continuous exposure can result in decreased fertility. Elevated lead exposure of either parent before pregnancy can increase the chances of miscarriage or birth defects. Exposure of the mother during pregnancy can cause birth defects.

Points of Attack: Kidneys, blood, gingival tissue, gastrointestinal system, central nervous system.

Medical Surveillance: *Before first exposure and every six months thereafter,* OSHA (1910. 1025) requires your employer to provide: Blood lead test. ZPP test (a special test for the effect of lead on blood cells). Before first exposure, and yearly for exposed person with blood lead over 40 micrograms per 100 g of whole blood, OSHA also requires a complete medical history and exam with the above tests, and: Complete blood count. Kidney function tests. OSHA defines "exposure" for these tests as air levels which average 30 micrograms of lead or more in a cubic meter of air. OSHA requires your employer to send the doctor a copy of the lead standard and provide one for you.

Note — Blood-lead level is a good indicator of total lead exposure. Current OSHA regulations require that if an individual has a blood-lead level greater than or equal to .050 mg lead per 100 ml blood, he or she must be removed from all exposures to lead and cannot return to the exposure environment until the blood level falls to .040 mg lead per 100 ml blood or less.

First Aid: If this chemical gets into the eyes, remove any contact lenses at once and irrigate immediately. If this chemical contacts the skin, flush with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make and unconscious person vomit.

Personal Protective Methods: Wear appropriate clothing to prevent repeated or prolonged skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash daily at the end of each work shift. Remove nonimpervious clothing immediately if wet or contaminated.

Respirator Selection:

OSHA
0.5 mg/m^3: SA/HiE/SCBA
1.25 mg/m^3: PAPRHiE/SA:CF
2.5 mg/m^3: HiEF/PAPRTHiE/
SCBAF/SAF/SAT:CF
50 mg/m^3: SA:PD,PP
100 mg/m^3: SAF:PD,PP
Emergency or planned entry in unknown concentration or IDLH
conditions: SCBAF:PD,PP/
SAF:PD,PP:ASCBA
Escape: HiEF/SCBAE

Storage: Lead must be stored to avoid contact with oxidizers (such as perchlorates, peroxides, permanganates, chlorates and nitrates) and chemically active metals (such as potassium, sodium, magnesium and zinc) since violent reactions occur. Lead is regulated by an OSHA Standard 1910. 1025. All requirements of the standard must be followed.

Shipping: Lead (metallic) is not specifically covered in DOT's performance-oriented packaging standards (19).

Spill Handling: Get all workers out of spill area. Put on necessary protective equipment including respirators. If spill is a solution cover with abosrbent and shovel into suitable container. If spill is in powder form, vacuum whenever possible to avoid raising dust by sweeping or blowing. Place in suitable container.

Fire Extinguishing: Use dry chemicals. Do not use water. Generally the problem is to fight a fire based on the surrounding combustible material since lead is not combustible. Lead powder may however be flammable.

Disposal Method Suggested: Recycle wherever possible. May be treated with HNO_3 to give lead nitrate; the lead may be precipitated as the sulfide which is then sent to a lead recovery plant (22).

References

National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Inorganic Lead*, NIOSH Doc. No. 73-11010, Wash., DC (1973).

U.S. Environmental Protection Agency, *Lead: Ambient Water Quality Criteria*, Wash., DC (1980).

U.S. Environmental Protection Agency, *Status Assessment of Toxic Chemicals: Lead*, Report EPA-600/2-79-210h, Cincinnati, Ohio (Dec. 1979).

U.S. Environmental Protection Agency, *Reviews of the Environmental Effects of Pollutants: VII. Lead*, Report EPA-600/1-78-029, Cincinnati, Ohio (1978).

U.S. Environmental Protection Agency, *Air Quality Criteria Document for Lead*, Report EPA-600/8-77-017, Research Triangle Park, NC (1977).

National Academy of Sciences, *Medical and Biologic Effects of Environmental Pollutants: Lead, Airborne Lead in Perspective*, Wash., DC (1972).

U.S. Environmental Protection Agency, *Lead*, Health and Environmental Effects Profile No. 121, Wash., DC, Office of Solid Waste (April 30, 1980).

World Health Organization, *Lead*, Environmental Health Criteria No. 3, Geneva, Switzerland (1977).

Sax, N.I., Ed., "Dangerous Properties of Industrial Materials Report," *1*, 47-49 (1981).

U.S. Public Health Service, "Toxicological Profile for Lead," Atlanta, Georgia, Agency for Toxic Substances and Disease Registry (Feb. 1988).

MAGNESIUM

MGX

Common Synonyms	Solid	Silvery	Odorless
	Sinks in water.		

Call fire department.
Stop discharge if possible. Keep people away.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Extinguish with dry graphite, soda ash, or other inert powder.
DO NOT USE WATER, FOAM, CARBON DIOXIDE, DRY CHEMICALS, OR VAPORIZING LIQUID ON FIRE.

Exposure

CALL FOR MEDICAL AID.

SOLID
Irritating to eyes.
Harmful if swallowed.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable solid; dangerous when wet
2.2 Class: 4

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: Mg
3.3 IMO/UN Designation: Pellets, turnings, or ribbon: 4.1/1869; powder, non-pyronic: 4.3/1418
3.4 DOT ID No.: 1418 (powder), 1869 (pellets)
3.5 CAS Registry No.: 7439-95-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: Silvery; looks like aluminum
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Eye protection
5.2 Symptoms Following Exposure: Dust irritates eyes in same way as any foreign material. Penetration of skin by fragments of metal is likely to produce local irritation, blisters, and ulcers which may become infected.
5.3 Treatment of Exposure: EYES: flush with water to remove dust. SKIN: treat as any puncture.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: Oral LD_{Low} (lowest lethal dose) = 230 mg/kg (dog)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Not pertinent
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent (solid). Flammable when in the form of turnings or powder.
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Inert dry powders (e.g., graphite, limestone, salt)
6.4 Fire Extinguishing Agents Not to be Used: Water, foam, halogenated agents, carbon dioxide.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Forms dense white smoke. Flame is very bright.
6.7 Ignition Temperature: 883°F
6.8 Electrical Hazard: Class I, Group E
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: In finely divided form, reacts with water and acids to release flammable hydrogen gas.
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: None
8.2 Waterfowl Toxicity: None
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Pigs, ingots, turnings, sticks: all high purity.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable solid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	1
Reactivity (Yellow)	2
	W

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 24.3
12.3 Boiling Point at 1 atm: 2,012°F = 1,100°C = 1,373°K
12.4 Freezing Point: 1,202°F = 650°C = 923°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.74 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: −11,950 Btu/lb = −6,650 cal/g = −278 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 88.9 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

2-Methylnaphthalene, 95-97%
ACROS97103

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 2-Methylnaphthalene, 95-97%
Catalog Numbers:
AC127170000, AC127170050, AC127175000
Synonyms:
Company Identification (Europe): Acros Organics N.V.
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium
Company Identification (USA): Acros Organics
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For information in Europe, call: 0032(0) 14575211
For emergencies in the US, call CHEMTREC: 800-424-9300
For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
91-57-6	2-Methylnaphthalene	95-97.0	202-078-3

Hazard Symbols: XN
Risk Phrases: 22

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: Not available.
Caution! Causes skin irritation. May cause allergic skin reaction. May be harmful if swallowed. May cause respiratory and digestive tract irritation. Causes eye irritation.
Target Organs: None.

Potential Health Effects

Eye:
Causes eye irritation.

Skin:
Causes skin irritation. May cause photosensitization in certain individuals.

Ingestion:
May be harmful if swallowed.

Inhalation:
Inhalation of dust may cause respiratory tract irritation.

Chronic:
No information found.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:
Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:
In case of fire use water spray, dry chemical, carbon dioxide, or chemical foam.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage:
Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
2-Methylnaphthalene	none listed	none listed	none listed

OSHA Vacated PELs:
2-Methylnaphthalene:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Solid
Appearance:	Not available.
Odor:	None reported
pH:	Not available.
Vapor Pressure:	< 1 mm Hg @25c
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	241.1 deg C
Freezing/Melting Point:	37-38c
Autoignition Temperature:	Not available.
Flash Point:	Not available.
NFPA Rating:	(est.) Health: 1; Flammability: 1; Reactivity: 0
Explosion Limits, Lower:	Not available.
Upper:	Not available.
Decomposition Temperature:	
Solubility:	Insoluble.
Specific Gravity/Density:	1.0000g/cm3
Molecular Formula:	C11H10
Molecular Weight:	142.20

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, dust generation, strong oxidants.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 91-57-6: QJ9635000
LD50/LC50:
CAS# 91-57-6: Oral, mouse: LD50 = 1279 mg/kg; Oral, rat: LD50 = 1630 mg/kg.
Carcinogenicity:
2-Methylnaphthalene -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classif as a hazardous waste.
US EPA guidelines for the classification determination are listed in 40 CFR Part

Additionally, waste generators must consult state and local hazardous waste regu
ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
Canadian TDG
Shipping Name: CAESIUM HYDROXIDE SOLUTION
Hazard Class: 8
UN Number: UN2681

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 91-57-6 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
None of the chemicals in this material have an RQ.
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 91-57-6: acute.
Section 313
No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
2-Methylnaphthalene is not present on state lists from CA, PA, MN, MA, FL, or NJ.
California No Significant Risk Level:
None of the chemicals in this product are listed.
European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: XN
Risk Phrases:
R 22 Harmful if swallowed.
Safety Phrases:
WGK (Water Danger/Protection)
CAS# 91-57-6: No information available.
United Kingdom Occupational Exposure Limits

Canada

CAS# 91-57-6 is listed on Canada's DSL/NDSL List.
This product has a WHMIS classification of D2A.
CAS# 91-57-6 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 91-57-6: OEL-RUSSIA:STEL 20 mg/m3

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 7/15/1998 Revision #1 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

2-Methylnaphthalene, 99% (gc)
ACROS69451

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 2-Methylnaphthalene, 99% (gc)
Catalog Numbers:
AC414550000, AC414550050, AC414551000, AC414555000, EK 114 5846, EK 114 5853, EK114 5846, EK114 5853, EK1145846, EK1145853
Synonyms:
Company Identification (Europe): Acros Organics N.V.
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium
Company Identification (USA): Acros Organics
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For information in Europe, call: 0032(0) 14575211
For emergencies in the US, call CHEMTREC: 800-424-9300
For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
91-57-6	2-Methylnaphthalene	99.0	202-078-3

Hazard Symbols: XN
Risk Phrases: 22

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: Not available.
Caution! Causes skin irritation. May cause allergic skin reaction. May be harmful if swallowed. May cause respiratory and digestive tract irritation. Causes eye irritation.
Target Organs: None.

Potential Health Effects

Eye:
Causes eye irritation.

Skin:
Causes skin irritation. May cause photosensitization in certain individuals.

Ingestion:
May be harmful if swallowed.

Inhalation:
Inhalation of dust may cause respiratory tract irritation.

Chronic:
No information found.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:
Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical

aid immediately.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

In case of fire use water spray, dry chemical, carbon dioxide, or chemical foam.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage:

Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
2-Methylnaphthalene	none listed	none listed	none listed

OSHA Vacated PELs:

2-Methylnaphthalene:

No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate protective gloves to prevent skin

exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

sical State:	Solid
earance:	Not available.
or:	None reported
l:	Not available.
apor Pressure:	< 1 mm Hg @25c
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	241.1 deg C
Freezing/Melting Point:	37-38c
Autoignition Temperature:	Not available.
Flash Point:	Not available.
NFPA Rating:	(est.) Health: 1; Flammability: 1; Reactivity: 0
Explosion Limits, Lower:	Not available.
Upper:	Not available.
Decomposition Temperature:	
Solubility:	Insoluble.
Specific Gravity/Density:	1.0000g/cm3
Molecular Formula:	C11H10
Molecular Weight:	142.20

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, dust generation, strong oxidants.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 91-57-6: QJ9635000
LD50/LC50:
CAS# 91-57-6: Oral, mouse: LD50 = 1279 mg/kg; Oral, rat: LD50 = 1630 mg/kg.
Carcinogenicity:
2-Methylnaphthalene -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology:
No data available.
Teratogenicity:
No data available.
Reproductive Effects:
No data available.
Neurotoxicity:
No data available.
Mutagenicity:

NAPHTHALENE

NTM

Common Synonyms	Solid	Colorless	Mothballs odor
Naphthalin Tar camphor	Solubles and floats or sinks in water		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and solid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Wear goggles and self-contained breathing apparatus.
Extinguish with water, foam, dry chemical or carbon dioxide.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.
SOLID OR LIQUID
Irritating to skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Floating to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Should be removed.
Chemical and physical treatment.

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_{10}H_8$
3.3 IMO/UN Designation: 4.1/2304
3.4 DOT ID No.: 2304
3.5 CAS Registry No.: 91-20-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (at shipping): Molten solid
4.2 Color: Colorless
4.3 Odor: Coal tar; moth balls

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved organic vapor canister unit; rubber gloves; chemical safety goggles; face shield; coveralls and/or rubber apron; rubber shoes or boots.
5.2 Symptoms Following Exposure: Vapors or fumes are irritating to eyes, nose, and throat and may cause headaches, dizziness, nausea, etc. Solid may be irritating to skin.
5.3 Treatment of Exposure: INHALATION: remove to fresh air. SKIN OR EYES: flush immediately with plenty of water for at least 15 min.; remove contaminated clothing immediately; call a physician.
5.4 Threshold Limit Value: 10 ppm
5.5 Short Term Inhalation Limits: 15 ppm for 5 min.
5.6 Toxicity by Ingestion: Grade 2; oral rat LD_{50} = 1780 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Hot liquid can cause severe burn. The solid may irritate the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 500 ppm

6. FIRE HAZARDS

6.1 Flash Point: 174°F C.C.; 190°F O.C.
6.2 Flammable Limits in Air: 0.9%-5.9%
6.3 Fire Extinguishing Agents: Water fog, carbon dioxide, dry chemical, or foam
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic vapors given off in a fire
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 979°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4.3 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Molten naphthalene spatters and foams on contact with water. No chemical reaction is involved.
7.2 Reactivity with Common Materials: None
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Reactivity (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity:
150 mg/l/96 hr/sunfish/TL_m/fresh water
1.9 ppm/72 hr/fingerling salmon/critical/ salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): (Fresh.) 59.5%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Pure; crude: 85% Pure; mp = 176°F Crude: mp = 165—176°F
9.2 Storage Temperature: Elevated
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: DOMA
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	3
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 128.19
12.3 Boiling Point at 1 atm: 424°F = 218°C = 491°K
12.4 Freezing Point: 176.4°F = 80.2°C = 353.4°K
12.5 Critical Temperature: 887.4°F = 475.2°C = 748.4°K
12.6 Critical Pressure: 580 psia = 40.0 atm = 4.05 MN/m²
12.7 Specific Gravity: 1.145 at 20°C (solid)
12.8 Liquid Surface Tension: 31.8 dynes/cm = 0.0318 N/m at 100°C
12.9 Liquid Water Interfacial Tension: Data not available
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.088
12.12 Latent Heat of Vaporization: 145 Btu/lb = 80.7 cal/g = 3.38 X 10⁵ J/kg
12.13 Heat of Combustion: −16,720 Btu/lb = −9287 cal/g = −388.8 X 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 35.96 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Low

NOTES

POTASSIUM

PTM

Common Synonyms	Solid	Silver-white	Odorless
	Reacts violently with water. Flammable gas is produced.		

Avoid contact with solid. Keep people away.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
IGNITES WHEN EXPOSED TO WATER OR MOISTURE.
Flammable gas is produced on contact with water.
Extinguish with dry graphite, soda ash, or other inert powder.
DO NOT USE WATER OR FOAM ON FIRE.
DO NOT USE WATER OR FOAM ON ADJACENT FIRES.

Exposure

CALL FOR MEDICAL AID.

SOLID
Will burn skin and eyes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability, corrosive
Restrict access
Disperse and flush

2. LABEL

2.1 Category: Flammable solid; dangerous when wet
2.2 Class: 4

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: K
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2257
3.5 CAS Registry No.: 7440-09-7

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: Silvery white
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Goggles or face shield; rubber gloves
5.2 Symptoms Following Exposure: Contact with eyes or skin causes severe burns.
5.3 Treatment of Exposure: EYES or SKIN: flush with water; treat caustic burns.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: Not pertinent
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent (combustible solid)
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Graphite, sand, sodium chloride
6.4 Fire Extinguishing Agents Not to be Used: Water, foam, carbon dioxide, or halogenated hydrocarbons
6.5 Special Hazards of Combustion Products: Data not available
6.6 Behavior in Fire: Reacts violently with water, forming flammable and explosive hydrogen gas. May ignite spontaneously in air.
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts violently to form flammable hydrogen gas and a strong caustic solution.
7.2 Reactivity with Common Materials: May ignite combustible materials if they are damp
7.3 Stability During Transport: Stable, if protected from air and moisture
7.4 Neutralizing Agents for Acids and Caustics: Caustic formed by reaction with water should be flushed with water, then area can be rinsed with dilute acetic acid.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 80 ppm/24 hr/mosquito fish/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial, 99.9+% (Shipped under oil)
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: Inerted
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

FIR

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable solid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	2
	W

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 39
12.3 Boiling Point at 1 atm: 1,425°F = 774°C = 1,047°K
12.4 Freezing Point: 145°F = 63°C = 336°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.86 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: −2,003 Btu/lb = −1,113 cal/g = −46.57 X 10^6 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: −2,104 Btu/lb = −1,169 cal/g = −48.91 X 10^6 J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 14.6 cal/g
12.26 Liquidus Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

N-PROPYLBENZENE

PBZ

Common Synonyms	Liquid	Light yellow
Isocumene 1-Phenylpropane UN 2364 (DOT) Benzene, propyl		

Avoid contact with liquid and vapor.
EVACUATE AREA. Keep people away.
Wear full face self-contained breathing apparatus, and protective clothing.
Shut off ignition sources. Call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharge material.
Notify local health and pollution control agencies.

Fire

Combustible.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Water may be ineffective on fire.
Wear full face self-contained breathing apparatus, and full protective clothing including rubber boots and gloves.
Extinguish with dry chemical, alcohol foam, or CO_2.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
May be irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
May be irritating to skin and eyes.
May be harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

Effect of low concentration on aquatic life is unknown.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Evacuate area.
Mechanical containment.
Should be removed.
Chemical and physical treatment.

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3.3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic hydrocarbons
3.2 Formula: $C_6H_5CH_2CH_2CH_3$
3.3 IMO/UN Designation: 3.3/2364
3.4 DOT ID No.: 2364
3.5 CAS Registry No.: 103-65-1

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Light yellow
4.3 Odor: Data not available.

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing apparatus, rubber boots and heavy rubber gloves.
5.2 Symptoms Following Exposure: May be harmful by inhalation, ingestion, or skin absorption. May cause eye and skin irritation.
5.3 Treatment of Exposure: INHALATION: Call for medical aid. Remove the victim to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. SKIN: Wash with soap and copious amounts of water. EYES: Flush with copious amounts of water for at least 15 minutes.
5.4 Threshold Limit Value: Data not available.
5.5 Short Term Inhalation Limits: Data not available.
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 8.04 g/kg rat
5.7 Late Toxicity: Data not available.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin.
5.10 Odor Threshold: Data not available.
5.11 IDLH Value: Data not available.

6. FIRE HAZARDS

6.1 Flash Point: 118°F C.C.
6.2 Flammable Limits in Air: LEL 0.8%; UEL 6%
6.3 Fire Extinguishing Agents: Water spray, carbon dioxide, dry chemical, alcohol foam.
6.4 Fire Extinguishing Agents Not to be Used: Data not available.
6.5 Special Hazards of Combustion Products: Vapor may travel considerable distance to a source of ignition and flashback.
6.6 Behavior in Fire: Data not available.
6.7 Ignition Temperature: Data not available.
6.8 Electrical Hazard: Data not available.
6.9 Burning Rate: Data not available.
6.10 Adiabatic Flame Temperature: Data not available.

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity with Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Will not occur
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available.
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available.
8.2 Waterfowl Toxicity: Data not available.
8.3 Biological Oxygen Demand (BOD): Data not available.
8.4 Food Chain Concentration Potential: Data not available.

9. SHIPPING INFORMATION

9.1 Grades of Purity: 98%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: Data not available.
9.4 Venting: Data not available.

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable Liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 120.20
12.3 Boiling Point at 1 atm: 318.2°F = 159°C = 432.2°K
12.4 Freezing Point: −140.2°F = −96°C = 174.2°K
12.5 Critical Temperature: Data not available.
12.6 Critical Pressure: Data not available.
12.7 Specific Gravity: 0.862
12.8 Liquid Surface Tension: Data not available.
12.9 Liquid Water Interfacial Tension: Data not available.
12.10 Vapor (Gas) Specific Gravity: 4.14
12.11 Ratio of Specific Heats of Vapor (Gas): Data not available.
12.12 Latent Heat of Vaporization: Data not available.
12.13 Heat of Combustion: Data not available.
12.14 Heat of Decomposition: Data not available.
12.15 Heat of Solution: Data not available.
12.16 Heat of Polymerization: Data not available.
12.25 Heat of Fusion: Data not available.
12.26 Limiting Value: Data not available.
12.27 Reid Vapor Pressure: 0.1456 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available.
6.12 Flame Temperature: Data not available.

SODIUM

SDU

Common Synonyms	Soft solid under kerosene	Silver to grayish-white	Odorless

Floats and reacts violently with water. Flammable gas is produced.

AVOID CONTACT WITH SOLID. Keep people away.
Call fire department.
Wear goggles, and rubber overclothing (including gloves).
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
FIRE MAY START ON CONTACT WITH AIR.
Flammable gas formed on contact with water or moisture.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
DO NOT USE WATER, CARBON DIOXIDE, OR VAPORIZING LIQUIDS.
Extinguish with dry graphite, soda ash, powdered sodium chloride or other approved dry powder.

Exposure

CALL FOR MEDICAL AID.

SOLID
Will burn skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Restrict access
Evacuate area
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable solid; dangerous when wet
2.2 Class: 4

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: Na
3.3 IMO/UN Designation: 4.3/1428
3.4 DOT ID No.: 1428
3.5 CAS Registry No.: 7440-23-5

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Soft solid or liquid
4.2 Color: Silvery white, changing to gray on exposure to air
4.3 Odor: Odorless

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Maximum protective clothing; goggles and face shield.
5.2 Symptoms Following Exposure: Severe burns caused by burning metal or by caustic soda formed by reaction with moisture on skin.
5.3 Treatment of Exposure: SKIN: brush off any metal, then flood with water for at least 15 min.; treat as heat or caustic burn; call a doctor.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Not pertinent
5.6 Toxicity by Ingestion: Not pertinent
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Non-volatile
5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second- and third-degree burns on short contact and is very injurious to the eyes.
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Dry soda ash, graphite, salt, or other approved dry powder such as dry limestone.
6.4 Fire Extinguishing Agents Not to be Used: Water, carbon dioxide or halogenated extinguishing agents.
6.5 Special Hazards of Combustion Products: Fumes of burning Na are highly irritating to skin, eyes, and mucous membranes.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 250°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts violently, with formation of flammable hydrogen gas and caustic soda solution. A fire often occurs.
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: After reaction with water, caustic soda formed can be diluted with water and/or neutralized with acetic acid.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Not pertinent
8.2 Waterfowl Toxicity: Not pertinent
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial grade: 99.95%
9.2 Storage Temperature: 230°—250°F (liquid); ambient (solid)
9.3 Inert Atmosphere: Dry nitrogen or argon (for liquid); under kerosene (for solid)
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

RR-C

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable solid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	1
Reactivity (Yellow)	2
	W

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 22.49
12.3 Boiling Point at 1 atm: 1621°F = 883°C = 1156°K
12.4 Freezing Point: 207.5°F = 97.5°C = 370.7°K
12.5 Critical Temperature: 3632°F = 2000°C = 2273°K
12.6 Critical Pressure: 5049 psia = 343 atm = 34.8 MN/m²
12.7 Specific Gravity: 0.971 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 27.4 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

TOLUENE

Common Synonyms			
Toluol Methylbenzene Methylbenzol	Watery liquid	Colorless	Pleasant odor

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shorelines.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_6H_5CH_3$
3.3 IMO/UN Designation: 3.2/1294
3.4 DOT ID No.: 1294
3.5 CAS Registry No.: 108-88-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (at shipping): Liquid
4.2 Color: Colorless
4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.
5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 600 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Kidney and liver damage may follow ingestion.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.17 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 40°F C.C.; 55°F O.C.
6.2 Flammable Limits in Air: 1.27%-7%
6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 997°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.7 mm/min.
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1160 mg/l/96 hr/sunfish/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 39% (fresh), 9 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research, reagent, nitration-of 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 80/120: less pure than industrial.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rat
Fire	
Health	
Vapor Irritant	
Liquid or Solid Irritant	
Poisons	
Water Pollution	
Human Toxicity	
Aquatic Toxicity	
Aesthetic Effect	
Reactivity	
Other Chemicals	
Water	
Self Reaction	

11.3 NFPA Hazard Classification:

Category	Classifica
Health Hazard (Blue)	
Flammability (Red)	
Reactivity (Yellow)	

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 16°C and 1 atm: Liquid
12.2 Molecular Weight: 92.14
12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C =
12.4 Freezing Point: −139°F = −95.0°C = 178.2°K
12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K
12.6 Critical Pressure: 595.1 psia = 40.55 atm = 4.108 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.0 dynes/cm = 0.0280 N/m at
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m a
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (
1.089
12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 X 10⁵ J/kg
12.13 Heat of Combustion: −17,430 Btu = −9686 cal/g = −405.5 X 10
12.14 Heat of Decomposition: Not perti
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not perti
12.17 Heat of Fusion: 17.17 cal/g
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: 1.1 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

ZINC

Air Pollutant Standard Set (New York, Montana) (60)
Water Pollution Standard Proposed (EPA) (6) (Kansas) (61) (Several Countries) (35)
Hazardous Substance (EPA) (RQ = 1.0/0.454) (4)
Priority Toxic Pollutant (EPA) (6)
Toxic Chemical (EPA) (8)
Cited in U.S. State Regulations: Florida (G), Illinois (G), Kansas (W), Maryland (G), Massachusetts (G), Michigan (G), Montana (A), New Hampshire (G), New Jersey (G), New York (G,A), Oklahoma (G), Pennsylvania (G), Rhode Island (G)

Description: Zinc, symbol Zn, is a soft silvery colored metal. It melts at 419.5°C and boils at 908°C.

Code Numbers:

CAS 7440-66-6	RTECS ZG8600000	UN 1383 (pyrophoric powder) UN 1436 (non-pyrophoric powder)

Synonyms: None.

Potential Exposure: Zinc is used most commonly as a protective coating of other metals. In addition, it is used in alloy such as bronze and brass, for electrical apparatus in many common goods, and in organic chemical extractions and reductions. Zinc chloride is a primary ingredient in smoke bombs used by military for screening purposes, crowd dispersal and occasionally in fire fighting exercises by both miliatry and civilian communities. In pharmaceuticals, salts of zinc are used as solubilizing agents in many drugs, including insulin.

Permissible Exposure Limits in Air: There are no U.S. or foreign standards for zinc metal in air. There are however, a few standarsd for zinc metal in ambient air (60) ranging from 0.03 $\mu g/m^3$ (New York) to 6.55-39.29 $\mu g/m^3$ (Montana).

Permissible Concentration in Water: There are a number of standards for zinc in water set around the world (35):

EEC	100-500 µg/ℓ	for drinking water
Germany	2000 µg/ℓ	for drinking water
Mexico	10,000 µg/ℓ	for estuaries
Mexico	10 µg/ℓ	for coastal waters
USSR	5000 µg/ℓ	for drinking water
USSR	1000 µg/ℓ	for surface water
USSR	10 µg/ℓ	in water for fishery purposes
WHO	5000 µg/ℓ	in water for esthetic quality

The USEPA (6) has set 5 mg/ℓ (5000 µg/ℓ) for the prevention of adverse effects due to the organoleptic properties of zinc. The State of Kansas has set a drinking water limit of 5 mg/ℓ also (61).

Harmful Effects and Symptoms: Zinc can affect you when breathed in. Zinc dust particles can irritate the eyes. Exposure to solid zinc is not known to cause acute or chronic health effects, but heated zinc may give off zinc oxide fume which can cause health effects. Metal fragments can scratch the eyes. When zinc is refined, cadmium is released. Cadmium is a cancer causing agent.

First Aid: *Inhalation* — In case of emergency to fume or dust, remove person from contaminated area to fresh air. Give oxygen or artificial respiration as needed. Seek medical attention, if necessary.

Skin — Wash affected area with plenty of water.

Eyes — Rinse with plenty of water for 15 minutes. Hold eyelids open. Seek medical attention, if necessary.

Ingestion — If person is conscious give water. Seek medical attention. Do not force an unconscious person to drink.

Personal Protective Methods: *Clothing* — Avoid skin contact with zinc dust. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation. All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection — Wear dust-proof goggles when working with powders or dust, unless full facepiece respiratory protection is worn.

Respirator Selection: Where the potential exists for exposures to zinc dusts, use a MSHA/NIOSH approved respirator equipped with particulate (dust/fume/mist) filters. Particulate filters must be checked every day before work for physical damage, such as rips or tears, and replaced as needed. Where the potential for high exposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in the positive pressure mode or with a full facepiece, hood, or helmet in the continuous flow mode, or use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

Storage: Zinc must be stored to avoid contact with chromic anhydride, manganese chloride, chlorates, chlorine and magnesium since violent reactions occur. Store in tightly closed containers in a cool, well-ventilated area away from water, acids and alkali hydroxides, because flammable hydrogen gas is produced. Sources of ignition such as smoking and open flames are prohibited where zinc is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Shipping: Zinc powder or zinc dust requires a shipping label of: "Dangerous When Wet, Spontaneously Combustible." It falls in DOT Hazard Class 4.3 and Packing Group II. The limit on passenger aircraft or railcar shipment is 15 kg and the limit on cargo aircraft shipment is 50 kg.

Spill Handling: Restrict persons not wearing protective equipment from area of spill until clean-up is complete. Remove all ignition sources. Collect powdered material in the most convenient and safe manner and depost in sealed containers.

Fire Extinguishing: Zinc is a combustible solid. Use dry chemical, sand, or foam extinguishers.

Disposal Method Suggested: Zinc powder should be reclaimed. Unsalvageable waste may be buried in an approved landfill. Leachate should be monitored for zinc content (22).

References

Sax, N.I., Ed., "Dangerous Properties of Industrial Materials Report 1, No. 7, 82-85 (1981).

U.S. Public Health Service, "Toxicological Profile for Zinc," Atlanta, Georgia, Agency for Toxic Substances and Disease Registry (Dec. 1988).

New Jersey Department of Health, "Hazardous Substance Fact Sheet: Zinc," Trenton, NJ (April 1986).

New York State Department of Health, "Chemical Fact Sheet: Zinc," Albany, NY, Bureau of Toxic Substance Assessment (March 1986).

Note — In the interest of compactness and utility of this work, a few zinc compounds have been selected for inclusion. Data is available on other zinc compounds as follows:

Compound	New Jersey Fact Sheet	Sax "Dangerous Properties of Industrial Materials Report"
Zinc Acetate	Zinc Acetate (June 1986)	*1*, No. 7, 88-90 (1981)
Zinc Borate	Zinc Borate (September 1986)	*4*, No. 2, 93-96 (1984)
Zinc Carbonate	Zinc Carbonate (September 1986)	*4*, No. 2, 98-100 (1984)

ATTACHMENT D

Severe Weather

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Severe Weather

When projects are conducted outside, the potential for severe weather must be considered. Thunderstorms, tornados and winter storms can develop quickly, jeopardizing your safety. The following emergency procedures are to be followed in the event of severe weather.

Thunderstorms and Lightning

Monitor weather conditions at all times while working. At a sign of an impending storm - increased cloudiness, darkened skies, increased wind - listen to a radio for the latest weather information.

When a thunderstorm accompanied by lightning is in the project area:

- Cease work immediately and shut down all powered equipment, such as drill rigs.
- Seek shelter inside nearby buildings or trailers. If there are no buildings nearby, seek shelter inside your vehicle.
- If you are caught outside, do not stand beneath tall, isolated trees or telephone poles. Avoid areas projecting above the landscape, such as hill tops. In open areas, go to a low place such as a ravine or valley. Stay away from open water, metal equipment, wire fences and metal pipes. If you are in a group of people in the open, spread out, staying several yards apart.
- If you are caught in a level field or open area far from shelter and you feel your hair stand on end, lightning may be about to strike you. Drop to your knees and bend forward, putting your hands on your knees. You should minimize the body area in direct contact with the ground; **DO NOT LIE FLAT ON THE GROUND.**
- If someone has been struck by lightning, monitor life signs and begin administering rescue breathing or CPR as needed. Seek medical attention.
- Check conscious victims for burns, especially at the fingers and toes and next to buckles and jewelry. Keep the victim calm and still. Administer first aid for shock.

Tornados

Tornados usually develop from thunderstorms and normally occur at the trailing edge of the storm. Most tornados occur in the months of April, May, June, and July in the late afternoon and early evening hours.

When storms are predicted for the project area, monitor weather conditions by radio. A tornado watch is issued when favorable conditions exist for the development of a tornado. A tornado warning is issued by the local weather service office when a tornado has actually been sighted or is strongly indicated by radar.

- If a tornado warning is issued, seek shelter immediately. If there are permanent buildings located onsite, go there immediately, moving toward interior hallways or small rooms on the lowest floor.
- If a tornado warning is issued and you are in a vehicle or a site trailer, leave and go to the nearest building, ditch, ravine, or culvert and lie flat. Shield your head from flying debris using your hands.
- Once a tornado has passed the site, site personnel are to assemble at the designated assembly area to determine if anyone is missing. Administer first aid and seek medical attention as needed.

Winter Storms

When snow or ice storms are predicted for the project area, site personnel should monitor weather conditions by radio. A winter storm watch is issued when a storm has formed and is approaching the area. A winter storm warning is issued when a storm is imminent and immediate action is to be taken.

- When a storm watch is issued, monitor weather conditions and prepare to terminate site activities. Notify the Project Manager of the situation. Seek shelter at site buildings or leave the site and seek warm shelter.
- If you are caught in a severe winter storm while traveling, seek warm shelter if road conditions prevent safe travel.