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# Solutia, Inc.
# St. Louis, Missouri

# Sauget Area 1 – EE/CA and RI/FS
# Volume II

# Human Health Risk Assessment
# Sauget Area 1
# Sauget and Cahokia, Illinois

# Part A

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# CONTENTS

**1.0 INTRODUCTION** ..... **1-1**

**2.0 SITE CHARACTERIZATION** ..... **2-1**

2.1 Study Area Description ..... 2-1

2.2 Sediment Removal Action ..... 2-2

**3.0 DATA EVALUATION AND HAZARD IDENTIFICATION** ..... **3-1**

3.1 Data Evaluation ..... 3-1

3.1.1 Areas and Media ..... 3-1

3.1.2 Analytes ..... 3-2

3.1.3 Summary Statistics ..... 3-3

3.1.4 Sample Collection and Data Evaluation by Area and Medium ..... 3-4

3.1.4.1 Groundwater ..... 3-4

3.1.4.2 Soil ..... 3-5

3.1.4.3 Sediment ..... 3-6

3.1.4.4 Surface Water ..... 3-6

3.1.4.5 Fish Fillet ..... 3-6

3.1.4.6 Air ..... 3-6

3.2 Methodology for Selection of Constituents of Potential Concern ..... 3-7

3.2.1 Evaluation of Frequency of Detection and Essential Nutrient Status ..... 3-7

3.2.2 Comparison to Background ..... 3-7

3.2.3 Toxicity Screen ..... 3-8

3.2.3.1 Sources of Screening Criteria ..... 3-9

3.2.3.2 Screening Methodology ..... 3-11

3.3 Hazard Identification ..... 3-11

3.3.1 Soils ..... 3-11

3.3.1.1 Residential Scenario Direct Contact Screen ..... 3-12

3.3.1.2 Industrial Scenario Direct Contact Screen ..... 3-12

3.3.1.3 Soil to Groundwater Pathway Screen ..... 3-12

3.3.1.4 Soil COPC Summary ..... 3-13

## CONTENTS (Cont'd)

3.3.2 Groundwater ..... 3-14
3.3.3 Sediment ..... 3-15
3.3.4 Surface Water ..... 3-15
3.3.5 Fish Fillet ..... 3-15
3.3.6 Air ..... 3-16

**4.0 DOSE-RESPONSE ASSESSMENT ..... 4-1**

4.1 Sources of Toxicity Values ..... 4-1
4.2 Noncarcinogenic Toxicity Assessment ..... 4-2
4.3 Carcinogenic Toxicity Assessment ..... 4-3
4.4 PCB Dose-Response ..... 4-5
4.5 Dioxin Dose-Response ..... 4-5
4.6 Absorption Adjustment Factors ..... 4-6

**5.0 EXPOSURE ASSESSMENT ..... 5-1**

5.1 Conceptual Site Model ..... 5-1
5.1.1 Sites ..... 5-2
5.1.2 Dead Creek and Borrow Pit Lake ..... 5-3
5.1.3 Transect Areas ..... 5-3
5.2 Identification of Potential Exposure Scenarios and Receptors ..... 5-4
5.2.1 Sites ..... 5-4
5.2.2 Dead Creek and Borrow Pit Lake ..... 5-5
5.2.3 Transect Areas ..... 5-6
5.3 Quantification of Potential Exposures ..... 5-7
5.3.1 Estimating Potential Exposure from Ingestion of and Dermal Contact with Soil or Sediment ..... 5-7
5.3.2 Estimating Potential Exposure via Inhalation ..... 5-8
5.3.3 Estimating Potential Exposure from Groundwater/Surface Water ..... 5-9
5.3.4 Estimating Potential Exposure From Food Consumption ..... 5-10
5.4 Receptor-Specific Exposure Parameters ..... 5-10
5.4.1 Receptor-Specific Exposure Parameters ..... 5-11
5.4.2 Soil Ingestion Rate – Adult Construction Worker ..... 5-11
5.4.3 Frequency of Exposure to COPC in Soil ..... 5-13

## CONTENTS (Cont'd)

5.5 Constituent-Specific Parameters ..... 5-14
5.5.1 Exposure Point Concentrations ..... 5-15
5.5.1.1 Measured EPCs ..... 5-15
5.5.1.2 Modeled EPCs ..... 5-17
5.5.2 Absorption Adjustment Factors ..... 5-18
5.5.3 Skin Permeability Constants ..... 5-20
5.6 Exposure Dose Calculations ..... 5-20

**6.0 RISK CHARACTERIZATION ..... 6-1**

6.1 Carcinogenic Risk Characterization ..... 6-1
6.2 Noncarcinogenic Risk Characterization ..... 6-3
6.3 Risk Characterization Results ..... 6-3
6.3.1 Indoor Industrial Worker ..... 6-3
6.3.2 Outdoor Industrial Worker ..... 6-4
6.3.3 Construction Worker ..... 6-4
6.3.3.1 Summary of Additional Construction Worker Evaluation ..... 6-5
6.3.4 Trespassing Teen ..... 6-6
6.3.5 Recreational Teen ..... 6-6
6.3.6 Recreational Fisher ..... 6-6
6.3.7 Residential Adult and Child ..... 6-7
6.4 Soil to Groundwater Pathway Analysis ..... 6-7
6.5 Uncertainty Analysis ..... 6-8
6.5.1 Selection of Constituents of Potential Concern ..... 6-8
6.5.1.1 COPCs for Groundwater Based on TACO Tier I Class I Groundwater Criteria. 6-10
6.5.1.2 Drinking Water Evaluation of Residential Non-Potable Use Wells ..... 6-10
6.5.2 Toxicity Assessment ..... 6-10
6.5.2.1 Animal-to-Human Extrapolation in Noncarcinogenic Dose-Response Evaluation ..... 6-10
6.5.2.2 Evaluation of Carcinogenic Dose-Response ..... 6-11
6.5.3 Exposure Assessment ..... 6-13
6.5.4 Risk Characterization ..... 6-15

## CONTENTS (Cont'd)

6.5.5 Risk from Multiple Constituents ..... 6-16
6.5.6 Risk to Sensitive Populations ..... 6-17
6.5.7 Summary of Sources of Uncertainty in Human Health Risk Assessment ..... 6-17

**7.0 SHORT-TERM RISK ASSESSMENT ..... 7-1**

7.1 Methodology for Selection of Constituents of Potential Concern for Short-Term Exposure. 7-1
7.1.1 Toxicity Screen ..... 7-1
7.1.1.1 Screening Methodology ..... 7-1
7.2 Hazard Identification ..... 7-1
7.2.1 Soils ..... 7-2
7.2.1.1 Residential Scenario Direct Contact Screen ..... 7-2
7.2.1.2 Industrial Scenario Direct Contact Screen ..... 7-2
7.2.1.3 Soil STCOPC Summary ..... 7-2
7.2.2 Groundwater ..... 7-2
7.2.3 Sediment ..... 7-4
7.2.4 Surface Water ..... 7-5
7.2.5 Fish Fillet ..... 7-5
7.2.6 Air ..... 7-6
7.2.7 Summary of STCOPC ..... 7-6

**8.0 SUMMARY AND CONCLUSIONS ..... 8-1**

8.1 Data Evaluation and Hazard Identification ..... 8-2
8.2 Dose-Response Assessment ..... 8-5
8.3 Exposure Assessment ..... 8-5
8.3.1 Conceptual Site Model ..... 8-5
8.3.2 Exposure Point Concentrations ..... 8-6
8.3.3 Receptor Evaluation ..... 8-7
8.4 Risk Characterization Methodology ..... 8-7
8.4.1 Carcinogenic Risk Characterization ..... 8-8
8.4.2 Non-Carcinogenic Risk Characterization ..... 8-9
8.4.3 Calculation of Remedial Goals ..... 8-9
8.5 Potential Carcinogenic Risk Results ..... 8-10

## CONTENTS (Cont'd)

8.5.1 Transects ..... 8-10
8.5.2 Sites ..... 8-10
8.5.3 Dead Creek/Borrow Pit Lake ..... 8-10
8.5.4 Summary of Potentially Carcinogenic Risk Results ..... 8-11
8.6 Potential Noncarcinogenic Hazard Results ..... 8-14
8.6.1 Transects ..... 8-14
8.6.2 Sites ..... 8-14
8.6.3 Dead Creek/Borrow Pit Lake ..... 8-14
8.6.4 Toxic Endpoint Analysis ..... 8-14
8.6.5 Summary of Noncarcinogenic Hazards ..... 8-15
8.7 Remedial Goals ..... 8-15
8.7.1 2,3,7,8-TCDD-TEQ in Site I ..... 8-15
8.7.2 Chloroform and Naphthalene in Site H ..... 8-16
8.7.3 PCBs in Site I - Outdoor Industrial Worker Scenario ..... 8-16
8.7.4 PCBs in Site I - Construction Worker Scenario ..... 8-17
8.8 Short-Term Risk Assessment ..... 8-17
8.9 Summary of Supplemental Construction Worker Risk Assessment ..... 8-18
8.10 Summary of Class I Groundwater Evaluation ..... 8-19
8.11 Summary ..... 8-19
**9.0 REFERENCES ..... 9-1**

**Appendices:**

A HHRA Workplan
B Summary Statistics
C Screening Values
D Background Calculations
E COPC Selection for Soils and Sediment for Residential Scenarios
F COPC Selection for Soils for Industrial Scenarios
G COPC Selection for the Soil to Groundwater Pathway
H COPC Selection for Groundwater
I COPC Selection for Surface Water and Fish Tissue
J Evaluation of Ambient Air Monitoring Data

## CONTENTS (Cont'd)

K Calculation of Indoor Air VOC Concentrations from Groundwater
L Calculation of Excavation Air VOC Concentrations from Standing Water
M Calculation of Outdoor Air VOC Concentrations from Groundwater
N Calculation of Produce Concentrations
O Absorption Adjustment Factors (AAFs)
P Risk Calculation Spreadsheets
Q Assessment of Potential Lead Exposures
R Toxic Endpoint Analysis
S Groundwater Ordinances
T Supplemental Construction Worker Evaluation
U Class I Groundwater Screen
V Risk Assessment for Nonpotable Use Residential Wells

# LIST OF TABLES

Table 1-1 SUMMARY AND EXPLANATION OF THE DEVIATIONS

Table 3-1 SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN: TRANSECTS – DIRECT CONTACT

Table 3-2 SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN: FILL AREA – DIRECT CONTACT

Table 3-3 SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN: TRANSECTS – SOIL TO GROUNDWATER

Table 3-4 SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN: FILL AREAS –SOIL-TO-GROUNDWATER

Table 3-5 SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN: GROUNDWATER – CHRONIC EXPOSURE

Table 3-6 SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN: SEDIMENT AND FISH TISSUE

Table 3-7 SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN: FILL AREAS – AIR

Table 4-1 DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS FROM CHRONIC EXPOSURE THROUGH THE ORAL ROUTE

Table 4-2 DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS THROUGH INHALATION ROUTE

Table 4-3 DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS BY THE ORAL ROUTE OF EXPOSURE

Table 4-4 DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS BY THE INHALATION ROUTE OF EXPOSURE

Table 4-5 TIERS OF CANCER SLOPE FACTORS FOR ENVIRONMENTAL PCBs

Table 4-6 TEFs FOR DIOXIN AND FURAN CONGENERS

Table 5-1 RECEPTOR/AREA MATRIX

Table 5-2 SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS – INDOOR INDUSTRIAL WORKER

Table 5-3 SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS – OUTDOOR INDUSTRIAL WORKER

Table 5-4 SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS – TRESPASSING TEENAGER

Table 5-5 SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS – CONSTRUCTION WORKER

## LIST OF TABLES (Cont'd)

Table 5-6 SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS – RESIDENT

Table 5-7 SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS – RECREATIONAL TEENAGER

Table 5-8 SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS – RECREATIONAL FISHER

Table 5-9 SOIL ADHERENCE FACTORS – OUTDOOR INDUSTRIAL WORKER

Table 5-10 SOIL ADHERENCE FACTORS – CONSTRUCTION WORKER

Table 5-11 SOIL ADHERENCE FACTORS – RESIDENT ADULT

Table 5-12 SOIL ADHERENCE FACTORS – RESIDENT CHILD

Table 5-13 SOIL ADHERENCE FACTORS – TRESPASSING TEENAGER (7 TO 18)

Table 5-14 EXPOSURE POINT CONCENTRATIONS (RME) – TRANSECT SOILS

Table 5-15 EXPOSURE POINT CONCENTRATIONS (RME) – FILL AREA SOILS

Table 5-16 EXPOSURE POINT CONCENTRATIONS (RME) – OUTDOOR AIR PARTICULATES

Table 5-17 EXPOSURE POINT CONCENTRATIONS (RME) – FILL AREA SOILS – OUT DOOR AIR PARTICULATES

Table 5-18 CALCULATION OF PARTICULATE EMISSION FACTOR FOR TRANSECTS AND FILL AREA L

Table 5-19 CALCULATION OF PARTICULATE EMISSION FACTOR FOR TRANSECTS AND FILL AREAS H AND N

Table 5-20 CALCULATION OF PARTICULATE EMISSION FACTOR FOR TRANSECTS AND FILL AREA I

Table 5-21 EXPOSURE POINT CONCENTRATIONS (RME) – TRANSECT AREA SOILS – OUTDOOR EXCAVATION AIR

Table 5-22 EXPOSURE POINT CONCENTRATIONS (RME) – FILL AREA SOILS – OUTDOOR EXCAVATION AIR

Table 5-23 EXPOSURE POINT CONCENTRATIONS (RME) – SEDIMENT AND FISH FILLET

Table 5-24 EXPOSURE POINT CONCENTRATIONS (RME) – GROUNDWATER

Table 5-25 EXPOSURE POINT CONCENTRATIONS (RME) – INDOOR AIR VOCs

Table 5-26 EXPOSURE POINT CONCENTRATIONS (RME) – EXCAVATION AIR, VOLATILIZATION FROM EXPOSED GROUNDWATER

Table 5-27 EXPOSURE POINT CONCENTRATIONS (RME) – OUTDOOR AIR VOCs

## LIST OF TABLES (Cont'd)

Table 5-28 EXPOSURE POINT CONCENTRATIONS (RME) – PRODUCE GROWN IN TRANSECT SOILS

Table 5-29 EXPOSURE POINT CONCENTRATIONS (MLE) – TRANSECT SOILS

Table 5-30 EXPOSURE POINT CONCENTRATIONS (MLE) – FILL AREA SOILS

Table 5-31 EXPOSURE POINT CONCENTRATIONS (MLE) – OUTDOOR AIR PARTICULATES

Table 5-32 EXPOSURE POINT CONCENTRATIONS (MLE) – FILL AREA SOILS – OUTDOOR AIR PARTICULATES

Table 5-33 EXPOSURE POINT CONCENTRATIONS (MLE) – TRANSECT AREA SOILS – OUTDOOR EXCAVATION AIR

Table 5-34 EXPOSURE POINT CONCENTRATIONS (MLE) – FILL AREA SOILS – OUTDOOR EXCAVATION AIR

Table 5-35 EXPOSURE POINT CONCENTRATIONS (MLE) – SEDIMENT AND FISH FILLET

Table 5-36 EXPOSURE POINT CONCENTRATIONS (MLE) – GROUNDWATER

Table 5-37 EXPOSURE POINT CONCENTRATIONS (MLE) – INDOOR AIR VOCs

Table 5-38 EXPOSURE POINT CONCENTRATIONS (MLE) – EXCAVATION AIR, VOLATILIZATION FROM EXPOSED GROUNDWATER

Table 5-39 EXPOSURE POINT CONCENTRATIONS (MLE) – OUTDOOR AIR VOCs

Table 5-40 EXPOSURE POINT CONCENTRATIONS (MLE) – PRODUCE GROWN IN TRANSECT SOILS

Table 5-41 ABSORPTION ADJUSTMENT FACTORS (AAFs) – FOR CHRONIC EXPOSURES

Table 5-42 DERMAL PERMEABILITY CONSTANTS

Table 5-43 CALCULATION OF DERMAL PERMEABILITY CONSTANTS

Table 5-44 SOURCE TERM IN THE THREE VOLATILIZATION MODELS

Table 6-1 TOTAL POTENTIAL CARCINOGENIC RISK – INDOOR WORKER – RME

Table 6-2 TOTAL POTENTIAL HAZARD INDEX – INDOOR WORKER – RME

Table 6-3 TOTAL POTENTIAL CARCINOGENIC RISK - OUTDOOR WORKER – RME

Table 6-4 TOTAL POTENTIAL HAZARD INDEX – OUTDOOR WORKER – RME

Table 6-5 TOTAL POTENTIAL CARCINOGENIC RISK – CONSTRUCTION WORKER – RME

Table 6-6 TOTAL POTENTIAL HAZARD INDEX – CONSTRUCTION WORKER – RME

## LIST OF TABLES (Cont'd)

Table 6-7 TOTAL POTENTIAL CARCINOGENIC RISK – TRESPASSING TEEN – RME

Table 6-8 TOTAL POTENTIAL HAZARD INDEX – TRESPASSING TEEN – RME

Table 6-9 TOTAL POTENTIAL CARCINOGENIC RISK – RECREATIONAL TEEN – RME

Table 6-10 TOTAL POTENTIAL HAZARD INDEX – RECREATIONAL TEEN – RME

Table 6-11 TOTAL POTENTIAL CARCINOGENIC RISK – RECREATIONAL FISHER – RME

Table 6-12 TOTAL POTENTIAL HAZARD INDEX – RECREATIONAL FISHER – RME

Table 6-13 TOTAL POTENTIAL CARCINOGENIC RISK – RESIDENTIAL RECEPTORS – RME

Table 6-14 TOTAL POTENTIAL HAZARD INDEX – RESIDENTIAL RECEPTORS – RME

Table 6-15 TOTAL POTENTIAL CARCINOGENIC RISK – INDOOR WORKER – MLE

Table 6-16 TOTAL POTENTIAL HAZARD INDEX – INDOOR WORKER – MLE

Table 6-17 TOTAL POTENTIAL CARCINOGENIC RISK – OUTDOOR WORKER – MLE

Table 6-18 TOTAL POTENTIAL HAZARD INDEX – OUTDOOR WORKER – MLE

Table 6-19 TOTAL POTENTIAL CARCINOGENIC RISK – CONSTRUCTION WORKER – MLE

Table 6-20 TOTAL POTENTIAL HAZARD INDEX – CONSTRUCTION WORKER – MLE

Table 6-21 TOTAL POTENTIAL CARCINOGENIC RISK – TRESPASSING TEEN – MLE

Table 6-22 TOTAL POTENTIAL HAZARD INDEX – TRESPASSING TEEN – MLE

Table 6-23 TOTAL POTENTIAL CARCINOGENIC RISK – RECREATIONAL TEEN – MLE

Table 6-24 TOTAL POTENTIAL HAZARD INDEX – RECREATIONAL TEEN – MLE

Table 6-25 TOTAL POTENTIAL CARCINOGENIC RISK – RECREATIONAL FISHER – MLE

Table 6-26 TOTAL POTENTIAL HAZARD INDEX – RECREATIONAL FISHER – MLE

Table 6-27 TOTAL POTENTIAL CARCINOGENIC RISK – RESIDENTIAL RECEPTORS – MLE

Table 6-28 TOTAL POTENTIAL HAZARD INDEX – RESIDENTIAL RECEPTORS – MLE

Table 7-1 SUMMARY OF SHORT-TERM CONSTITUENTS OF POTENTIAL CONCERN

Table 7-2 COMPARISON OF CALCULATED AIR CONCENTRATIONS FOR VOCs TO PRGs – GROUNDWATER – SHORT-TERM EXPOSURE

Table 7-3 COMPARISON OF CALCULATED VOC AIR CONCENTRATIONS TO SHORT-TERM ACTION LEVELS – GROUNDWATER – SHORT-TERM EXPOSURE

Table 8-1 SUMMARY OF POTENTIAL RISKS FOR ALL RECEPTORS – TRANSECTS

## LIST OF TABLES (Cont'd)

Table 8-2 SUMMARY OF POTENTIAL HAZARD INDICES FOR ALL RECEPTORS – TRANSECTS

Table 8-3 SUMMARY OF POTENTIAL RISKS FOR ALL RECEPTORS – FILL AREAS

Table 8-4 SUMMARY OF POTENTIAL HAZARD INDICES FOR ALL RECEPTORS – FILL AREAS

Table 8-5 SUMMARY OF TARGET ENDPOINT ANALYSIS – CONSTRUCTION WORKER

Table 8-6 SUMMARY OF POTENTIAL RISKS FOR ALL RECEPTORS – DEAD CREEK AND BORROW LAKE PIT

Table 8-7 SUMMARY OF POTENTIAL HAZARD INDICES FOR ALL RECEPTORS – DEAD CREEK AND BORROW LAKE PIT

Table 8-8 TOTAL POTENTIAL RISKS - ORIGINAL AND SUPPLEMENTAL - CONSTRUCTION WORKER - RME

Table 8-9 TOTAL POTENTIAL RISKS - ORIGINAL AND SUPPLEMENTAL - CONSTRUCTION WORKER - MLE

# LIST OF FIGURES

Figure 1-1 SAUGET AREA 1 STUDY AREA

Figure 3-1 SOIL, SEDIMENT, SURFACE WATER AND GROUNDWATER SAMPLING LOCATIONS EVALUATED IN THE RISK ASSESSMENT

Figure 3-2 GROUNDWATER SAMPLE LOCATIONS EVALUATED IN THE HHRA

Figure 3-3 TRANSECT SURFACE AND SUBSURFACE SOIL SAMPLE LOCATIONS

Figure 3-4 SITE SURFACE SOIL SAMPLES AND LOCATIONS EVALUATED IN THE HHRA

Figure 3-5 SEDIMENT AND SURFACE WATER SAMPLE LOCATIONS

Figure 3-6 BACKGROUND SAMPLE LOCATIONS: GROUNDWATER AND SOIL

Figure 3-7 AIR SAMPLE LOCATIONS AND RESULTS EVALUATED IN THE HHRA

Figure 5-1 CONCEPTUAL SITE MODEL

Figure 5-2 DIRECT CONTACT – FILL AREA SOILS – RESIDENTIAL AND INDUSTRIAL SCENARIOS – EPCs

Figure 5-3 RESIDENTIAL SCENARIO – TRANSECT SURFACE SOIL EPCs

Figure 5-4 INDUSTRIAL SCENARIO – SURFACE SOILS EPCs

Figure 5-5 INDUSTRIAL SCENARIO – SUBSURFACE SOIL EPCs

Figure 5-6 GROUNDWATER EPCs

Figure 8-1 SAMPLE BY SAMPLE CONCENTRATIONS OF COCs

# LIST OF ACRONYMS

| | |
|---|---|
| AAF | Absorption Adjustment Factors |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| AOC | Administrative Order by Consent |
| ARAR | Applicable or Relevant and Appropriate Requirement |
| ASTM | American Society for Testing and Materials |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| AWQC | Ambient Water Quality Criteria |
| BEI | Biological Exposure Indices |
| bgs | below ground surface |
| BPL | Borrow Pit Lake |
| CADD | Chronic Average Daily Dose |
| CAS | Chemical Abstracts Service |
| COC | Constituent of Concern |
| COPC | Constituent of Potential Concern |
| CS | Creek Segment |
| CSF | Cancer Slope Factor |
| CSM | Conceptual Site Model |
| DQL | Data Quality Level |
| EE/CA | Engineering Evaluation and Cost Analysis |
| EFH | Exposure Factors Handbook |
| ELCR | Excess Lifetime Cancer Risk |
| EPC | Exposure Point Concentration |
| ESL | Effects Screening Level |
| HEAST | Health Effects Assessment Summary Tables |
| HHRA | Human Health Risk Assessment |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| IEPA | Illinois Environmental Protection Agency |
| IRIS | Integrated Risk Information System |
| LADD | Lifetime Average Daily Dose |
| LMS | Linearized Multi-Stage |
| LOAEL | Lowest Observed Adverse Effect Level |
| MLE | Most Likely Exposure |
| NCEA | National Center for Environmental Assessment |
| NCP | National Contingency Plan |
| NIOSH | National Institute of Occupational Safety and Health |
| NOAA | National Oceanographic and Atmospheric Administration |
| NOAEL | No Observed Adverse Effect Level |
| PAH | Polycyclic Aromatic Hydrocarbons |

## LIST OF ACRONYMS (Cont'd)

| | |
|---|---|
| PC | Skin Permeability Constant |
| PCB | Polychlorinated Biphenyl |
| PEF | Particulate Emission Factor |
| PM10 | Particulate Matter with Mean Diameter 10 microns |
| PQL | Practical Quantitation Limit |
| PRG | Preliminary Remediation Goal |
| QAPP | Quality Assurance Project Plan |
| RAGS | Risk Assessment Guidance for Superfund |
| RBC | Risk-Based Concentration |
| RfC | Reference Concentration |
| RfD | Reference Dose |
| RG | Remedial Goal |
| RI/FS | Remedial Investigation and Feasibility Study |
| RI/SC | Remedial Investigation/Site Characterization |
| RME | Reasonable Maximum Exposure |
| SOW | Scope of Work |
| SSL | Soil Screening Level |
| SSP | Support Sampling Plan |
| SQL | Sample Quantitation Limit |
| STCOPC | Short-Term Constituent of Potential Concern |
| SVOC | Semi-Volatile Organic Compound |
| TACO | Tiered Approach to Corrective Action Objectives |
| TCDD | Tetrachlorodibenzo-p-dioxin |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TEF | Toxic Equivalence Factor |
| TEQ | Toxic Equivalence Concentration |
| TLV | Threshold Limit Value |
| TNRCC | Texas Natural Resources Conservation Commission |
| TPH | Total Petroleum Hydrocarbons |
| UAO | Unilateral Administrative Order |
| UCL | Upper Confidence Limit |
| USEPA | U.S. Environmental Protection Agency |
| VOC | Volatile Organic Compounds |
| WHO | World Health Organization |

# 1.0 INTRODUCTION

This report presents the baseline human health risk assessment (HHRA) and the stream-lined short-term risk assessment for Sauget Area 1, located in Sauget and Cahokia, Illinois. It is Volume II of the Remedial Investigation/Site Characterization Report (RI/SC) for Sauget Area 1 (in preparation). The environmental evaluations of Sauget Area 1 are being conducted as an Engineering Evaluation and Cost Analysis (EE/CA) for the Sauget Area 1 sites and soil, sediment, surface water and air, and for the Remedial Investigation and Feasibility Study (RI/FS) for Sauget Area 1 groundwater. The HHRA was conducted to satisfy the Scope of Work (SOW) for the EE/CA and RI/FS (specifically Task 4 Section 2.5 and Task 5 Section 2 of the SOW) provided as an attachment to the Administrative Order by Consent (AOC) entered into by the U.S. Environmental Protection Agency (USEPA) and Solutia Inc. (Solutia), as well as to be compliant with the National Contingency Plan (NCP) (USEPA, 1990).

The HHRA and the short-term risk assessment were conducted in accordance with the USEPA-approved Human Health Risk Assessment Workplan (HHRA Workplan) dated June 25, 1999 (including the August 6, 1999 revised pages), which was submitted as Volume 1B of the Support Sampling Plan (SSP) for Sauget Area 1 (Solutia, 1999). The HHRA Workplan is provided as Appendix A to this report. [Note that sections, figures and tables from the HHRA Workplan will be referenced in this report. Because of the similarity of numbering, the following approach has been taken to identify workplan elements: "Figure (Appendix A) 2-1" refers to an HHRA Workplan figure, and "Figure 2-1" refers to an HHRA Report figure.]

The HHRA and the short-term risk assessment were conducted using data from environmental samples collected from the study area (shown in Figure 1-1 and described in more detail in Section 2) in accordance with the USEPA-approved SSP. Validated laboratory analytical data are compiled in the Data Validation Report (Solutia, 2000a), and field data are compiled in the Field Sampling Report (Solutia, 2000b). These data are summarized and evaluated in the RI/SC (of which this report is Volume II).

There have been some deviations from the work plan in the conduct of this HHRA. Table 1-1 provides a summary and explanation of the deviations.

Baseline Risk Assessment

The purpose of the baseline HHRA is to evaluate potential human health effects of chronic daily exposures to constituents detected in samples of environmental media collected from the study area.

The HHRA was conducted to be consistent with USEPA guidance for conducting a risk assessment including, but not limited to, the following:

- Risk Assessment Guidance for Superfund (RAGS): Volume 1 - Human Health Evaluation Manual (Parts A and D) (USEPA, 1989a and 1998a).
- Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions (USEPA, 1991a).
- USEPA Soil Screening Guidance: User's Guidance Manual, and Technical Background Document (USEPA, 1996a,b).
- Human Health Evaluation Manual Supplemental Guidance; Standard Default Exposure Factors. OSWER Directive 9285.6-03 (USEPA, 1991b).
- Exposure Factors Handbook (USEPA, 1997a).
- Land Use in CERCLA Remedy Selection Process. OSWER Directive No. 9355.7-04 (USEPA, 1995a).

In addition, elements of the Illinois Environmental Protection Agency (IEPA) Tiered Approach to Corrective Action Objectives (TACO) (IEPA, 1998) were used in the conduct of the HHRA.

The baseline HHRA has been conducted in accordance with the four-step paradigm for human health risk assessments developed by USEPA (USEPA, 1989a); these steps are:

- Data Evaluation and Hazard Identification
- Toxicity Assessment
- Exposure Assessment
- Risk Characterization

Streamlined Short-Term Risk Assessment

The purpose of the short-term risk assessment is to evaluate potential human health effects of short-term (i.e., subchronic) exposures to constituents detected in samples of environmental media collected as part of the SSP. Since short-term health evaluations are not a standard component of most hazardous waste site health assessments, limited guidance exists for performing these types of evaluations. The short-term evaluation was conducted using the same four-step paradigm presented above for the baseline HHRA, and followed the procedures presented in the HHRA Workplan.

Report Organization

A description of the site is presented in Section 2.0. The baseline HHRA is presented in Section 3.0 through 6.0 of this report. The short-term risk assessment is presented in Section 7.0. Section 8.0

presents the summary and conclusions and Section 9.0 provides the references. A summary of the information presented in each section of the report follows.

- Section 2.0 – Site Characterization. This section discusses the site and its environs, describes source areas, potential migration pathways, and potentially impacted media.
- Section 3.0 – Data Evaluation and Hazard Identification. This section presents a summary of the site data for use in the HHRA, and the results of the process used for the selection of constituents of potential concern (COPCs) to be quantitatively evaluated in the baseline HHRA.
- Section 4.0 – Dose-Response Assessment. The dose-response assessment evaluates the relationship between the magnitude of exposure (dose) and the potential for occurrence of specific health effects (response) for each COPC. Both potential carcinogenic and noncarcinogenic effects are considered. This section presents the quantitative dose-response values used in the baseline HHRA. The most current USEPA verified dose-response values are used when available.
- Section 5.0 – Exposure Assessment. The purpose of the exposure assessment is to provide a quantitative estimate of the magnitude and frequency of potential exposure to COPCs by a receptor. This section presents the updated conceptual site model (CSM) originally presented in the HHRA Workplan. Potentially exposed individuals, and the pathways through which those individuals may be exposed to COPCs are identified based on the physical characteristics of the site, as well as the current and reasonably foreseeable future uses of the site and surrounding area. The extent of a receptor's exposure is estimated by constructing exposure scenarios that describe the potential pathways of exposure to COPCs and the activities and behaviors of individuals that might lead to contact with COPCs in the environment.
- Section 6.0 – Risk Characterization. Risk characterization combines the results of the exposure assessment and the toxicity assessment to derive site-specific estimates of potentially carcinogenic and noncarcinogenic risks resulting from both current and reasonably foreseeable potential human exposures to COPCs. The results of the risk characterization are used to identify constituents of concern (COCs), which are a subset of those COPCs whose risks result in an exceedance of the target risk range of $1x10^{-6}$ to $1x10^{-4}$ for potential carcinogens and a target Hazard Index of one for noncarcinogens (that act on the same target organ), as defined in the AOC SOW, USEPA guidance (USEPA, 1991a), and by IEPA (1998). The target risk levels used for the identification of COCs are based on USEPA guidance and Illinois TACO guidance. Specifically, USEPA provides the following guidance (USEPA, 1991a):

  "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than $10^{-4}$, and the non-

carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." and,

"The upper boundary of the risk range is not a discrete line at $1 \times 10^{-4}$, although EPA generally uses $1 \times 10^{-4}$ in making risk management decisions. A specific risk estimate around $10^{-4}$ may be considered acceptable if justified based on site-specific conditions."

IEPA provides the following summary for the evaluation of cumulative risk for carcinogens (IEPA, 1998, Fact Sheet 13: Mixture Rule):

"The cumulative risk of carcinogenic contaminants attacking the same target must not exceed 1 in 10,000 [$10^{-4}$]. Therefore, the risk from all on-site similar acting carcinogens must be added together. If this cumulative risk level is greater than 1 in 10,000, corrective action must be taken to reach an acceptable risk level."

Within any of the steps of the risk evaluation process described above, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. The assumptions that introduce the greatest amount of uncertainty in this risk evaluation are discussed in Section 6.0.

- Section 7.0 – Short-Term Risk Assessment. The results of the short-term risk assessment, as described above, are presented in this section.

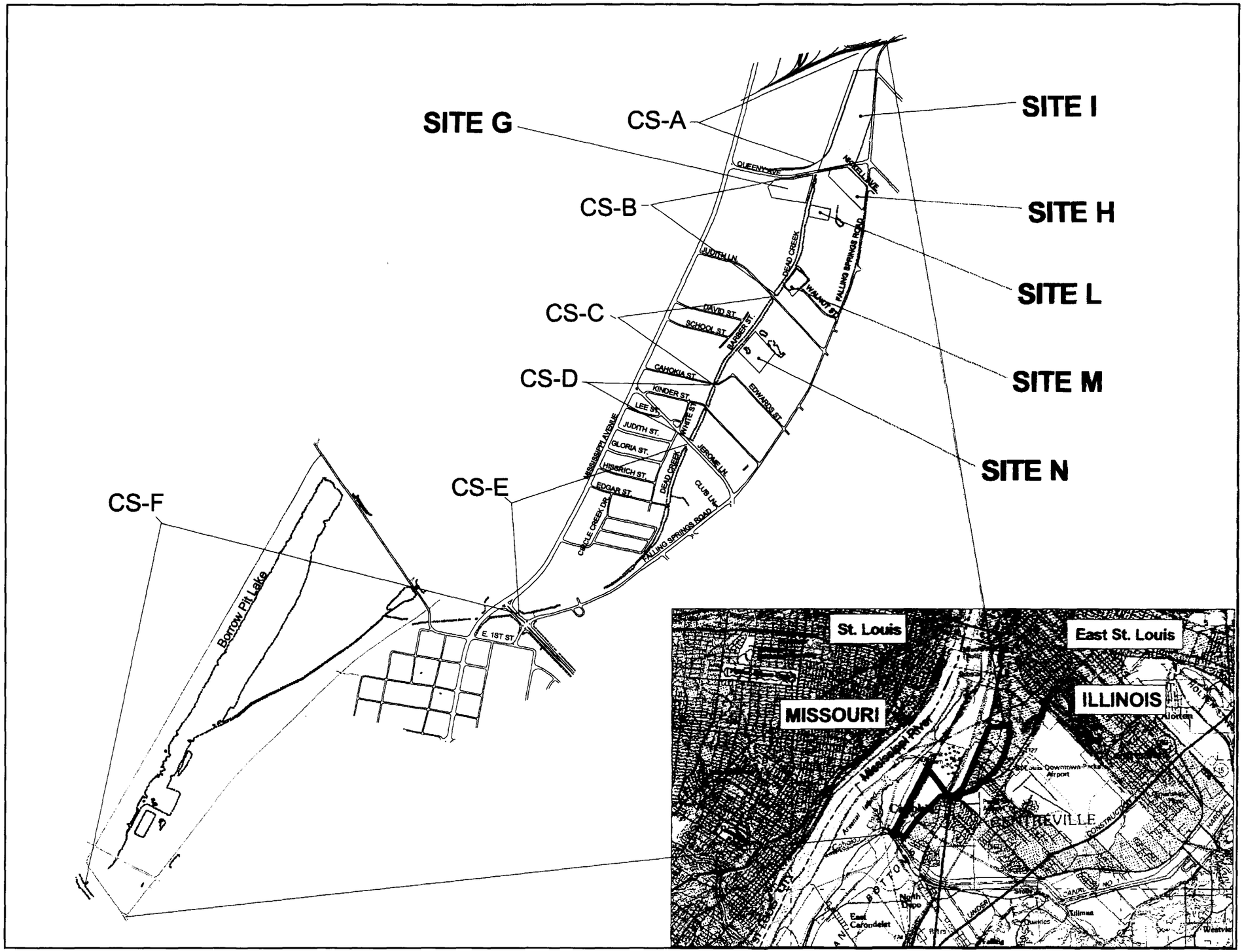
- Section 8.0 – Summary and Conclusions. This section presents a summary of the results of the baseline and short-term HHRAs. COCs are further evaluated in this section, and remedial goals (RGs) are calculated.

- Section 9.0 – This section presents the references used in the text.

Tables and figures follow each section.

Table 1-1
Modifications from Workplan
Sauget Area 1 EE/CA and RI/FS
Human Health Risk Assessment

| Modification | Rationale |
|---|---|
| No comparison to Minimal Risk Levels (MRLs) was performed in the Short Term Risk Assessment. | No Short Term Constituents of Potential Concern (STCOPCs) were identified in soil. |
| No acute risk calculations were performed for the Short Term Risk Assessment. | The only STOPCs identified did not exhibit excess risks or hazards in the chronic risk assessment. Therefore, they would not exhibit excess risks or hazards in the short term risk assessment. |
| Site subsurface waste data were not collected. | Although the workplan indicated that this data would be collected, it was not stipulated in the Site Sampling Plan (SSP). An evaluation using historical data is presented in Appendix T. |
| Industry-Specific Analytes: copper, zinc, fluorides and phosphorous data were not validated. | Although the workplan indicated that this data would be validated, it was not stipulated in the SSP. |
| The Class II groundwater criteria were not adjusted for cumulative effects. | The TACO guidance does not require this adjustment for Class II standards. |
| Site M, CS-B, CS-C, CS-D, CS-E, the reference area and portions of CS-F were not included in the risk assessment. | Under an UAO, a sediment removal action is planned, thereby eliminating these areas as exposure areas. |
| Transects 1 and 2 (all media) were not included in the quantitative evaluation for any receptor. | No Constituents of Potential Concern (COPCs) were identified in these areas. |
| Site G surface soil was not included in the quantitative evaluation for any receptor. | No COPCs were identified in soil for Site G. |
| Site N surface soil was only included in the quantitative evaluation for residential receptors. | No COPCs were identified for the industrial scenario for soils in Site N. |
| The quantitative evaluation of the Indoor Industrial Worker, the Outdoor Industrial Worker, the Construction Worker, and the Resident did not include inhalation of constituents volatilized from Site subsurface waste or Transect subsurface soil. The quantitative evaluation of the Trespassing Teenager did not include inhalation of constituents volatilized from Site subsurface waste. | Site subsurface waste data were not collected, as collection of this data was not stipulated by the SSP. No volatile organic compounds (VOCs) were identified as COPCs in Transect subsurface soil. |
| The quantitative evaluation of the Recreation Teenager and the Recreational Fisher did not include ingestion of and dermal contact with surface water. | No COPCs were identified in surface water. |
| The quantitative evaluation of the Resident did not include inhalation of constituents volatilized from groundwater. | The only COPC identified in residential wells was lead, which is not volatile. |
| The produce ingestion rates for the adult and child resident changed (see Table 5-7 of the workplan and Table 5-6 of the risk assessment). | The produce ingestion rates were adjusted for cooking loss and dry weight. |




N

LEGEND

- Site
- Water Body
- Roads
- CS-A Dead Creek Segment Designations

**FIGURE 1-1**

Sauget Area 1 Study Area

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

3000 0 3000 Feet

ENSR INTERNATIONAL

J:/Indl_Serv/Project Files/Solutia-6105/Sauget-6105-008/Maps/ensrmaps.apr
December 29, 2000
Revision 0

# 2.0 SITE CHARACTERIZATION

This HHRA addresses data from environmental samples collected in accordance with the SSP from the areas of Sauget Area 1 identified in the AOC. Specifically, the EE/CA for Sauget Area 1 addresses waste, soil, surface water, sediment and air in the following areas:

- Sites G, H, I, L, M, and N
- Potentially impacted areas:
  - Dead Creek Segments (CS): CS-B, CS-C, CS-D, CS-E, and CS-F
  - Undeveloped, commercial and/or residential properties adjacent to these creek segments

The RI/FS for Sauget Area 1 addresses groundwater in the following areas:

- Sites and areas downgradient of the sites
- Private wells along Walnut Street and Judith Lane in Cahokia, IL

## 2.1 Study Area Description

Figure 1-1 presents the study area addressed by the EE/CA and RI/FS.

As discussed in Sections 1.0 and 2.0 of the SSP, Sites G, H, I, L, M and N contain wastes that came from a wide variety of municipal and industrial sources. Site M is a fenced former sand borrow pit that is now filled with water and is hydrologically connected to Dead Creek. Site G is a fill area stabilized by USEPA in an emergency response that solidified organic wastes, placed a temporary soil cover over the site, and controlled site access by the installation of a fence. Recent inspection indicates that the site and fence are still stable. Recent inspection of Site H indicated that the site is stable with a vegetative cover and no exposed wastes at the surface. Site L also appears to be stable. It is covered with cinders and is located in a vegetated field. Site N reportedly contains construction rubble. Site I was originally used as a sand and gravel pit that received industrial and municipal wastes. The site is currently graded and covered with crushed stone and used for equipment and truck parking.

Dead Creek is an intermittent urban stream that bisects Sauget Area 1, passing through areas of commercial land use, areas of open land, and areas of residential land use, and eventually discharges to Borrow Pit Lake and Prairie DuPont Creek. The Borrow Pit Lake was formed as the result of the excavation of borrow material in the mid-1950's for local construction, including the levy.

The northern portion of the study area is an industrial area. Land use south of Area L is mixed undeveloped, commercial and residential. Groundwater is not used as a source of drinking water in the area. Both the Village of Sauget and the Village of Cahokia have in effect ordinances that prohibit the use of groundwater as a potable water supply. Copies of these ordinances are presented in Appendix S. However, there are some private wells in the area that may be used for outdoor household activities.

## 2.2 Sediment Removal Action

On May 31, 2000, the USEPA issued a Unilateral Administrative Order (UAO) to Monsanto Company and Solutia Inc. (Docket No. V-W-99-C-554) pursuant to section 106(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended, 42 U.S.C. Section 9606(a). The Order requires the following response activities at Sauget Area 1 Creek Segments B and Site M and Creek Segments C, D and E and the portion of Creek Segment F between Creek Segment E and Route 3, which are located in Sauget and Cahokia, Illinois:

- Preparation of a Time Critical Removal Action Work Plan;
- Implementation of the Removal Action in accordance with the Work Plan to mitigate the threats posed by presence of contamination in Dead Creek sediments and certain adjacent soils and their potential migration via overflow and flood waters from the Site;
- Removal of materials from CS-B (creek sediments, creek bed soils and flood plain soils); CS-C, D, E, and a portion of F (non-native creek sediments only); and Site M (pond sediments and pond bottom soils) in Sauget Area 1, while minimizing adverse impacts to area wetlands and habitat;
- Proper handling, dewatering, treatment and placement of such materials in the on-site Containment Cell;
- A plan for management of Dead Creek storm water during the removal action;
- Sampling and analysis of areas where materials has been removed, for the purpose of defining remaining contamination;
- Placement of membrane liner material over CS-B and in all other excavated areas where, based on post-removal sample results, such liner is determined to be necessary; and
- Design of a containment cell that will provide adequate protection to human health and the environment.

The Order requires Solutia to conduct these removal activities to abate a potential imminent and substantial endangerment to the public health, welfare or the environment that may be presented by the actual or threatened release of hazardous substances at or from the site.

Therefore, environmental data from Site M and Dead Creek segments CS-B, CS-C, CS-D, CS-E, and a portion of CS-F have not been included in the risk assessment.

Upon completion of the sediment removal action, exit sampling will be conducted in Dead Creek and Site M. A risk assessment will be performed using these data to determine what, if any, additional actions should be taken in these areas.

Conceptual Site Model

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a conceptual site model (CSM) for human health was developed. The purpose of the CSM is to identify source areas, potential migration pathways of constituents from source areas to environmental media where exposure can occur, and to identify potential human receptors. The CSM is meant to be a "living" model that can be updated and modified as additional data become available.

The initial CSM for the site is presented in Figure (Appendix A) 2-1, and was used to guide the investigation presented in the SSP and the COPC selection process in Section 3.0. An updated CSM is presented in Section 5.0, based on the data evaluation and COPC selection conducted in Section 3.0.

# 3.0 DATA EVALUATION AND HAZARD IDENTIFICATION

The purpose of the data evaluation and hazard identification process is two-fold: 1) to evaluate the nature and extent of release of constituents present at the site; and 2) to select a subset of these constituents identified as COPCs for quantitative evaluation in the risk assessment. This step of the risk assessment involves compiling and summarizing the data for the risk assessment, and selecting COPCs based on a series of screening steps.

## 3.1 Data Evaluation

The HHRA was conducted using validated data collected from the site in support of the SSP. Data used in the HHRA are presented in the Data Validation Report (Solutia, 2000a) and the Field Sampling Report (Solutia, 2000b).

### 3.1.1 Areas and Media

The SSP for Sauget Area 1 was designed to investigate three major areas of the Sauget Area 1 study area:

- Sites G, H, I, L, M, and N;
- Dead Creek and its environs including creek segments CS-B, CS-C, CS-D, CS-E, and CS-F, which includes the Borrow Pit Lake; and
- The residential/commercial/undeveloped areas adjacent to Dead Creek, evaluated as Transects 1, 2, 3, 4, 5, 6, and 7.

Of the data collected in support of the SSP, analytical data for use in the HHRA are available for the following media:

- Site shallow groundwater;
- Site downgradient alluvial groundwater;
- Shallow groundwater southwest of the sites;
- Shallow groundwater in the vicinity of Walnut Street and Judith Lane;
- Groundwater from private wells in the vicinity of Walnut Street and Judith Lane;
- Site surface soil (0-0.5 feet below ground surface (bgs));
- Residential area surface soil;

- Residential area subsurface soil (0.5-6 feet bgs);
- Dead Creek sediment;
- Borrow Pit Lake sediment;
- Dead Creek surface water;
- Borrow Pit Lake surface water;
- Fish tissue from Borrow Pit Lake; and
- 24-hour air samples at Sites G, H, I, and L.

Analytical data for use in the HHRA from background or reference locations are available for the following media:

- Surface soil;
- Subsurface soil;
- Groundwater;
- Surface water;
- Sediment;
- Fish tissue; and
- Upwind air.

Figure 3-1 shows the study area and the sample collection locations for soil, groundwater, surface water and sediment (excluding the reference or background areas).

### 3.1.2 Analytes

The SSP identified the suites of analytes for each medium. For ease of discussion here, the analytes included in the risk assessment are identified as follows:

- Full suite of analytes – volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, mercury, cyanide, polychlorinated biphenyls (PCBs), pesticides, and herbicides;
- Dioxins – dioxins and furans; and
- Industry-specific analytes – PCBs, total petroleum hydrocarbons (TPH), copper, zinc, fluorides, phosphorous and ortho-phosphate. [Note – of these analytes, only the data for PCBs were

validated for inclusion in the HHRA. Data packages are available for the other analyses, but validation was not necessary to perform the HHRA.]

All analytical data collected in support of the SSP were compiled and tabulated in a database for statistical analysis. These data are presented in the Data Validation Report (Solutia, 2000a).

### 3.1.3 Summary Statistics

The data for each area and medium were summarized for use in the risk assessment. The following guidance documents were used to develop the summary statistics:

- Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual, Part A (U.S. EPA, 1989a).
- Supplemental Guidance to RAGS: Calculating the Concentration Term (U.S. EPA, 1992a).

The steps used to summarize the data by area and medium for use in identifying COPCs in the screening process presented in this section are discussed here. The additional steps used to summarize the data for identifying exposure point concentrations (EPCs) are presented in Section 5.0.

The steps used to summarize the data by area and medium are as follows:

Treatment of Duplicates: Data for samples and their duplicates were averaged before summary statistics were calculated, such that a sample and its duplicate were treated as one sample for calculation of summary statistics (including maximum detection and frequency of detection).

Treatment of Non-Detects:

- Summary statistics were not calculated for constituents that were not detected in a particular area/medium.
- Where constituents were detected in some samples and not in others in a particular area/medium, ½ the reported sample quantitation limit (SQL) was used as a proxy concentration for the samples reported as nondetect (USEPA, 1989b).
- For all non-detects for which ½ the SQL was calculated, ½ the SQL was compared to the maximum detected concentration for that area and medium. Where ½ the SQL was greater than the maximum detected concentration in a particular area/medium,

the SQL value was not used in the calculation of summary statistics for that constituent in that area and medium (USEPA, 1989a).

Frequency of Detection: The frequency of detection is reported as a percentage based on the total number of samples analyzed and the number of samples reported as detected for a specific constituent. The number of samples used to calculate statistics reflects the treatment of non-detects described above.

Minimum Detected Concentration: This is the minimum detected concentration for each constituent/area/medium combination, after duplicates have been averaged.

Maximum Detected Concentration: This is the maximum detected concentration for each constituent/area/medium combination, after duplicates have been averaged.

Average Concentration: This is the arithmetic mean concentration for each constituent/area/medium combination, after duplicates have been averaged and non-detects have been evaluated.

Appendix B presents the summary statistics by area and medium. For each area/medium combination, two tables are presented: the first presents the summary statistics, and the second identifies the samples used in the calculation of the summary statistics.

### 3.1.4 Sample Collection and Data Evaluation by Area and Medium

Data sets for each medium are described below.

#### 3.1.4.1 Groundwater

Figure 3-2 identifies the residential non-potable use wells and the groundwater sample locations evaluated in the risk assessment.

Transects - Analytical data for shallow groundwater in the Walnut Street/Judith Lane residential area, as well as for four domestic wells in this area were evaluated in the risk assessment. These data include the full suite of analytes and dioxins.

For the purposes of the risk assessment, shallow groundwater is defined as samples collected between 0 and 30 feet bgs. This depth interval has been selected based on potential construction activities and potential for volatilization to indoor and/or outdoor air, as discussed more fully in Section 5.0. The screening interval of the wells in the residential areas is unknown, however samples from these wells were included in the risk assessment.

Sites - Data for shallow groundwater collected from locations within the sites, the downgradient alluvial aquifers, and shallow groundwater southwest of the sites, as identified in the SSP, were evaluated in the risk assessment. These data include the full suite of analytes and dioxins.

Collection of groundwater samples downgradient of the sites using push sampling methods per the SSP began at the water table, and samples were collected at approximately 10-foot intervals down to bedrock. Groundwater sample collection with a site/fill area began below the lower depth of the waste.

Screening of the groundwater data to identify COPCs was conducted on a location-by-location basis, therefore, summary statistics are not presented for groundwater in Appendix B.

#### 3.1.4.2 Soil

Transects - Figure 3-3 identifies the location of each soil sample for each transect. Surface (0-0.5 feet bgs) and subsurface (0.5-6 feet bgs) soil samples were collected from undeveloped areas along seven transects as identified in the SSP in the residential/commercial/undeveloped area adjacent to Dead Creek and analyzed for the full suite of analytes and dioxins. These Undeveloped Area Soil sample identification numbers use the following format: undeveloped area soil designator – transect number – location – depth interval, e.g., UAS-T7-S4-0-0.5FT. Only surface soil sample identification numbers are provided on Figure 3-3 – all subsurface soil samples are co-located and distinguished by the sample depth interval "3-6FT".

Based on the transect analytical results, additional surface and subsurface soil samples were collected from three residences along each of Transects 1 through 6 and two residences along Transect 7 and analyzed for the full suite of analytes and dioxins. These samples are identified as Developed Area Soils, and follow the same sample identification scheme as above, but using the developed area soil designator of "DAS." Figure 3-3 also provides the developed area soil sample locations.

Sites - Figure 3-4 identifies the location of each surface soil sample for each site. Surface soil (0-0.5 feet bgs) samples were collected in each site. These samples were analyzed for the full suite of analytes and dioxins. The site soil sample identification numbers have the following format: site – location – depth interval, e.g., WASTE-N-B2-0-0.5FT.

It should be noted that some of the samples in Transect 4 were taken in Site N. Although both sets of data are evaluated for both residential and worker scenarios, their evaluation has been conducted separately in the HHRA.

Appendix B provides the summary statistics for Site and Transect soils and a listing of each sample included in each area/medium combination evaluated.

#### 3.1.4.3 Sediment

Sediment sample locations included in the risk assessment are identified on Figure 3-5, and Appendix B presents the summary statistics. Study area sediment samples from locations not included in the sediment removal action (discussed in Section 2.0) are located in the lower reach of Dead Creek (downstream of Route 3) and in the Borrow Pit Lake. This area is being evaluated as one area in the risk assessment.

Per the SSP, sediment samples were analyzed for the industry-specific constituents, while a subset were analyzed for the full suite of analytes and dioxins. Samples analyzed for the industry-specific analytes are identified by the designator "FASED" followed by either "CSF" for Creek Segment F or "BPL" for Borrow Pit Lake, and then a location and depth designator. The remaining sediment samples have either a "BPL-ESED" designator, or a "SED-CSF" designator.

#### 3.1.4.4 Surface Water

Surface water sample locations included in the risk assessment are identified on Figure 3-5, and Appendix B presents the summary statistics. Study area surface water samples from locations not included in the sediment removal action (discussed in Section 2.0) are located in the lower reach of Dead Creek (downstream of Route 3) and in the Borrow Pit Lake. This area is being evaluated as one area in the risk assessment.

The surface water samples were analyzed for the full suite of analytes and dioxins, and have sample designators of "SW" followed by either "CSF" for Creek Segment F or "BPL" for Borrow Pit Lake, and then a location designator.

#### 3.1.4.5 Fish Fillet

Fish fillet samples were collected from Borrow Pit Lake and analyzed for the full suite of analytes (with the exception of VOCs) and dioxins. Three white crappie composite fish fillet samples and two white bass fillet samples were collected. Since it was difficult to obtain sufficient tissue mass from a single species, white crappie fillets were analyzed for VOCs, SVOCs, metals, mercury, cyanide and PCBs, and white bass fillets were analyzed for pesticides and herbicides.

#### 3.1.4.6 Air

Air samples were collected in the vicinity of Sites G, H, I, and L and analyzed for VOCs, SVOCs, PCBs, dioxins, and metals. Air samples were collected over a 24-hour period during hot, dry conditions (September, 1999) conducive to air emissions of dust and volatiles. To perform the HHRA,

these data were compared to chronic and, if appropriate, to subchronic or acute criteria as discussed in the HHRA Workplan (Appendix A).

## 3.2 Methodology for Selection of Constituents of Potential Concern

COPCs are a subset of the complete list of constituents detected in site media that are carried through the quantitative risk assessment process. Selection of COPCs focuses the analysis on the most likely risk "drivers." As stated in USEPA guidance (USEPA, 1993a):

> "Most risk assessments are dominated by a few compounds and a few routes of exposure. Inclusion of all detected compounds at a site in the risk assessment has minimal influence on the total risk. Moreover, quantitative risk calculations using data from environmental media that may contain compounds present at concentrations too low to adversely affect public health have no effect on the overall risk estimate for the site. The use of a toxicity screen allows the risk assessment to focus on the compounds and media that may make significant contributions to overall risk."

Several factors are typically considered in selecting COPCs for a site, including natural background, frequency of detection, and toxicity, including essential nutrient status. Each of these evaluation steps is called a "screening step." Risk calculations are conducted using the COPCs identified in these steps.

The steps used to identify COPCs are presented below.

### 3.2.1 Evaluation of Frequency of Detection and Essential Nutrient Status

Per the HHRA Workplan (Appendix A), a frequency of detection screen was conducted on each medium (e.g., sediment, surface soil, etc.). According to this screening step, constituents that are detected in fewer than 5% of samples, provided 20 samples are available, would not be included as COPCs, though some of these constituents would be retained as COPCs based on professional judgment, considering factors such as the presence of a hotspot. However, based on the frequency of detection information presented in the summary statistics in Appendix B, no constituents were excluded from consideration as a COPC based on the frequency of detection screen. In addition, essential nutrients (i.e., calcium, iron, magnesium, sodium and potassium) were not included as COPCs (HHRA Workplan, and USEPA, 1989a).

### 3.2.2 Comparison to Background

Background samples were collected in the vicinity of the site to provide information on naturally-occurring levels of constituents typical for the local area. The purpose of comparing site conditions to

local background is to determine if site concentrations of constituents are representative of background concentrations, which, therefore, should not be included in risk calculations. Background comparisons were conducted for each medium using site-specific background data and background concentrations.

Three background groundwater samples were collected in upgradient locations, and three surface soil and three subsurface soil samples were collected at background locations, all identified in the SSP. These background locations are presented on Figure 3-6. Four surface water samples, four sediment samples and four fish fillet samples were collected from reference locations, as there are no upgradient locations in Dead Creek outside of the study area (see the Ecological Risk Assessment in Volume III of this report).

The procedure for determining whether a constituent concentration is consistent with background follows that developed by USEPA Region 4 (USEPA, 2000a) and presented in the HHRA Workplan (Appendix A). Maximum detected concentrations of constituents in environmental media at the site were compared to two times the arithmetic mean site-specific background concentration. USEPA Region 4 states that although RAGS (USEPA, 1989a) allows the use of statistics in data evaluation, statistics may not be sufficiently conservative at this stage of the risk evaluation; and in most cases, there are not a sufficient number of samples for conducting a statistical analysis. Therefore, if maximum concentrations of inorganic constituents in an area are found to be less than two times the average background concentrations, then those constituents are eliminated from quantitative evaluation in the risk assessment. Constituents whose maximum detected concentrations are above the defined background levels and not identified as an essential nutrient were retained for evaluation in the next step of the hazard identification process (Toxicity Screen).

The calculation of background concentrations is presented in Appendix D. It should be noted that arsenic in soil in a subset of the sites and transects was the only constituent eliminated as a COPC based solely on the background screening step.

The background locations for soil and groundwater are those identified by USEPA or its contractors in previous investigations. A review of the background data for the soil samples indicates that organic constituent concentrations from location EE-20 may not be representative of background, although the inorganic concentrations are similar to those from the other background locations. Since arsenic is the only constituent eliminated as a COPC based solely on the comparison to background, the use of this sample's results has not affected the outcome of the risk assessment.

### 3.2.3 Toxicity Screen

A toxicity screen was performed in accordance with USEPA Region 5 guidance (USEPA, 1998b) and IEPA regulations (IEPA, 1998).

#### 3.2.3.1 Sources of Screening Criteria

USEPA Region 5 guidance identifies the following three sources as appropriate screening levels for soil, in order of preference:

1) Most recent generic soil screening levels (SSLs) developed and presented in Appendix A of the Soil Screening Guidance (USEPA, 1996b). The SSLs are based on ingestion and inhalation (direct contact) and soil-to-groundwater exposure pathways for a residential scenario.
2) Site-specific SSLs derived using the methodology outlined in the above reference.
3) Most recent USEPA Region 9 Preliminary Remediation Goals (PRGs; USEPA, 1999).

The IEPA TACO program (IEPA, 1998) is very similar to that outlined in the SSL guidance (USEPA, 1996a) in that it provides Tier I criteria based on direct contact (ingestion and inhalation) and the soil-to-groundwater pathway. In fact, the TACO Tier I criteria have been developed based on the USEPA SSL guidance. However, the TACO Tier I criteria are more comprehensive because values are provided for a longer list of constituents, and Tier I criteria are available for both residential and industrial scenarios.

Therefore, IEPA TACO Tier I criteria were used for the identification of COPCs for soil and groundwater for quantitative evaluation in the risk assessment. Where IEPA TACO Tier I criteria (IEPA, 1998) were not available, structural similarity was used to assign a surrogate TACO Tier 1 criterion, and where this was not possible USEPA Region 9 PRGs (1999) were used. The screening values are presented in Appendix C. It should be noted that the TACO Tier 1 criteria are being used here strictly as screening values; they are not considered either by USEPA or IEPA to be an "applicable or relevant and appropriate requirement" (ARAR) under the NCP.

Residential values were used to identify COPCs for residential soils and sediments, and industrial values were used to evaluate fill area soils. Region 9 PRGs were used as screening criteria for ten constituents detected in soil.

The TACO program also provides screening criteria for the groundwater ingestion component of the soil to groundwater pathway that were used here. These latter values conservatively address leaching of constituents from soils to underlying groundwater.

The IEPA TACO program provides Tier 1 groundwater remediation objectives for two classes of groundwater: Class I and Class II. Class I is potable resource groundwater, and Class II applies to all other groundwater. The derivation of the Class I and Class II criteria are discussed in Appendix C. Class II criteria were developed to allow for facile treatment of groundwater to meet Class I criteria, and

to be protective of agricultural uses of groundwater. Thus, the Class II criteria are considered to be protective of incidental groundwater exposures.

The groundwater in the study area meets the Class I: Potable Resource Groundwater criteria set forth in 35 Ill. Adm. Code 620. However, as noted in the HHRA Workplan, a drinking water scenario would only be included in the risk assessment if it was determined that groundwater was being used as a sole source of drinking water for any of the residences in the study area that are downgradient of the fill areas. Private wells in the study area are either not used or are used for outdoor household activities. In addition, ordinances are in effect in the Village of Sauget and the Village of Cahokia that prohibit the use of groundwater as a potable water supply (these are presented in Appendix S). Therefore, a drinking water scenario is not included in the risk assessment. To identify COPCs for potential incidental exposures to groundwater (i.e., non-drinking water scenarios), the Class II criteria were used. Region 9 PRGs for tap water were used as screening criteria for fourteen constituents detected in groundwater.

However, to provide a range of evaluations, groundwater was separately compared to TACO Tier I Class I groundwater criteria; this comparison is presented in Appendix U. In addition, the residential non-potable use wells sampled as part of the SSP were also evaluated for a drinking water use scenario; this evaluation is presented in Appendix V. The results of these evaluations are discussed in Section 6.5.

IEPA TACO Tier I values are not available for surface water, fish tissue, or air. Hence, surface water data were compared to the Class II groundwater criteria, as surface water exposures for evaluation in the risk assessment involve incidental contact with surface water, and not a drinking water exposure. Fish tissue data were compared to the USEPA Region 3 Risk-Based Concentrations (RBCs) for fish (USEPA, 2000b). As fish tissue data were available for evaluation, a comparison of surface water data to human health Ambient Water Quality Criteria (AWQCs) for fish ingestion (USEPA, 1998c) was not required. Air concentrations were compared to USEPA Region 9 PRGs (USEPA, 1999).

The toxicity criteria available at the time of the HHRA Workplan (Appendix A) preparation were used to develop data quality levels (DQLs), which were used to identify appropriate practical quantitation limits (PQLs) for laboratory methods for the analytical program addressed in the Quality Assurance Project Plans (QAPPs) for the site (see Volumes 2B and 3B of the SSP).

As noted in the HHRA Workplan, the PRGs and RBCs are periodically updated by USEPA. The most current criteria available at the time of the screening were used in the selection of COPCs. These are the Region 3 RBCs dated October 5, 2000 and the Region 9 PRGs dated October 1, 1999. The screening was conducted in October, 2000. The Region 9 PRGs were updated in the fall of 2000; the date on the Region 9 PRG update is November 1, 2000 (USEPA, 2000d). A review of the PRG values used in the screening indicates that only the value for lead in industrial soil has changed significantly

(from 1000 mg/kg to 750 mg/kg). Therefore, the latter value was used in the industrial soil screening, though all of the screening tables by necessity refer to the 1999 PRGs.

The as-published sources of screening criteria are presented in the HHRA Workplan Appendices. The TACO Tier I values are presented in Appendix (Workplan) B, and the current AWQCs are presented in Appendix (Workplan) E. Because the USEPA Region 9 PRGs and the USEPA Region 3 RBCs have been updated since the submittal of the workplan, the current versions of these values used in this risk assessment have been included in the workplan appendices. Therefore, the current (2000d) USEPA Region 9 PRGs are presented in Appendix (Workplan) C, the current USEPA Region 3 RBCs (2000b) are presented in Appendix (Workplan) D.

Appendix C presents the specific screening values used for the residential soil – direct contact screen, the industrial soil – direct contact screen, the soil to groundwater pathway screen, the groundwater and surface water screen, the air screen, and the fish tissue screen used in this risk assessment.

#### 3.2.3.2 Screening Methodology

Constituents in an area/medium with maximum concentrations less than or equal to the toxicity screening criteria were not included as COPCs. Where no COPCs are identified for an area/medium, that area/medium is not evaluated quantitatively in the HHRA.

## 3.3 Hazard Identification

This section presents the results of the COPC selection by medium and area. COPCs selected here are included in subsequent risk calculations.

### 3.3.1 Soils

Data for transect soils were compared to background, residential and industrial direct contact screening values as well as to the soil to groundwater screening values. Data for site soils were compared to background, industrial direct contact and the soil groundwater screening values. Calculation of background concentrations of constituents in soils is presented in Appendix D Table D-1 for subsurface soils and D-2 for surface soils. As noted previously, arsenic in a subset of transect and site soils is the only constituent to be eliminated as a COPC based solely on the comparison to background.

#### 3.3.1.1 Residential Scenario Direct Contact Screen

Maximum constituent concentrations in surface soil in all seven transects and for Site N were compared to residential soil screening values for direct contact. The screening tables are presented in Appendix E.

Transects. No residential scenario COPCs were identified in surface soil in Transects 1 and 2. COPCs identified in surface soil for a residential scenario for Transects 3 through 7 are presented in Table 3-1.

Sites. COPCs identified in surface soil for a residential scenario for Site N are presented in Table 3-2.

#### 3.3.1.2 Industrial Scenario Direct Contact Screen

Maximum constituent concentrations in surface soil and subsurface soil in all transects and surface soil in all sites were compared to industrial screening values for direct contact. The screening tables are presented in Appendix F.

Transects. No industrial scenario COPCs were identified in surface soil for Transects 1, 2 or 5. No industrial scenario COPCs were identified in subsurface soil for Transects 1, 2, 3, 5, or 7. COPCs identified in surface soil for an industrial scenario for Transects 3, 4, 6, and 7 are presented in Table 3-1. COPCs identified in subsurface soil for an industrial scenario for Transects 4 and 6 are also presented in Table 3-1.

Sites. No industrial scenario COPCs were identified in surface soil for Sites G and N. COPCs identified in surface soil for an industrial scenario for Sites H, I, and L are presented in Table 3-2.

#### 3.3.1.3 Soil to Groundwater Pathway Screen

Maximum constituent concentrations in surface soil and subsurface soil in all transects and surface soil in all sites were compared to soil to groundwater pathway screening values. The screening tables are presented in Appendix G.

Transects. No soil to groundwater pathway COPCs were identified in subsurface soil in Transects 1, 2, and 5. As shown in Table 3-3, pentachlorophenol was identified as a COPC in all remaining transect soils. Selenium, dieldrin, beta-BHC and benzo(a)anthracene were each identified as a COPC once in transect soils. Of these, dieldrin was detected once in a residential area groundwater sample location (SGW-S1) and beta-BHC was detected once in a residential area groundwater sample location (SGW-S2), both below the groundwater screening values (Appendix H). The remaining constituents were not detected in the residential area groundwater.

Sites. No soil to groundwater pathway COPCs were identified in surface soil in Site G. As shown in Table 3-4, pentachlorophenol was identified as a COPC in all remaining site soils. Dieldrin, beta-BHC and 4-chloroaniline were each identified as a COPC once in site soils, and selenium was identified twice.

#### 3.3.1.4 Soil COPC Summary

No direct contact COPCs for either a residential or industrial scenario were identified for Transect 1, Transect 2, or Site G. Therefore, surface and subsurface soils in these areas will not be further evaluated in the risk assessment.

The majority of the COPCs identified in surface and subsurface soils in the transects and in Site N (five of seven) are polycylic aromatic hydrocarbons (PAHs). Of the remaining two COPCs, dieldrin was identified as a COPC in surface soil only in Transect 5 for the residential scenario, and arsenic was identified as a COPC in surface soil only in Transect 7 for both the residential and industrial scenarios.

PAHs are common combustion products and are found in grilled foods, charcoal, and in motor oils and asphalt paving (ATSDR, 1995). A paper entitled "Background Levels of Polycyclic Aromatic Hydrocarbons (PAH) and Selected Metals in New England Urban Soils" (Bradley et al., 1994) investigated the occurrence of PAHs in soils in three New England towns: Boston, MA; Providence, RI; and Springfield, MA. Samples were collected in non-industrial areas. PAH concentrations were consistently higher than residential screening criteria. Higher PAH concentrations were found near roadways and near telephone poles. A copy of the paper is presented in Appendix D – Background Calculations. Comparison of the PAH concentrations in this paper with those concentrations detected in Transect 3, 4, 5, 6, and 7 surface soils indicates that the transect concentrations are similar to those presented in the paper, i.e., are consistent with urban background.

Arsenic was identified as a COPC in surface soils in Transect 7. Of the nine surface soil samples collected in this transect, eight had concentrations ranging from 6.2 to 8.1 mg/kg, below the site-specific background concentration of 19 mg/kg. However, one sample in Transect 7 (UAS-T7-S1-0-0.5FT) had an arsenic concentration of 34 mg/kg. Because this maximum detected value is greater than the background concentration, arsenic was identified as a COPC in Transect 7. This concentration is within the range of arsenic concentrations detected in eastern U.S. soils of 0.1 to 73 mg/kg (ATSDR, 1992).

IEPA has published a report entitled "A Summary of Selected Background Conditions for Inorganics in Soil" (IEPA, 1994). This report is presented here in Appendix D. In this publication, background concentrations are reported for soils within counties in metropolitan areas and soils in counties outside of metropolitan areas. Within metropolitan areas, 114 soil samples were evaluated; arsenic concentrations ranged from 1.1 to 24 mg/kg, with a mean concentration of 7.4 mg/kg and a median

concentration of 7.2 mg/kg. Outside of metropolitan areas, 120 soil samples were evaluated; arsenic concentrations ranged from 0.35 to 22.4 mg/kg, with a mean concentration of 5.9 mg/kg and a median concentration of 5.2 mg/kg. The TACO program identifies the background arsenic concentration in counties within metropolitan statistical areas as 13 mg/kg (IEPA, 1998, Appendix A, Table G, as amended January 6, 2001). Sauget Area 1 is in St. Clair County, which is identified as a metropolitan area county in the TACO program. All detected concentrations of arsenic in soil were within the range of arsenic concentrations detected in metropolitan areas (1.1 to 24 mg/kg) with the exception of the single sample noted above. As provided for in the TACO program, an alternative statistical approach for background was used in the HHRA, as identified in the HHRA Workplan. The site-specific background concentration for arsenic of 19 mg/kg is also within the range of arsenic concentrations detected in background locations presented in the IEPA report.

Therefore, although the majority of the COPCs identified in the transect soils are likely consistent with background concentrations, they have all been quantitatively evaluated in the risk assessment.

The COPCs identified in the industrial scenario screen for surface soils in the fill areas are PAHs, arsenic, and copper, PCBs and tetrachlorodibenzo-p-dioxin (TCDD) equivalents. These are all quantitatively evaluated in the risk assessment.

### 3.3.2 Groundwater

The selection of COPCs for groundwater was conducted on a location-by-location basis. The screening tables are presented in Appendix H, which lists each well included in the analysis. Screening intervals and/or sample depths are also included where known.

As noted above and in the HHRA Workplan, a drinking water scenario would only be included in the risk assessment if it was determined that groundwater was being used as a sole source of drinking water for any of the residences in the study area that are downgradient of the fill areas. Private wells in the study area are either not used or are used for outdoor household activities, and ordinances are in effect that prohibit the use of groundwater as a potable water supply source (Appendix S). Therefore, a drinking water scenario is not included in the risk assessment. COPCs were identified to evaluate potential incidental exposures to groundwater (i.e., non-drinking water scenarios), including incidental contact by a construction worker that may excavate to a depth where groundwater would be exposed in the excavation, or potential volatilization of VOCs through the soil column to indoor or outdoor air. As noted above, the groundwater concentrations are compared to TACO Tier 1 Class II Groundwater Remediation Objectives (presented in Appendix C).

A 30-foot bgs excavation depth is assumed as some sewer lines in the area are located at that depth. Moreover, volatilization from groundwater through the soil column to indoor and/or outdoor air is generally assumed to occur up to depths of up to 15 feet bgs (MADEP, 1995). Therefore, wells and or

well samples with screening intervals or sample collection depths between 0 and 30 feet bgs were included in the evaluation.

Data from 34 groundwater sampling locations were included in the evaluation: 19 existing wells (those beginning with EE and EGG designations), 11 push sampling locations installed in support of the SSP (those beginning with AA and SW designations), and four existing residential area non-potable use wells (those beginning with DW designations).

The results of the COPC selection are presented in Table 3-5. COPCs were identified in 14 of the 34 groundwater sampling locations. Five locations have only one or two COPCs identified. Seven locations have between six and 11 COPCs identified, and two locations have 17 and 19 COPCs identified; these are in Sites G and H, respectively. There appears to be no clear pattern of COPCs between locations. A total of 42 COPCs were identified in the 14 locations combined. Of these, 12 are VOCs. Of the four residential area non-potable use wells, a single COPC, lead, was identified in only one well (DW-MCDO). This is the only COPC identified in the approximately 10 locations south of Site L, and lead was not identified as a COPC in any other groundwater sampling location included in the evaluation.

### 3.3.3 Sediment

Maximum constituent concentrations in sediment in the combined CS-F/Borrow Pit Lake area were compared to residential soil screening values for direct contact, per the HHRA Workplan. The screening table is presented in Appendix E.

Two COPCs were identified in sediment, as shown in Table 3-6; arsenic and PCBs.

### 3.3.4 Surface Water

Maximum constituent concentrations in surface water in the combined CS-F/Borrow Pit Lake area were compared to the screening values for surface water, which are the Class II groundwater criteria. The screening table is presented in Appendix I. Based on this screen, no COPCs were identified in surface water. Therefore, surface water is not evaluated further in the risk assessment.

### 3.3.5 Fish Fillet

The selection of COPCs for fish fillet samples was conducted on a sample-by-sample basis. Fish tissue concentrations were compared to the USEPA Region 3 RBCs (USEPA, 2000b). The screening tables are presented in Appendix I. The background calculation is also presented in Appendix I.

One COPC was identified in fish tissue – arsenic, as shown on Table 3-6. Arsenic was detected in only one of the three fish tissue samples analyzed for arsenic.

### 3.3.6 Air

Ambient air sampling was conducted at Sites G, H, I and L to determine the tendency of site constituents to enter the atmosphere and local wind patterns. At Site G, air samples were collected at two upwind and two downwind locations. At Sites H, I, and L, air samples were collected at one upwind and two downwind locations. Figure 3-7 identifies the ambient air sampling locations.

Air samples were analyzed for VOCs, SVOCs, PCBs, dioxins, and metals. Appendix J presents the upwind or background air concentrations and the comparison of each downwind sample concentration to upwind concentrations and to the PRGs for ambient air (USEPA, 1999).

Table 3-7 provides the summary for the COPCs identified in air. It should be noted that 4-methyl-2-pentanone, acetone and methylene chloride are all common laboratory contaminants, however, review of the field blank data did not clearly indicate a problem with sample collection or analysis. Methylene chloride was identified as a COPC in all four sites. However, the numerical results are sporadic (see Table 3-7 and Appendix J). For example, in each downwind sample pair, methylene chloride was detected at a high concentration in one sample, and not detected or detected at a much lower concentration in the second downwind sample. As samples were collected from all areas on the same day, such spikes would not be expected. Moreover, methylene chloride was not identified as a COPC in site soils or groundwater. Therefore, although it is not indicated by the sample blank evaluations, laboratory contamination seems to be the most likely source of methylene chloride in these samples.

As discussed in Appendix J, the detected concentration of cadmium does not exceed its respective PRG adjusted for an 8 hours per day, 250 days per year adult worker scenario, and a $1x10^{-5}$ target risk level. These data are evaluated further in Section 7.0.

TABLE 3-1
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
TRANSECTS - DIRECT CONTACT
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Residential Scenario | | | | | Industrial Scenario | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | | | | Surface Soil | | | | Subsurface Soil | |
| **Constituent** | **T3** | **T4** | **T5** | **T6** | **T7** | **T3** | **T4** | **T6** | **T7** | **T4** | **T6** |
| Arsenic | -- | -- | -- | -- | X | -- | -- | -- | X | -- | -- |
| Benzo(a)anthracene | -- | X | -- | X | X | -- | -- | -- | -- | X | -- |
| Benzo(a)pyrene | X | X | X | X | X | X | X | X | X | X | X |
| Benzo(b)fluoranthene | X | X | -- | X | X | -- | -- | -- | -- | X | -- |
| Dibenzo(a,h)anthracene | X | X | X | X | X | -- | X | -- | -- | X | -- |
| Dieldrin | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | -- | X | -- | X | X | -- | -- | -- | -- | -- | -- |
| | | | | | | | | | | | |
| **Total:** | **3** | **5** | **3** | **5** | **6** | **1** | **2** | **1** | **2** | **4** | **1** |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this scenario.
T - Transect.

TABLE 3-2
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
SITES - DIRECT CONTACT
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Residential Scenario | Industrial Scenario | | |
|---|---|---|---|---|
| **Constituent** | **N** | **H** | **I** | **L** |
| Arsenic | -- | X | -- | X |
| Benzo(a)pyrene | X | -- | X | X |
| Copper | -- | -- | X | -- |
| Dibenzo(a,h)anthracene | X | -- | -- | X |
| Total 2,3,7,8-TCDD TEQ | -- | X | X | -- |
| Total PCBs | -- | X | X | X |
| | | | | |
| **Total:** | **2** | **3** | **4** | **4** |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this scenario.

TABLE 3-3
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
TRANSECTS - SOIL-TO-GROUNDWATER
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Soil-to-Groundwater Pathway | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | | | | | | Subsurface Soil | | | |
| **Constituent** | **T1** | **T2** | **T3** | **T4** | **T5** | **T6** | **T7** | **T3** | **T4** | **T6** | **T7** |
| Benzo(a)anthracene | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- |
| beta-BHC | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- |
| Dieldrin | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- |
| Pentachlorophenol | X | X | X | X | X | X | X | X | X | X | X |
| Selenium | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total:** | **1** | **1** | **2** | **1** | **2** | **2** | **1** | **1** | **2** | **1** | **1** |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this pathway.
T - Transect.

TABLE 3-4
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
SITES - SOIL-TO-GROUNDWATER
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Soil-to-Groundwater Pathway | | | |
|---|---|---|---|---|
| | H | I | L | N |
| 4-Chloroaniline | -- | X | -- | -- |
| beta-BHC | -- | -- | X | -- |
| Dieldrin | -- | X | -- | -- |
| Pentachlorophenol | X | X | X | X |
| Selenium | X | -- | X | -- |
| **Total:** | **2** | **3** | **3** | **1** |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this pathway.

TABLE 3-5
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
GROUNDWATER - CHRONIC EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Site | Site G | | | Site H | | | Site I | | | | | | Site L | RES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constituent / Location | EE-05 | EEG-106 | EEG-107 | EE-01 | EE-02 | EE-03 | AA-I-S1 | AA-I-S2 | EE-12 | EE-13 | EE-14 | EE-15 | EEG-109 | DW-MCDO |
| 1,1,2,2-Tetrachloroethane * | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | -- | -- | X | X | X | -- | X | X | -- | -- | X | X | -- | -- |
| 2,4,5-TP (Silvex) | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | -- | -- | -- | X | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | -- | -- | X | -- | X | -- | -- | -- | -- | -- | -- | -- | X | -- |
| 2-Chlorophenol | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3-Methylphenol/4-Methylphenol | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4,4-DDE | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- |
| 4-Chloroaniline | X | -- | X | X | X | -- | X | X | X | -- | X | -- | X | -- |
| 4-Methyl-2-pentanone * | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Nitroaniline | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| alpha-BHC | -- | X | X | -- | X | -- | -- | -- | X | -- | X | -- | -- | -- |
| Antimony | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | X | -- |
| Benzene * | X | -- | X | X | X | -- | X | X | X | -- | X | -- | X | -- |
| Benzo(k)fluoranthene | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- |
| beta-BHC | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| Cadmium | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- |
| Carbazole | -- | -- | -- | X | -- | -- | -- | -- | X | -- | X | -- | -- | -- |
| Chlorobenzene * | X | -- | X | X | X | -- | X | X | X | -- | X | -- | -- | -- |
| Chloroform * | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | X | -- |
| Cis/Trans-1,2-Dichloroethene * | -- | -- | -- | -- | -- | -- | X | X | -- | -- | -- | -- | -- | -- |
| delta-BHC | X | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethylbenzene * | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Heptachlor | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- |
| Heptachlor Epoxide | -- | -- | -- | -- | X | -- | -- | -- | X | -- | -- | -- | -- | -- |
| Lead | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X |
| Molybdenum | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene * | X | -- | X | X | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Nickel | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | X | -- |
| Nitrobenzene | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pentachlorophenol | -- | -- | X | X | X | -- | -- | -- | -- | -- | X | -- | -- | -- |
| Phenol | X | -- | X | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene * | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Toluene * | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total PCBs | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- |
| Total 2,3,7,8-TCDD TEQ | X | -- | X | X | -- | X | -- | -- | X | X | X | -- | -- | -- |
| Trichloroethene * | -- | -- | X | -- | X | -- | -- | X | -- | -- | -- | -- | -- | -- |
| Vanadium | -- | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride * | -- | -- | X | -- | -- | -- | X | X | -- | -- | -- | -- | -- | -- |
| Zinc | -- | -- | -- | -- | -- | -- | -- | X | -- | -- | -- | -- | -- | -- |
| Total: | 10 | 2 | 19 | 11 | 17 | 1 | 6 | 11 | 9 | 1 | 10 | 1 | 6 | 1 |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this scenario.
* Indicates volatile organic compound (VOC).
RES - Residential Non-Potable Use Well.

TABLE 3-6
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
SEDIMENT AND FISH TISSUE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

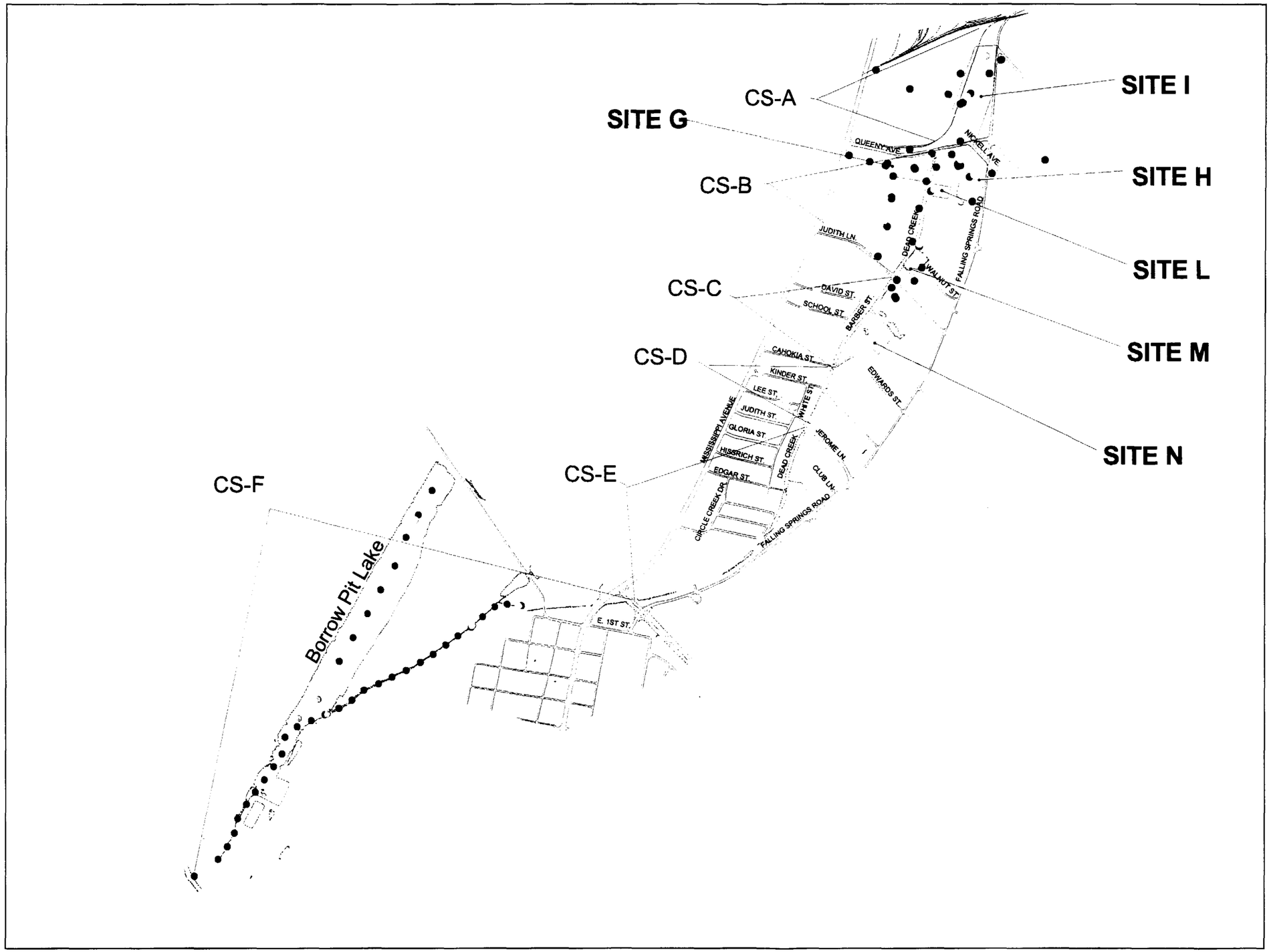
| Constituent | Sediment | Fish |
|---|---|---|
| Arsenic | X | X |
| Total PCBs | X | -- |
| **Total:** | **2** | **1** |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this scenario.

TABLE 3-7
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
SITES - AIR
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Ambient Air Pathway | | | |
|---|---|---|---|---|
| | G | H | I | L |
| 4-Methyl-2-pentanone | X | -- | -- | -- |
| Acetone | X | -- | -- | -- |
| Methylene Chloride | X | X | X | X |
| Trichloroethene | -- | X | -- | -- |
| Cadmium | -- | -- | X | -- |
| **Total:** | **3** | **2** | **2** | **1** |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this pathway.




N

LEGEND

- Site
- Water Body
- Roads
- Sediment Sample Locations
  Soil Sample Locations
- Surface Water Sample Locations
- Groundwater Well Locations
- CS-A Dead Creek Segment Designations

**FIGURE 3-1**

Soil, Sediment, Surface Water and Groundwater Sampling Locations Evaluated in the Risk Assessment

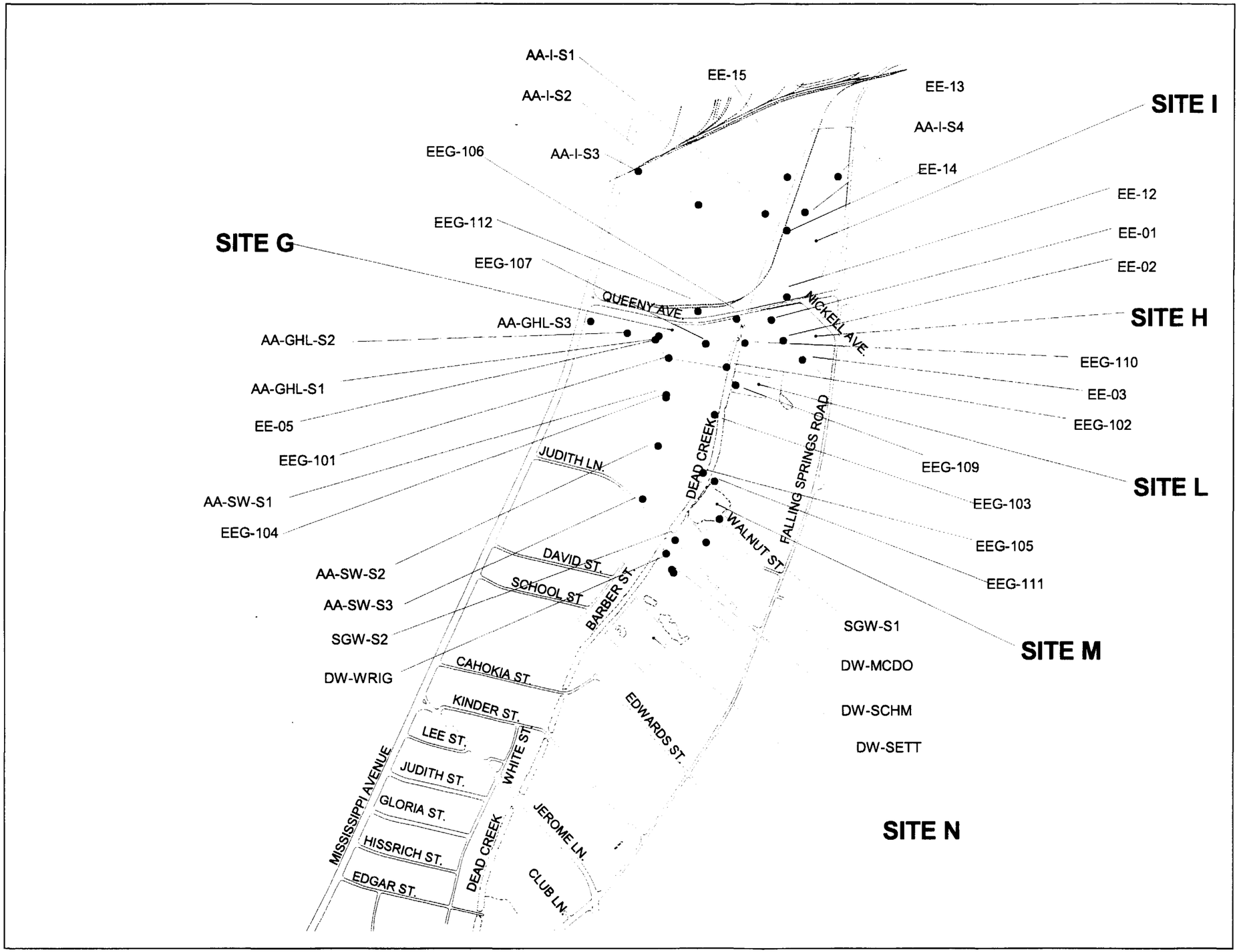
**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

3000 0 3000 Feet

ENSR INTERNATIONAL

J:/Indl_Serv/Project Files/Solutia-6105/Sauget-6105-008/Maps/ensrmaps.apr
December 29, 2000
Revision 0




N

LEGEND

- Site
- Water Body
- Roads
- Groundwater Sample Locations

**FIGURE 3-2**
Groundwater Sample Locations Evaluated in the HHRA

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

2000 0 2000 Feet

ENSR INTERNATIONAL

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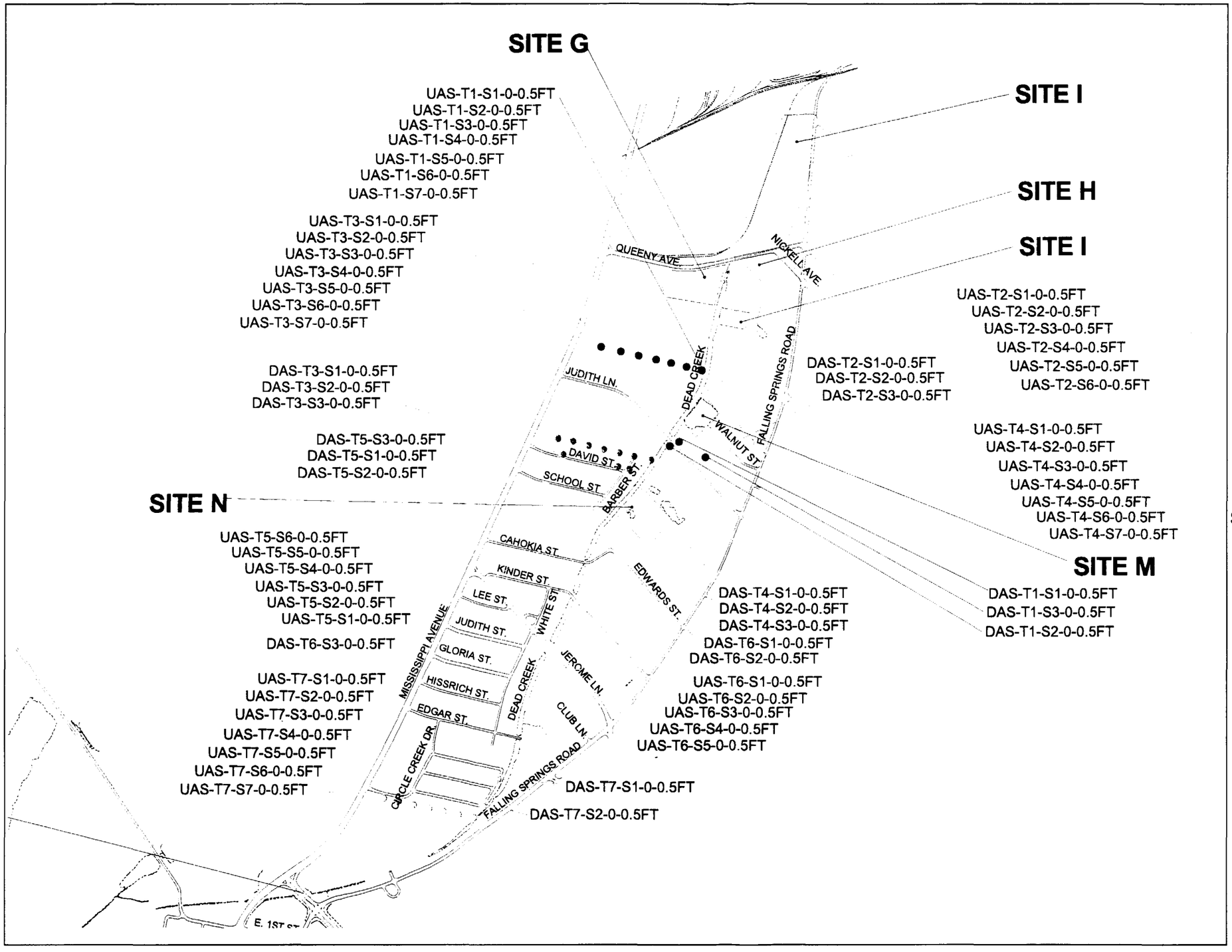
December 29, 2000
Revision 0




N

LEGEND

- Site
- Water Body
- Roads
- Transect 1
- Transect 2
- Transect 3
- Transect 4
- Transect 5
- Transect 6
- Transect 7

DAS-T2-S1-0-0.5FT - Surface sample ID and location
Corresponding subsurface soil sample
(-3-6FT) is colocated

**FIGURE 3-3**

Transect Surface and Subsurface Soil Sample Locations Evaluated in the HHRA

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

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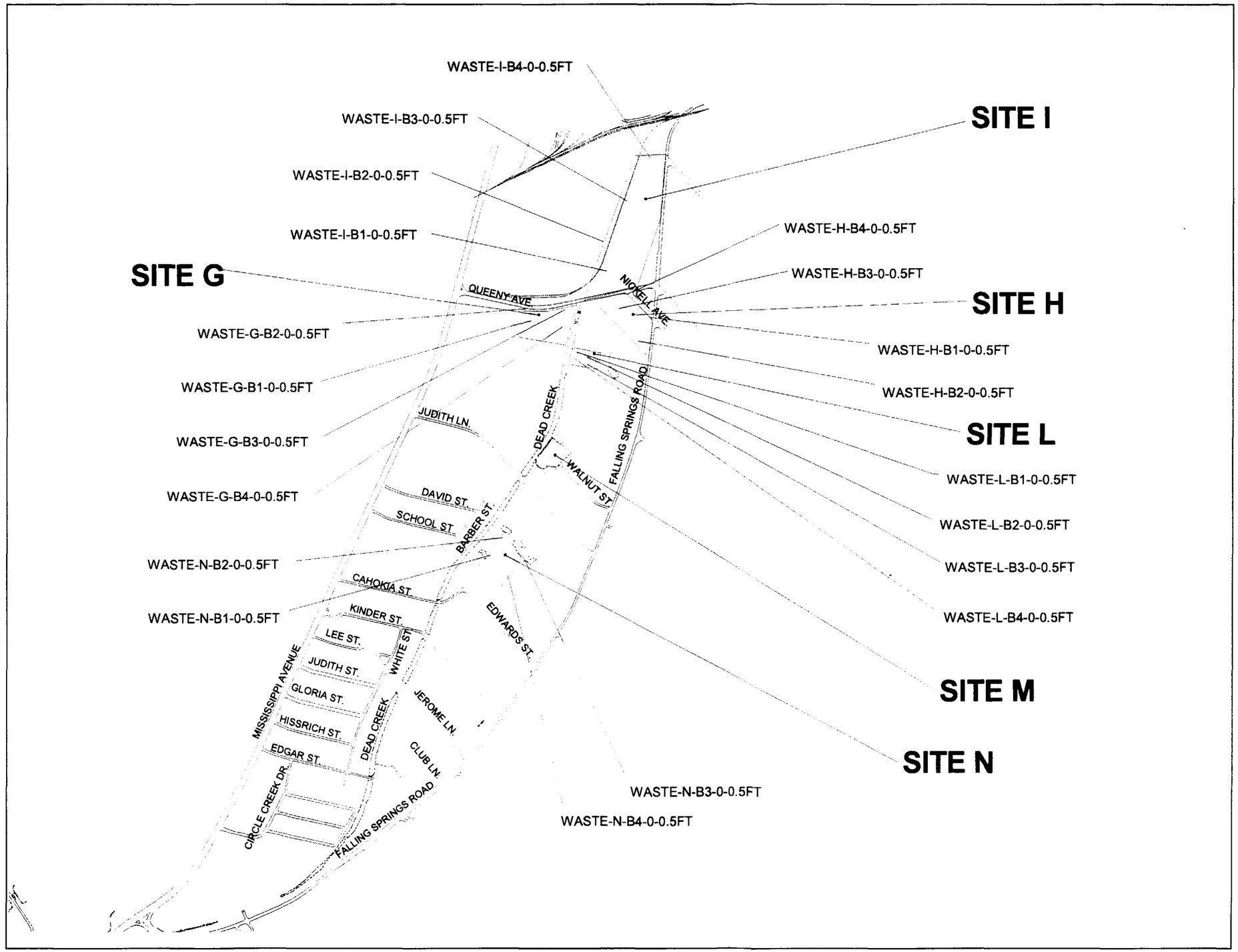
December 29, 2000
Revision 0




N

LEGEND

Site
Water Body
Roads

Surface Soil Sample Locations

CS-A Dead Creek Segment Designations

**FIGURE 3-4**
Site Surface Soil Samples and Locations Evaluated in the HHRA

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

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St. Louis, Missouri

2000 0 2000 Feet

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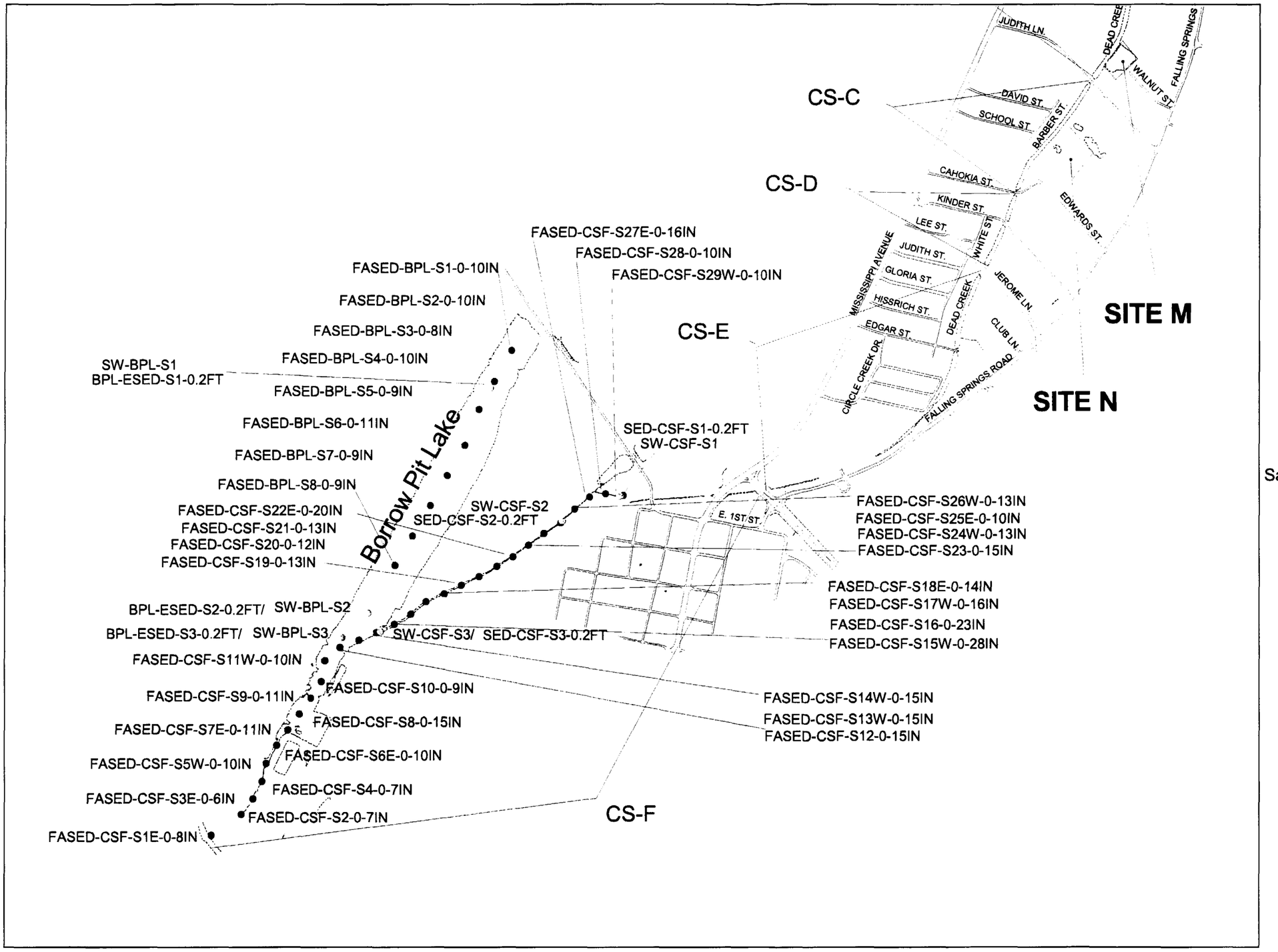
Revision 0




N

LEGEND

- Site
- Water Body
- Roads
- ● Sediment Sample Locations
- Surface Water Sample Locations
- CS-A Dead Creek Segment Designations

**FIGURE 3-5**

Sediment and Surface Water Sample Locations Evaluated in the HHRA

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

3000 0 3000 Feet

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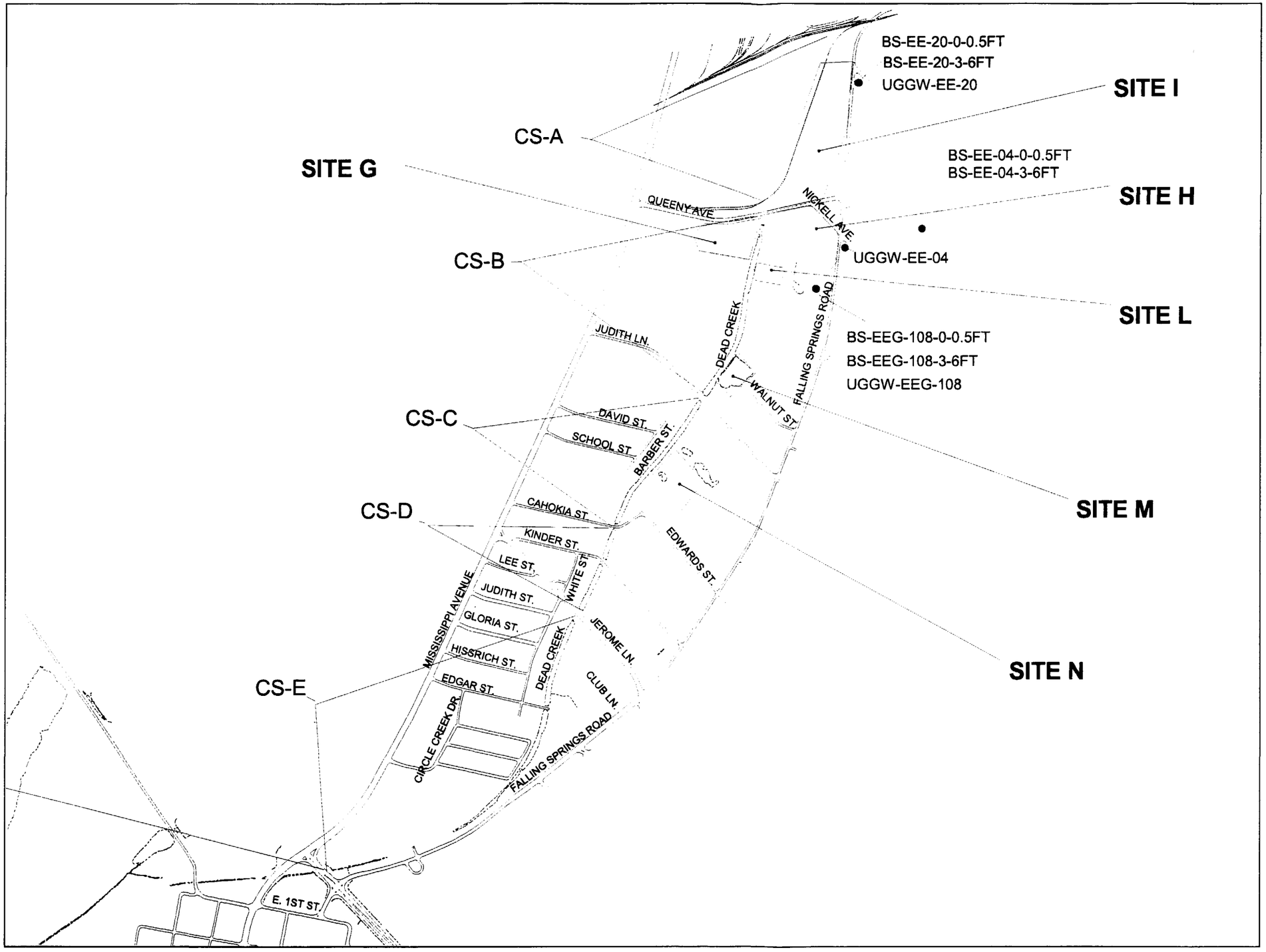
December 29, 2000
Revision 0




N

LEGEND

- Site
- Water Body
- Roads
- Background Sample Locations
- CS-A Dead Creek Segment Designations

**FIGURE 3-6**
Background Sample Locations
Soil and Groundwater

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

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Remediation Technology Group
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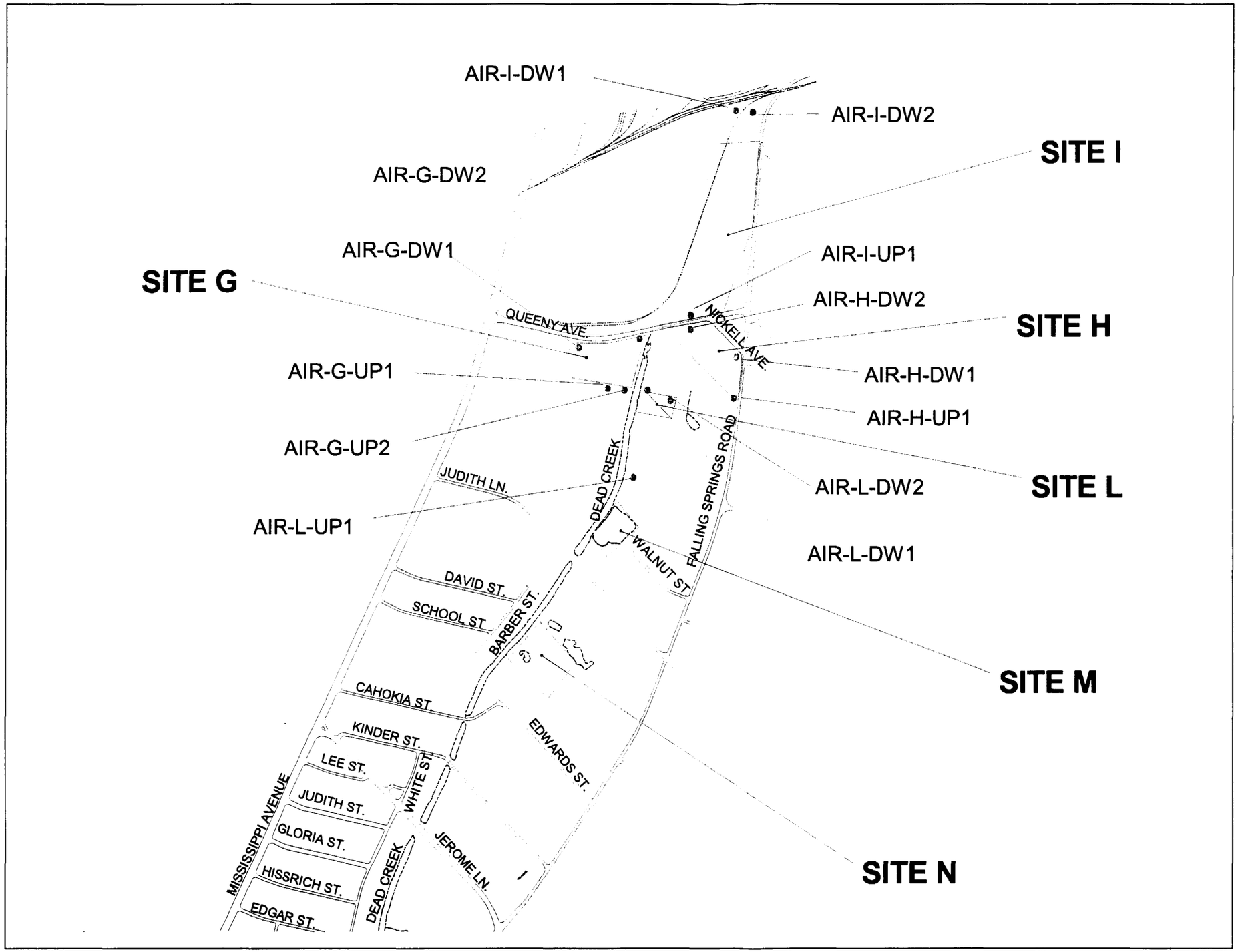
December 29, 2000
Revision 0




N

LEGEND

- Site
- Water Body
- Roads
- Air Sample Locations

BKG - Background (Upwind)
DW1 - Downwind Location
UP2 - Upwind Location

**FIGURE 3-7**
Air Sample Locations and Results Evaluated in the HHRA

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
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St. Louis, Missouri

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December 29, 2000
Revision 0

# 4.0 DOSE-RESPONSE ASSESSMENT

The purpose of the dose-response assessment is to identify the types of adverse health effects a constituent may potentially cause, and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response) (USEPA, 1989a). Adverse effects are classified by USEPA as potentially carcinogenic or noncarcinogenic (i.e., potential effects other than cancer). Dose-response relationships are defined by USEPA for oral exposure and for exposure by inhalation. Oral toxicity values are also used to assess dermal exposures, with appropriate adjustments, because USEPA has not yet developed values for this route of exposure. Combining the results of the toxicity assessment with information on the magnitude of potential human exposure provides an estimate of potential risk.

Numerical toxicity values are generally obtained from USEPA databases/sources. The dose-response relationship is often determined from laboratory studies conducted under controlled conditions with laboratory animals. These laboratory studies are controlled to minimize responses due to confounding variables, and are conducted at relatively high dose levels to ensure that responses can be observed using as few animals as possible in the experiments. Mathematical models or uncertainty factors are used to extrapolate the relatively high doses administered to animals to predict potential human responses at dose levels far below those tested in animals. Humans are typically exposed to chemicals in the environment at levels much lower than those tested in animals. These low doses may be detoxified or rendered inactive by the myriad of protective mechanisms that are present in humans (Ames et al., 1987) and that may not function at the high dose levels used in animal experiments. Therefore, the results of these animal studies may only be of limited use in accurately predicting a dose-response relationship in humans. However, to be protective of human health, USEPA incorporates many conservative assumptions and safety factors when deriving numerical toxicity criteria from laboratory studies, as discussed below.

This section contains five subsections. Section 4.1 describes the sources of toxicity values. Section 4.2 describes USEPA's approach for developing noncarcinogenic toxicity values. Section 4.3 describes the toxicity values developed by USEPA for the evaluation of potential carcinogenic effects. Section 4.4 discusses PCB dose-response issues, and Section 4.5 discusses dioxin dose-response issues.

## 4.1 Sources of Toxicity Values

Sources of the published toxicity values in this risk assessment include USEPA's Integrated Risk Information System (IRIS) (USEPA, 2000c), the Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b), and the USEPA National Center for Environmental Assessment (NCEA) in Cincinnati, Ohio.

The primary USEPA source of toxicity values is IRIS, an on-line computer database of toxicological information (USEPA, 2000c). The IRIS database is updated monthly to provide the most current USEPA verified toxicity values. As defined by the USEPA (1997b), a toxicity value is "Work Group-Verified" if all available information on the value has been examined by an Agency Work Group, the value has been calculated using current Work Group methodology, a unanimous consensus has been reached on the value by the Work Group, and the value appears on IRIS.

Another source of toxicity values is the USEPA Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b). HEAST is published annually by the USEPA and provides a compilation of toxicity values available at the time of publishing. Because HEAST is no longer updated regularly, the toxicity values provided may not represent the most current values available. In addition, the toxicity values provided by HEAST are considered to be provisional, i.e., the value has had some form of agency review, but does not appear on IRIS. The HEAST values may or may not have been generated through the Agency Work Group process, but the values generally use all available information, use current methodology, and a consensus was reached by Agency scientists on the value. HEAST is, therefore, considered to be an unverified source of dose-response values and should be used only if no toxicity value is available on IRIS.

When a toxicity value is not available from IRIS or HEAST, the USEPA National Center for Environmental Assessment (NCEA) in Cincinnati may be consulted for provisional toxicity values. These toxicity values may or may not meet the HEAST criteria. The NCEA generally provides a toxicological summary for the value. The USEPA Region 3 RBC Table (USEPA, 2000b) and the USEPA Region 9 PRG Table (USEPA, 2000d) also use toxicity information from NCEA where available, and can serve as a source of these values. Therefore, the hierarchy of toxicity value sources correlates in general with the level of confidence in the values, with the values directly provided by NCEA having the lowest level of scientific review and approval and, thus, the least level of confidence.

## 4.2 Noncarcinogenic Toxicity Assessment

Constituents with known or potential noncarcinogenic effects are assumed to have a dose below which no adverse effect occurs or, conversely, above which an adverse effect may be seen. This dose is called the threshold dose. A conservative estimate of the true threshold dose is called a No Observed Adverse Effect Level (NOAEL). The lowest dose at which an adverse effect has been observed is called a Lowest Observed Adverse Effect Level (LOAEL). By applying uncertainty factors to the NOAEL or the LOAEL, Reference Doses (RfDs) for chronic exposure to chemicals with noncarcinogenic effects have been developed by USEPA (1997b, 2000c).

In regulatory toxicity assessment, USEPA assumes that humans are as sensitive, or more sensitive, to the toxic effects of a chemical as the most sensitive species use in the laboratory studies. Moreover,

the RfD is developed based on the most sensitive or critical adverse health effect observed in the study population, with the assumption that if the most critical effect is prevented, then all other potential toxic effects are prevented. Uncertainty factors are applied to the NOAEL (or LOAEL, when a NOAEL is unavailable) for this critical effect to account for uncertainties associated with the dose-response relationship. These include using an animal study to derive a human toxicity value, extrapolating from a LOAEL to a NOAEL, extrapolating from a subchronic (partial lifetime) to a chronic lifetime exposure, and evaluating sensitive subpopulations. Generally, a 10-fold factor is used to account for each of these uncertainties; thus, the total uncertainty factor can range from 10 to 10,000. In addition, an uncertainty factor or a modifying factor of up to 10 can be used to account for inadequacies in the database or other uncertainties. The resulting RfDs are very conservative, i.e., health protective, because of the use of the large uncertainty factors. For chemicals with noncarcinogenic effects, an RfD provides reasonable certainty that no noncarcinogenic health effects are expected to occur even if daily exposures were to occur at the RfD level for a lifetime. RfDs and exposure doses are expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day). The lower the RfD value, the lower is the assumed threshold for effects, and the greater the assumed toxicity.

Table 4-1 summarizes the toxicity information for COPCs with potential noncarcinogenic effects for the oral route of exposure. For each COPC, the chemical abstracts service number (CAS number), the dose-response value (RfD), and the reference for the toxicity value are presented. In addition, the USEPA confidence level in the value, the uncertainty factor, the modifying factor, the study animal, study method, target organ and critical effect upon which the toxicity value is based are also presented for each COPC, where available. The confidence level is provided for constituents published on IRIS, and is based on the confidence in the study and the extent of toxicity information available for that constituent.

Table 4-2 summarizes the toxicity information for COPCs with potential noncarcinogenic effects for the inhalation route of exposure. For each COPC, the CAS number and the toxicity value are presented. Inhalation RfD (in units of mg/kg-day) values are calculated from Reference Concentrations (RfC) (in units of $mg/m^3$) assuming a 70 kg adult breathes 20 $m^3$ of air per day. Both values are presented where available. In addition, the reference for the toxicity value, the USEPA confidence level in the value, the uncertainty factor, the modifying factor, the study animal, study method, target organ and critical effect upon which the toxicity value is based are also presented for each constituent. USEPA does not support use of oral toxicity values to evaluate inhalation exposures (USEPA, 1996b).

## 4.3 Carcinogenic Toxicity Assessment

In assessing the carcinogenic potential of a constituent, the Human Health Assessment Group of USEPA has classified constituents into one of the following groups (USEPA 1997b, 2000c), according to the weight of evidence from epidemiologic and animal studies:

| | | |
|---|---|---|
| Group A | - | Human Carcinogen (sufficient evidence of carcinogenicity in humans) |
| Group B | - | Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans) |
| Group C | - | Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data) |
| Group D | - | Not Classifiable as to Human Carcinogenicity (inadequate or no evidence) |
| Group E | - | Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies) |

The underlying assumption of regulatory risk characterization for constituents with known or assumed potential carcinogenic effects is that no threshold dose exists. Thus, the characterization assumes that there is some finite level of risk associated with each non-zero dose. The USEPA has developed computerized models that extrapolate dose-response relations observed at the relatively high doses used in animal studies to the low dose levels encountered by humans in environmental situations. The mathematical models developed by USEPA assume no threshold, and use both animal and human data (where available) to develop a potency estimate for a given chemical. The potency estimate, called a cancer slope factor (CSF) is expressed in units of $(mg/kg\text{-}day)^{-1}$; the higher the CSF, the greater the carcinogenic potential.

Table 4-3 summarizes the toxicity information for COPCs classified by the USEPA as potential carcinogens for the oral route of exposure. For each constituent, the CAS number, USEPA carcinogenicity class, the oral cancer-slope factor and the reference are provided. In addition, the study animal and route of exposure upon which the CSF is based are presented.

Table 4-4 summarizes the toxicity information for COPCs classified by the USEPA as potential carcinogens for the inhalation route of exposure. For each constituent, the CAS number, USEPA carcinogenicity class, the inhalation cancer slope factor and unit risk factor (provided in units of $(ug/m^3)^{-1}$)and the reference are provided. In addition, the study animal and route of exposure upon which the CSF is based are presented. The CSF is calculated from the unit risk assuming a 70 kg adult breathes 20 $m^3$ of air per day.

## 4.4 PCB Dose-Response

The biphenyl structure of PCBs consists of two aromatic 6-member rings connected by a single bond. There are five locations on each ring that can be chlorinated, and there are 209 individual PCB congeners, each identified by a unique congener number. Structurally, PCB congeners can be classified into groups based on the number of chlorines per molecule (e.g., monochloro-, dichloro-, trichloro-, up to decachloro-biphenyl). These groups are referred to as homologs.

Aroclor mixtures are the commercial mixtures of PCBs that were used in industry. The Aroclors are identified numerically (e.g., Aroclor 1260, Aroclor 1016). The higher the Aroclor number, the more enriched is the mixture in congeners containing higher numbers of chlorines. Each Aroclor mixture exhibits a characteristic, however overlapping, range of congeners, and Aroclors are identified and quantitated in samples by comparing the sample results to Aroclor standards. Total PCBs in a sample can be calculated by summing the Aroclor concentrations. Alternatively, PCBs can be quantitated by homolog and the homolog concentrations summed to give a total PCB concentration. This latter method was used in the Sauget Area 1 risk assessment.

Risks from potential exposures to PCBs have been calculated using the most current guidance available from USEPA. Currently, USEPA-approved guidance is provided in IRIS (USEPA, 2000c). Total PCB concentrations were calculated by summing the separate homolog concentrations. The total PCB concentrations were used to calculate the PCB exposure dose to be combined with the verified cancer slope factors listed in IRIS (USEPA, 2000c). Guidance provided in IRIS specifies three tiers of human slope factors for environmental PCBs: high risk and persistence, low risk and persistence, and lowest risk and persistence. The choice of slope factors for use depends on the medium of exposure and PCB chlorine content, as outlined in IRIS (USEPA, 2000c). These values are presented in Table 4-5. Based on a review of the media evaluated in the risk assessment and the CSF selection criteria, the CSF value of 2 $(mg/kg\text{-}day)^{-1}$ was used in the Sauget Area 1 risk assessment.

Non-cancer risks from potential exposures to PCBs were calculated using the most conservative RfD for a PCB mixture, the oral reference dose for Aroclor 1254 of 2E-05 mg/kg-day.

## 4.5 Dioxin Dose-Response

The potential carcinogenic effects associated with exposure to dioxin and furan congeners in environmental media were assessed in accordance with the approach developed by USEPA (1989b). Risks were calculated for 2,3,7,8-TCDD and the dioxin and furan congeners using the cancer slope factor for 2,3,7,8-TCDD listed in HEAST and using the toxic equivalency factors (TEFs) provided by World Health Organization (WHO) (Van den Berg et al., 1998). The TEFs are fractions that equate the potential toxicity of each congener to that of 2,3,7,8-TCDD. The TEFs are listed in Table 4-6. For

each sample, the reported sample concentration (or half the detection limit, as appropriate, for non-detected congeners) for each dioxin and furan congener having a TEF listed by WHO was multiplied by its TEF, resulting in a TCDD toxic equivalence concentration (TCDD-TEQ). The TCDD-TEQ values for each of the congeners were then added together for each sample and treated as one sample concentration in the risk assessment. The cancer slope factor for 2,3,7,8-TCDD was used to calculate potential carcinogenic risks resulting from potential exposure to 2,3,7,8-TCDD-TEQs.

## 4.6 Absorption Adjustment Factors

Differences exist in absorption between humans in an environmental situation and the animals generally used in the studies to develop the dose-response values. Absorption Adjustment Factors (AAFs) are used in a risk assessment to account for these differences. AAFs are discussed in greater detail in Section 5.5.2 and Appendix O.

TABLE 4-1
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS FROM CHRONIC EXPOSURE THROUGH THE ORAL ROUTE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Oral Dose-Response Value (mg/kg-day) | | Reference (Last Verified) Type | EPA Confidence Level | Uncertainty Factor | Modifing Factor | Targent Organ/ Critical Effect at LOAEL | Study Animal | Study Method |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 6.00E-02 | | NCEA (e) | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | 106-46-7 | 3.00E-02 | | NCEA (e) | NA | NA | NA | NA | NA | NA |
| 2,4,5-TP (Silvex) | 93-72-1 | 8.00E-03 | | IRIS (11/2000) | MEDIUM | 100 | 1 | Histopathological changes in the liver | DOG | ORAL:DIET |
| 2,4,6-Trichlorophenol | 88-06-2 | NA | | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dichlorophenol | 120-83-2 | 3.00E-03 | | IRIS (11/2000) | LOW | 100 | 1 | Decreased delayed hypersensitivity response | RAT | ORAL:DRINKING WATER |
| 2-Chlorophenol | 95-57-8 | 5.00E-03 | | IRIS (11/2000) | LOW | 1000 | 1 | Reproductive effects | RAT | ORAL:DRINKING WATER |
| 2-Nitroaniline | 88-74-4 | NA | | NA | NA | NA | NA | NA | NA | NA |
| 3-Methylphenol/4-Methylphenol | (a) | 5.00E-02 | (b) | IRIS (11/2000) | MEDIUM | 1000 | 1 | Decreased body weight, neurotoxicity | RAT | ORAL:GAVAGE |
| 4,4-DDE | 72-55-9 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | 106-47-8 | 4.00E-03 | | IRIS (11/2000) | LOW | 3000 | 1 | Splenic lesions | RAT | ORAL:DIET |
| 4-Methyl-2-pentanone | 108-10-1 | 8.00E-02 | | HEAST | NA | 3000 | 1 | Increased liver and kidney weights, increased urinary protein | RAT | ORAL:GAVAGE |
| 4-Nitroaniline | 100-01-6 | NA | | NA | NA | NA | NA | NA | NA | NA |
| Acetone | 67-64-1 | 1.00E-01 | | IRIS (11/2000) | LOW | 1000 | 1 | Increased liver and kidney weights and nephrotoxicity | RAT | ORAL:GAVAGE |
| alpha-BHC | 319-84-6 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| *Antimony* | 7440-36-0 | 4.00E-04 | | IRIS (11/2000) | LOW | 1000 | 1 | *Decreased longevity, dec. blood glucose and cholesterol changes* | RAT | ORAL:DRINKING WATER |
| Arsenic | 7440-38-2 | 3.00E-04 | | IRIS (11/2000) | MEDIUM | 3 | 1 | Hyperpigmentation and keratosis of the skin and poss. vascular complications | HUMAN | ORAL:DRINKING WATER |
| Benzene | 71-43-2 | 3.00E-03 | | NCEA (7/29/96) | MEDIUM-LOW | 3000 | NA | Hematological and Immunological | RAT | ORAL:GAVAGE |
| Benzo(a)anthracene | 56-55-3 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | 50-32-8 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | 205-99-2 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 207-08-9 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| beta-BHC | 319-85-7 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Cadmium | 7440-43-9 | 5.00E-04 | | IRIS (11/2000) | HIGH | 10 | 1 | Proteinuria | HUMAN | ORAL |
| Carbazole | 86-74-8 | NA | | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | 108-90-7 | 2.00E-02 | | IRIS (11/2000) | MEDIUM | 1000 | 1 | Histopathologic changes in liver | DOG | ORAL:CAPSULE |
| Chloroform | 67-66-3 | 1.00E-02 | | IRIS (11/2000) | MEDIUM | 1000 | 1 | Fatty cyst formation in liver | DOG | ORAL:CAPSULE |
| Cis/Trans-1,2-Dichloroethene | 107-06-2 | 1.00E-02 | (c) | HEAST | NA | 3000 | 1 | Decreased hematocrit and hemoglobin | RAT | ORAL:GAVAGE |
| Copper | 7440-50-8 | 3.70E-02 | | HEAST | NA | NA | NA | GI irritation | HUMAN | ORAL |
| delta-BHC | 319-86-8 | 3.00E-04 | (f) | NA | NA | NA | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | 53-70-3 | NA | | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Dieldrin | 60-57-1 | 5.00E-05 | | IRIS (11/2000) | MEDIUM | 100 | 1 | Liver lesions | RAT | ORAL:DIET |
| Ethylbenzene | 100-41-4 | 1.00E-01 | | IRIS (11/2000) | LOW | 1000 | 1 | Liver and kidney toxicity | RAT | ORAL:GAVAGE |

TABLE 4-1
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS FROM CHRONIC EXPOSURE THROUGH THE ORAL ROUTE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Oral Dose-Response Value (mg/kg-day) | Reference (Last Verified) Type | EPA Confidence Level | Uncertainty Factor | Modifing Factor | Targent Organ/ Critical Effect at LOAEL | Study Animal | Study Method |
|---|---|---|---|---|---|---|---|---|---|
| gamma-BHC | 58-89-9 | 3.00E-04 | IRIS (11/2000) | MEDIUM | 1000 | 1 | Liver and kidney toxicity | RAT | ORAL:DIET |
| Heptachlor | 76-44-8 | 5.00E-04 | IRIS (11/2000) | LOW | 300 | 1 | Increased liver weight | RAT | ORAL:DIET |
| Heptachlor epoxide | 1024-57-3 | 1.30E-05 | IRIS (11/2000) | LOW | 1000 | 1 | Increased liver to body-weight ratios | DOG | ORAL:DIET |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Lead | 7439-92-1 | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Molybdenum | 7439-98-7 | 5.00E-03 | IRIS (11/2000) | MEDIUM | 30 | 1 | Increased uric acid levels | HUMAN | ORAL:DIET |
| Naphthalene | 91-20-3 | 2.00E-02 | IRIS (11/2000) | LOW | 3000 | 1 | Decreased BW in males | RAT | ORAL:GAVAGE |
| Nickel | 7440-02-0 | 2.00E-02 | IRIS (11/2000) | MEDIUM | 300 | 1 | Decreased body & organ wts | RAT | ORAL:DIET |
| Nitrobenzene | 98-95-3 | 5.00E-04 | IRIS (11/2000) | LOW | 10000 | 1 | Hematologic effects, and adrenal, renal & hepatic lesions | RAT/MOUSE | INHALATION |
| Pentachlorophenol | 87-86-5 | 3.00E-02 | IRIS (11/2000) | MEDIUM | 100 | 1 | Liver & kidney pathology | RAT | ORAL:DIET |
| Phenol | 108-95-2 | 6.00E-01 | IRIS (11/2000) | Low | 100 | 1 | Reduced fetal body weights | RAT | ORAL:GAVAGE |
| Tetrachloroethene | 127-18-4 | 1.00E-02 | IRIS (11/2000) | MEDIUM | 1000 | 1 | Hepatotoxicity in mice, decreased weight gain in rats | MOUSE/RAT | ORAL:GAVAGE/DRINKING WATER |
| Toluene | 108-88-3 | 2.00E-01 | IRIS (11/2000) | MEDIUM | 1000 | 1 | Changes in liver and kidney weights | RAT | ORAL:GAVAGE |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | NA | HEAST | NA | NA | NA | NA | NA | NA |
| Total PCBs | 1336-36-3 | 2.00E-05 (d) | IRIS (11/2000) | MEDIUM | 300 | 1 | Ocular, meibomiam gland, finger and toenail, and immune effects | MONKEY | ORAL:CAPSULE |
| Trichloroethene | 79-01-6 | 6.00E-03 | NCEA (e) | LOW | 3000 | 1 | Increased relative liver weight | MOUSE | ORAL:DRINKING WATER |
| Vanadium | 7440-62-2 | 7.00E-03 | HEAST | NA | 100 | 1 | No effects reported | RAT | ORAL:DRINKING WATER |
| Vinyl chloride | 75-01-4 | 3.00E-03 | IRIS (11/2000) | MEDIUM | 30 | 1 | Liver cell polymorphism | RAT | ORAL:DIET |
| Zinc | 7440-66-6 | 3.00E-01 | IRIS (11/2000) | MEDIUM | 3 | 1 | Hematologic effects | HUMAN | ORAL:DIET SUPPLEMENT |

Notes:
CAS - Chemical Abstracts Service.
LOAEL - Lowest Observed Adverse Effects Level.
RfD - Reference Dose.
NCEA - National Center for Environmental Assessment.
IRIS - Integrated Risk Information System, an on-line computer database of toxicological information (USEPA, 2000c).
HEAST - Health Effects Assessment Summary Tables, published annually by the USEPA (1997b).
(a) The CAS numbers for 3-Methylphenol and 4-Methylphenol are 106-44-5 and 108-39-4, respectively.
(b) Value for 3-Methylphenol; IRIS value for 4-Methylphenol has been withdrawn.
(c) Value for cis-1,2-dichloroethene.
(d) Value for Aroclor 1254 (IRIS).
(e) As reported in the USEPA Region 9 PRG Table (10/1999).

TABLE 4-2
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS THROUGH THE INHALATION ROUTE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Inhalation Dose-Response Value (mg/kg-day) | Inhalation Reference Concentration (mg/m³) | Reference (Last Verified) Type | EPA Confidence Level | Uncertainty Factor | Modifying Factor | Target Organ/ Critical Effect at LOAEL | Study Animal | Study Method |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | 79-34-5 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | 106-46-7 | 2.29E-01 | 8.05E-01 | IRIS (11/2000) | MEDIUM | 100 | 1 | Increased liver weight | RAT | INHALATION |
| 2,4,5-TP (Silvex) | 93-72-1 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | 88-06-2 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 2,4-Dichlorophenol | 120-83-2 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | 95-57-8 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | 88-74-4 | 5.71E-05 | 2.00E-04 | HEAST | NA | 10000 | 1 | Hematological effects | RAT | INHALATION:INTERMITTENT |
| 3-Methylphenol/4-Methylphenol | (a) | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 4,4-DDE | 72-55-9 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | 106-47-8 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | 108-10-1 | 2.29E-02 | 8.00E-02 | HEAST | NA | 1000 | 1 | Increased liver wt, kidney effects | RAT | INHALATION:INTERMITTENT |
| 4-Nitroaniline | 100-01-6 | 5.71E-05 (b) | NA | NA | NA | 10000 | 1 | Hematological effects | RAT | INHALATION:INTERMITTENT |
| Acetone | 67-64-1 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| alpha-BHC | 319-84-6 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Antimony | 7440-36-0 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Arsenic | 7440-38-2 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Benzene | 71-43-2 | 1.70E-03 | 6.00E-03 | NCEA (7/2/96) | MEDIUM | 1000 | NA | Hematopoietic Effects | MOUSE | INHALATION:VAPOR |
| Benzo(a)anthracene | 56-55-3 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | 50-32-8 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | 205-99-2 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | 207-08-9 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| beta-BHC | 319-85-7 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Cadmium | 7440-43-9 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Carbazole | 86-74-8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | 108-90-7 | 5.71E-03 | 2.00E-02 | HEAST | NA | 10000 | 1 | Liver and kidney effects | RAT | INHALATION: INTERMITTENT |
| Chloroform | 67-66-3 | 8.60E-05 | NA | NCEA 12/1/97 | NA | NA | NA | Nasal Effects | NA | NA |
| Cis/Trans-1,2-Dichloroethene | 107-06-2 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Copper | 7440-50-8 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| delta-BHC | 319-86-8 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Dibenzo(a,h)anthracene | 53-70-3 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Dieldrin | 60-57-1 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | 100-41-4 | 2.86E-01 | 1.00E+00 | IRIS (11/2000) | LOW | 300 | 1 | Developmental toxicity | RAT/RABBIT | INHALATION |

TABLE 4-2
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS THROUGH THE INHALATION ROUTE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Inhalation Dose-Response Value (mg/kg-day) | Inhalation Reference Concentration (mg/m³) | Reference (Last Verified) Type | EPA Confidence Level | Uncertainty Factor | Modifying Factor | Target Organ/ Critical Effect at LOAEL | Study Animal | Study Method |
|---|---|---|---|---|---|---|---|---|---|---|
| gamma-BHC | 58-89-9 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Heptachlor | 76-44-8 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Heptachlor epoxide | 1024-57-3 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Lead | 7439-92-1 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Molybdenum | 7439-98-7 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Naphthalene | 91-20-3 | 8.57E-04 | 3.00E-03 | IRIS (11/2000) | MEDIUM | 3000 | 1 | Nasal effects | MOUSE | INHALATION |
| Nickel | 7440-02-0 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | 98-95-3 | 5.70E-04 | 2.00E-03 | HEAST | NA | 10000 | 1 | Hematological effects and adrenal, renal, and heptatic lesions | MOUSE/RAT | INHALATION |
| Pentachlorophenol | 87-86-5 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Phenol | 108-95-2 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | 127-18-4 | 1.14E-01 | 4.00E-01 | NCEA (c) | MEDIUM | 300 | 1 | Hepatotoxicity and renal toxicity | MOUSE | INHALATION |
| Toluene | 108-88-3 | 1.14E-01 | 4.00E-01 | IRIS (11/2000) | MEDIUM | 300 | 1 | Neurological effects | HUMAN | INHALATION:OCCUPATIONAL |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | NA | NA | HEAST | NA | NA | NA | NA | NA | NA |
| Total PCBs | 1336-36-3 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Trichloroethene | 79-01-6 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |
| Vanadium | 7440-62-2 | NA | NA | HEAST | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | 75-01-4 | 2.86E-02 | 1.00E-01 | IRIS (11/2000) | MEDIUM | 30 | 1 | Liver cell polymorphism | RAT | ORAL:DIET |
| Zinc | 7440-66-6 | NA | NA | IRIS (11/2000) | NA | NA | NA | NA | NA | NA |

Notes:
CAS - Chemical Abstracts Service.
LOAEL - Lowest Observed Adverse Effects Level.
RfC - Reference Concentration.
NCEA - National Center for Environmental Assessment
IRIS - Integrated Risk Information System, an on-line computer database of toxicological information (USEPA, 2000c).
HEAST - Health Effects Assessment Summary Tables, published annually by the USEPA (1997b)
(a) The CAS numbers for 3-Methylphenol and 4-Methylphenol are 106-44-5 and 108-39-4, respectively.
(b) Due to structural similarities, value for 2-Nitroaniline used.
(c) As reported in the USEPA Region 9 PRG Table (10/1999).

TABLE 4-3
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL CARCINOGENIC EFFECTS BY THE ORAL ROUTE OF EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | EPA Carcinogen Class | Oral CSF (mg/kg-day)$^{-1}$ | Oral CSF Reference (Last Verified) | Oral CSF Study Animal | Oral CSF Study Method |
|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | 79-34-5 | C | 2.00E-01 | IRIS (11/2000) | MOUSE | ORAL:GAVAGE |
| 1,4-Dichlorobenzene | 106-46-7 | C | 2.40E-02 | HEAST (1997) | MOUSE | ORAL:GAVAGE |
| 2,4,5-TP (Silvex) | 93-72-1 | D | NA | IRIS (11/2000) | NA | NA |
| 2,4,6-Trichlorophenol | 88-06-2 | B2 | 1.10E-02 | IRIS (11/2000) | RAT | ORAL DIET |
| 2,4-Dichlorophenol | 120-83-2 | NA | NA | IRIS (11/2000) | NA | NA |
| 2-Chlorophenol | 95-57-8 | NA | NA | IRIS (11/2000) | NA | NA |
| 2-Nitroaniline | 88-74-4 | NA | NA | IRIS (11/2000) | NA | NA |
| 3-Methylphenol/4-Methylphenol | (a) | C | NA | IRIS (11/2000) | NA | NA |
| 4,4-DDE | 72-55-9 | B2 | 3.40E-01 | IRIS (11/2000) | MOUSE/HAMSTER | ORAL DIET |
| 4-Chloroaniline | 106-47-8 | NA | NA | IRIS (11/2000) | NA | NA |
| 4-Methyl-2-pentanone | 108-10-1 | NA | NA | IRIS (11/2000) | NA | NA |
| 4-Nitroaniline | 100-01-6 | NA | NA | NA | NA | NA |
| Acetone | 67-64-1 | D | NA | IRIS (11/2000) | NA | NA |
| alpha-BHC | 319-84-6 | B2 | 6.30E+00 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Antimony | 7440-36-0 | NA | NA | IRIS (11/2000) | NA | NA |
| Arsenic | 7440-38-2 | A | 1.50E+00 | IRIS (11/2000) | HUMAN | ORAL:DRINKING WATER |
| Benzene | 71-43-2 | A | 1.50E-02 (b) | IRIS (11/2000) | HUMAN | INHALATION OCCUPATIONAL |
| Benzo(a)anthracene | 56-55-3 | B2 | 7.30E-01 (c) | IRIS (11/2000) | NA | NA |
| Benzo(a)pyrene | 50-32-8 | B2 | 7.30E+00 | IRIS (11/2000) | MOUSE | ORAL:DIET |
| Benzo(b)fluoranthene | 205-99-2 | B2 | 7.30E-01 (c) | IRIS (11/2000) | NA | NA |
| Benzo(k)fluoranthene | 207-08-9 | B2 | 7.30E-02 (d) | IRIS (11/2000) | NA | NA |
| beta-BHC | 319-85-7 | C | 1.80E+00 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Cadmium | 7440-43-9 | B1 | NA | IRIS (11/2000) | NA | NA |
| Carbazole | 86-74-8 | B2 | 2.00E-02 | HEAST | MOUSE | ORAL DIET |
| Chlorobenzene | 108-90-7 | D | NA | IRIS (11/2000) | NA | NA |
| Chloroform | 67-66-3 | B2 | 6.10E-03 | IRIS (11/2000) | RAT | ORAL DRINKING WATER |
| Cis/Trans-1,2-Dichloroethene | 107-06-2 | D | NA (e) | IRIS (11/2000) | NA | NA |
| Copper | 7440-50-8 | D | NA | IRIS (11/2000) | NA | NA |
| delta-BHC | 319-86-8 | D | NA | IRIS (11/2000) | NA | NA |
| Dibenzo(a,h)anthracene | 53-70-3 | B2 | 7.30E+00 (f) | IRIS (11/2000) | NA | NA |
| Dieldrin | 60-57-1 | B2 | 1.60E+01 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Ethylbenzene | 100-41-4 | D | NA | IRIS (11/2000) | NA | NA |
| gamma-BHC | 58-89-9 | B2-C | 1.30E+00 | HEAST | MOUSE | ORAL:DIET |
| Heptachlor | 76-44-8 | B2 | 4.50E+00 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Heptachlor epoxide | 1024-57-3 | B2 | 9.10E+00 | IRIS (11/2000) | MOUSE | ORAL:DIET |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | B2 | 7.30E-01 (c) | IRIS (11/2000) | NA | NA |
| Lead | 7439-92-1 | B2 | NA | NA | NA | NA |
| Molybdenum | 7439-98-7 | NA | NA | IRIS (11/2000) | NA | NA |
| Naphthalene | 91-20-3 | C | NA | IRIS (11/2000) | NA | NA |
| Nickel | 7440-02-0 | NA | NA (i) | IRIS (11/2000) | NA | NA |
| Nitrobenzene | 98-95-3 | D | NA | IRIS (11/2000) | NA | NA |
| Pentachlorophenol | 87-86-5 | B2 | 1.20E-01 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Phenol | 108-95-2 | D | NA | IRIS (11/2000) | NA | NA |
| Tetrachloroethene | 127-18-4 | NA | 5.20E-02 | NCEA (k) | NA | NA |
| Toluene | 108-88-3 | D | NA | IRIS (11/2000) | NA | NA |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | B2 | 1.50E+05 | HEAST | RAT | ORAL DIET |
| Total PCBs | 1336-36-3 | B2 | 2.00E+00 (g) | IRIS (11/2000) | RAT | ORAL DIET |
| Trichloroethene | 79-01-6 | NA | 1.10E-02 | NCEA (k) | MOUSE | ORAL GAVAGE |
| Vanadium | 7440-62-2 | NA | NA | HEAST | NA | NA |
| Vinyl chloride | 75-01-4 | A | 7.20E-01 (h) | IRIS (11/2000) | RAT | ORAL:DIET |
| Zinc | 7440-66-6 | D | NA | IRIS (11/2000) | NA | NA |

Notes
CAS - Chemical Abstracts Service
CSF - Cancer Slope Factor
NCEA - National Center for Environmental Assessment
IRIS - Integrated Risk Information System, an online computer database of toxicological information (USEPA, 2000c).
HEAST - Health Effects Assessment Summary Tables, published annually by the USEPA (1997b)
(a) The CAS numbers for 3-Methylphenol and 4-Methylphenol are 106-44-5 and 108-39-4, respectively
(b) IRIS provides a range of CSF for benzene of 1.5E-02 to 5.5E-02 kg*day/mg. IRIS states that each value within this range has equal scientific plausibility.
(c) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 0.1 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d)
(d) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 0.01 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d)
(e) Cis-1,2-Dichloroethene has a carcinogen class of D; trans-1,2-Dichloroethene has not been classified, per IRIS
(f) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 1.0 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d)
(g) This is the upperbound CSF for high risk and persistence PCBs. USEPA provides a range of slope factor or IRIS, these will be discussed in the risk characterization
(h) Value provided by IRIS for continuous adult exposure. This value used in calculations as vinyl chloride was not identified as a constituent of potential concern in residential areas
(i) - Information for nickel, soluble salts on IRIS

TABLE 4-4
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL CARCINOGENIC EFFECTS BY THE INHALATION ROUTE OF EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | EPA Carcinogen Class | Inhalation CSF (mg/kg-day)$^{-1}$ (i) | Unit Risk Factor ($m^3$/ug) | Inhalation CSF Reference (Last Verified) | Inhalation CSF Study Animal | Inhalation CSF Study Method |
|---|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | 79-34-5 | C | 2.03E-01 | 5.80E-05 | IRIS (11/2000) | MOUSE | ORAL GAVAGE |
| 1,4-Dichlorobenzene | 106-46-7 | C | 2.20E-02 | NA | NCEA (k) | NA | NA |
| 2,4,5-TP (Silvex) | 93-72-1 | D | NA | NA | IRIS (11/2000) | NA | NA |
| 2,4,6-Trichlorophenol | 88-06-2 | B2 | 1.09E-02 | 3.10E-06 | IRIS (11/2000) | RAT | ORAL DIET |
| 2,4-Dichlorophenol | 120-83-2 | NA | NA | NA | IRIS (11/2000) | NA | NA |
| 2-Chlorophenol | 95-57-8 | NA | NA | NA | IRIS (11/2000) | NA | NA |
| 2-Nitroaniline | 88-74-4 | NA | NA | NA | IRIS (11/2000) | NA | NA |
| 3-Methylphenol/4-Methylphenol | (a) | C | NA | NA | IRIS (11/2000) | NA | NA |
| 4,4-DDE | 72-55-9 | B2 | NA | NA | IRIS (11/2000) | NA | NA |
| 4-Chloroaniline | 106-47-8 | NA | NA | NA | IRIS (11/2000) | NA | NA |
| 4-Methyl-2-pentanone | 108-10-1 | NA | NA | NA | IRIS (11/2000) | NA | NA |
| 4-Nitroaniline | 100-01-6 | NA | NA | NA | NA | NA | NA |
| Acetone | 67-64-1 | D | NA | NA | IRIS (11/2000) | NA | NA |
| alpha-BHC | 319-84-6 | B2 | 6.30E+00 | 1.80E-03 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Antimony | 7440-36-0 | NA | NA | NA | NA | NA | NA |
| Arsenic | 7440-38-2 | A | 1.50E+01 | 4.30E-03 | IRIS (11/2000) | HUMAN | INHALATION: OCCUPATIONAL |
| Benzene | 71-43-2 | A | 7.70E-03 (b) | 2.20E-06 | IRIS (11/2000) | HUMAN | INHALATION: OCCUPATIONAL |
| Benzo(a)anthracene | 56-55-3 | B2 | 3.10E-01 (c) | NA | IRIS (11/2000) | NA | NA |
| Benzo(a)pyrene | 50-32-8 | B2 | 3.10E+00 | NA | NCEA (k) | NA | NA |
| Benzo(b)fluoranthene | 205-99-2 | B2 | 3.10E-01 (c) | NA | IRIS (11/2000) | NA | NA |
| Benzo(k)fluoranthene | 207-08-9 | B2 | 3.10E-02 (d) | NA | IRIS (11/2000) | NA | NA |
| beta-BHC | 319-85-7 | C | 1.86E+00 | 5.30E-04 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Cadmium | 7440-43-9 | B1 | 6.30E+00 | 1.80E-03 | IRIS (11/2000) | HUMAN | INHALATION: OCCUPATIONAL |
| Carbazole | 86-74-8 | B2 | NA | NA | NA | NA | NA |
| Chlorobenzene | 108-90-7 | D | NA | NA | IRIS (11/2000) | NA | NA |
| Chloroform | 67-66-3 | B2 | 8.05E-02 | 2.30E-05 | IRIS (11/2000) | MOUSE | ORAL GAVAGE |
| Cis/Trans-1,2-Dichloroethene | 107-06-2 | D | NA | NA | IRIS (11/2000) | NA | NA |
| Copper | 7440-50-8 | D | NA | NA | IRIS (11/2000) | NA | NA |
| delta-BHC | 319-86-8 | D | NA | NA | IRIS (11/2000) | NA | NA |
| Dibenzo(a,h)anthracene | 53-70-3 | B2 | 3.10E+00 (f) | NA | IRIS (11/2000) | NA | NA |
| Dieldrin | 60-57-1 | B2 | 1.61E+01 | 4.60E-03 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Ethylbenzene | 100-41-4 | D | NA | NA | IRIS (11/2000) | NA | NA |
| gamma-BHC | 58-89-9 | B2-C | NA | NA | IRIS (11/2000) | NA | NA |
| Heptachlor | 76-44-8 | B2 | 4.50E+00 | 1.30E-03 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Heptachlor epoxide | 1024-57-3 | B2 | 9.10E+00 | 2.60E-03 | IRIS (11/2000) | MOUSE | ORAL DIET |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | B2 | 3.10E-01 (c) | NA | IRIS (11/2000) | NA | NA |
| Lead | 7439-92-1 | B2 | NA | NA | IRIS (11/2000) | NA | NA |
| Molybdenum | 7439-98-7 | NA | NA | NA | IRIS (11/2000) | NA | NA |
| Naphthalene | 91-20-3 | C | NA | NA | IRIS (11/2000) | NA | NA |
| Nickel | 7440-02-0 | NA | NA (j) | NA | IRIS (11/2000) | NA | NA |
| Nitrobenzene | 98-95-3 | D | NA | NA | IRIS (11/2000) | NA | NA |
| Pentachlorophenol | 87-86-5 | B2 | NA | NA | IRIS (11/2000) | NA | NA |
| Phenol | 108-95-2 | D | NA | NA | NA | NA | NA |
| Tetrachloroethene | 127-18-4 | NA | 2.00E-03 | 5.80E-07 | NCEA (k) | NA | NA |
| Toluene | 108-88-3 | D | NA | NA | IRIS (11/2000) | NA | NA |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | B2 | 1.50E+05 | NA | HEAST | RAT | ORAL DIET |
| Total PCBs | 1336-36-3 | B2 | 2.00E+00 (g) | NA | IRIS (11/2000) | RAT | ORAL DIET |
| Trichloroethene | 79-01-6 | NA | 6.00E-03 | NA | NCEA (k) | NA | NA |
| Vanadium | 7440-62-2 | NA | NA | NA | HEAST | NA | NA |
| Vinyl chloride | 75-01-4 | A | 1.54E-02 | 4.40E-06 (h) | IRIS (11/2000) | RAT | INHALATION |
| Zinc | 7440-66-6 | D | NA | NA | IRIS (11/2000) | NA | NA |

Notes:
CAS - Chemical Abstracts Service.
CSF - Cancer Slope Factor.
NCEA - National Center for Environmental Assessment
IRIS - Integrated Risk Information System, an online computer database of toxicological information (USEPA, 2000c).
HEAST - Health Effects Assessment Summary Tables, published annually by the USEPA (1997b).
(a) The CAS numbers for 3-Methylphenol and 4-Methylphenol are 106-44-5 and 108-39-4, respectively.
(b) IRIS provides a range of inhalation unit risk factors for benzene of 2.2E-06 to 7.8E-06 $m^3$/ug. These are equivalent to an CSF range of 7.7 E-03 to 2.7E-02 kg*day/mg. IRIS states that each value within this range has equal scientific plausibility.
(c) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 0.1 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d).
(d) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 0.01 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d).
(e) Cis-1,2-Dichloroethene has a carcinogen class of D; trans-1,2-Dichloroethene has not been classified, per IRIS.
(f) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 1.0 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d).
(g) This is the upperbound CSF for high risk and persistence PCBs. USEPA provides a range of slope factor or IRIS; these will be discussed in the risk characterization.
(h) Value provided by IRIS for continuous adult exposure. This value used in calculations as vinyl chloride was not identified as a constituent of potential concern in residential areas.
(i) Inhalation CSF calculated from the unit risk factor, where available, assuring a 70 kg adult breathes 20 $m^3$ of air per day.
(j) - Information for nickel, soluble salts, on IRIS.
(k) As reported in the USEPA Region 9 PRG Table (10/1999).

| **TABLE 4-5<br>TIERS OF CANCER SLOPE FACTORS FOR ENVIRONMENTAL PCBs (a)<br>SAUGET AREA 1 - EE/CA AND RI/FS<br>HUMAN HEALTH RISK ASSESSMENT** |
|---|
| HIGH RISK AND PERSISTENCE<br><br>Upper-bound slope factor: 2.0 $(mg/kg\text{-}day)^{-1}$<br>Central-estimate slope factor: 1.0 $(mg/kg\text{-}day)^{-1}$ |
| Criteria for use:<br>- Food chain exposure<br>- Sediment or soil ingestion<br>- Dust or aerosol inhalation<br>- Dermal exposure, if an absorption factor has been applied<br>- Presence of dioxin-like, tumor-promoting, or persistent congeners<br>- Early-life exposure (all pathways) |
| LOW RISK AND PERSISTENCE<br><br>Upper-bound slope factor: 0.4 $(mg/kg\text{-}day)^{-1}$<br>Central-estimate slope factor: 0.3 $(mg/kg\text{-}day)^{-1}$ |
| Criteria for use:<br>- Ingestion of water-soluble congeners<br>- Inhalation of evaporated congeners<br>- Dermal exposure if no absorption factor has been applied |
| LOWEST RISK AND PERSISTENCE<br><br>Upper-bound slope factor: 0.07 $(mg/kg\text{-}day)^{-1}$<br>Central-estimate slope factor: 0.04 $(mg/kg\text{-}day)^{-1}$ |
| Criteria for use:<br>Congener or isomer analyses verify that congeners with more than 4 chlorines comprise less than 0.5% of total PCBs. |

(a) USEPA. 2000c. Integrated Risk Information System (IRIS).

TABLE 4-6
TEFs FOR DIOXIN AND FURAN CONGENERS
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSM

| Constituent | CAS NO. | TEF (a) |
|---|---|---|
| | | |
| **Dioxins** | | |
| 2,3,7,8-TetraCDD | 1746-01-6 | 1 |
| 1,2,3,7,8-PentaCDD | 40321-76-4 | 1 |
| 1,2,3,4,7,8-HexaCDD | 39227-28-6 | 0.1 |
| 1,2,3,6,7,8-HexaCDD | 57653-85-7 | 0.1 |
| 1,2,3,7,8,9-HexaCDD | 19408-74-3 | 0.1 |
| 1,2,3,4,6,7,8-HeptaCDD | 35822-39-4 | 0.01 |
| OctaCDD | 3268-87-9 | 0.0001 |
| 2,3,7,8-PentaCDDs | NA | NA |
| 2,3,7,8-HexaCDDs | NA | NA |
| 2,3,7,8-HeptaCDDs | NA | NA |
| | | |
| **Furans** | | |
| 2,3,7,8-TetraCDF | 51207-31-9 | 0.1 |
| 1,2,3,7,8-PentaCDF | 57117-41-6 | 0.05 |
| 2,3,4,7,8-PentaCDF | 57117-31-4 | 0.5 |
| 1,2,3,4,7,8-HexaCDF | 70648-26-9 | 0.1 |
| 1,2,3,6,7,8-HexaCDF | 57117-44-9 | 0.1 |
| 1,2,3,7,8,9-HexaCDF | 72918-21-9 | 0.1 |
| 2,3,4,6,7,8-HexaCDF | 60851-34-5 | 0.1 |
| 1,2,3,4,6,7,8-HeptaCDF | 67562-39-4 | 0.01 |
| 1,2,3,4,7,8,9-HeptaCDF | 55673-89-7 | 0.01 |
| OctaCDF | 39001-02-0 | 0.0001 |
| 2,3,7,8-HexaCDFs | NA | NA |
| 2,3,7,8-HeptaCDFs | NA | NA |
| | | |

Notes:
CAS - Chemical Abstracts Service.
CDD- Chorodibenzodioxin
CDF - Chlorodibenzofuran.
TEF - Toxicity Equivalency Factor.
(a) - "Toxic Equivalency Factors for PCBs, PCDDs, PCDFs for Humans and Wildlife." Van den Berg, et al. 1998.

# 5.0 EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to predict the magnitude and frequency of potential human exposure to each of the COPC retained for quantitative evaluation in the HHRA. The first step in the exposure assessment process is the characterization of the setting of the site and surrounding area. Current and potential future site uses and potential receptors (i.e., people who may contact the impacted environmental media of interest) are then identified. Potential exposure scenarios identifying appropriate environmental media and exposure pathways for current and potential future site uses and receptors are then developed. Those potential exposure pathways for which COPCs are identified and are judged to be complete are evaluated quantitatively in the risk assessment. This information is used to develop or update the conceptual site model (CSM) for the site.

To estimate the potential risk to human health that may be posed by the presence of COPCs in environmental media in the study area, it is first necessary to estimate the potential exposure dose of each COPC for each receptor. The exposure dose is estimated for each constituent via each exposure route/pathway by which the receptor is assumed to be exposed. Reasonable maximum exposure (RME) scenarios, and most likely exposure (MLE) scenarios based on appropriate USEPA guidance are both evaluated in the quantitative risk assessment. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day). The exposure doses are combined with the toxicity values to estimate potential risks and hazards for each receptor.

This section contains seven subsections. Section 5.1 presents the updated CSM for the site. Section 5.2 identifies the potential exposure scenarios and receptors. Section 5.3 presents the methods for quantifying potential exposures. Section 5.4 presents the receptor-specific exposure parameters, and Section 5.5 presents the constituent-specific exposure parameters. Section 5.6 discusses the risk calculations.

## 5.1 Conceptual Site Model

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a CSM for human health was developed as part of the scoping activities in the HHRA Workplan (presented in Appendix A). The purpose of the CSM is to identify source areas, potential migration pathways of constituents from source areas to environmental media where exposure can occur, and to identify potential human receptors. The CSM is meant to be a "living" model that can be updated and modified as additional data become available.

The initial CSM for the site is presented in Figure (Appendix A) 2-1. Table (Appendix A) 5-1 presented the matrix of receptors and pathways by area and medium that would be considered for evaluation in the risk assessment. The CSM and the receptor area matrix have been updated based on a review of the analytical results and the COPC selection process. The updated CSM is presented in Figure 5-1. The updated receptor/area matrix is presented in Table 5-1. Both are discussed below.

### 5.1.1 Sites

In Sauget Area 1, the sites are identified as Sites G, H, I, L, M, and N. These are identified as source areas in the CSM (Figure 5-1). Constituents in the sites may leach to underlying groundwater. In accordance with the SSP, samples of wastes in the fill areas were analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) to address potential leachate issues.

Site M is included in the UAO sediment removal action (Section 2.0), therefore, it is not evaluated further in the HHRA. COPCs were identified in samples of shallow groundwater in Site H, Site G, Site L, and in Site I and downgradient (west) of Site I. Groundwater is, therefore, identified as a secondary source in the CSM (Figure 5-1), and these COPCs are quantitatively evaluated in the HHRA. It should be noted that no COPCs were identified in groundwater south of Site L, with the exception of lead in a nonpotable use well in the residential area.

As discussed in the EE/CA and RI/FS report for Sauget Area 1, groundwater flow direction was evaluated by installing nine piezometer clusters within the area. Each cluster contained three small-diameter piezometers screened in the shallow hydrogeologic unit (0-30 feet bgs), the middle hydrogeologic unit (30-70 feet bgs), and the deep hydrogeologic unit (greater than 60 feet bgs). Each of these wells was gauged quarterly to determine the potentiometric surface in each zone. The data for four quarters were plotted to show the potentiometric surface contours for groundwater. [These are shown in Figures 4-28 through 4-39 of the EE/CS and RI/FS report.] The results indicate that groundwater flow direction is to the west at an approximate gradient of one foot vertical to 1,000 feet horizontal. These results indicate that the nonpotable use domestic wells sampled in the residential area are in fact cross-gradient of groundwater beneath the Sites where COPCs were identified in groundwater.

VOCs identified as COPCs in shallow groundwater may volatilize and infiltrate indoor air in overlying buildings and outdoor air, and these potential exposure pathways (Figure 5-1) are evaluated in the HHRA. Construction work may occur to depths at which shallow groundwater may be encountered by direct contact, and this pathway is evaluated in the HHRA. It is assumed that construction could occur to depths up to 30 feet bgs as some sewer lines in the area are at this depth. It is assumed that volatilization of VOCs to indoor or outdoor air can occur from groundwater up to this depth, although this pathway is more commonly evaluated for groundwater less than 15 feet bgs (MADEP, 1995).

No COPCs were identified in surface soil in Site G, therefore, this medium is not further evaluated in the HHRA. COPCs were identified in surface soil in Sites H, I, L, and N. COPCs in surface soil may be suspended in dusts in outdoor air (no VOCs were identified as COPCs in site soils). Exposure to COPCs in outdoor air as well as direct contact with soils are evaluated as potential exposure pathways in the HHRA (Figure 5-1).

### 5.1.2 Dead Creek and Borrow Pit Lake

Historical information presented in the SSP demonstrates that the major source of COPCs in surface water and sediments in Dead Creek was past industrial and municipal discharges directly to the creek. There are no current discharges to the creek other than stormwater.

As noted in Section 2.0, a sediment removal action will be conducted in Site M, CS-B through CS-E, and including portions of CS-F between CS-E and Route 3 under a UAO with USEPA. Therefore, these areas are not evaluated in the HHRA.

Surface water and sediments in Dead Creek CS-F and the Borrow Pit Lake were collected and analyzed and evaluated as one area in the HHRA. No COPCs were identified in surface water and two COPCs (arsenic, PCBs) were identified in sediment. Therefore, sediment is evaluated quantitatively in the HHRA as a potential exposure pathway (Figure 5-1). Fish in the Borrow Pit Lake may have accumulated constituents present in surface water and/or sediments, and one COPC (arsenic) was identified in fish tissue. Therefore, fish tissue is evaluated quantitatively in the HHRA as a potential exposure pathway (Figure 5-1).

### 5.1.3 Transect Areas

Surface and subsurface soil samples were collected and analyzed from transects in the residential/commercial/undeveloped areas. The SSP sampling program for this area was developed to address the potential for sediments in Dead Creek to serve as a source of constituents to soils in the surrounding flood plain via overbank flooding. Transects were located on alternating sides of Dead Creek from the sites south to Route 3 (Figure 3-1), with the intention of determining if there was a north to south concentration gradient of constituents. Sampling locations on the transects extended out east or west of the creek, with the intention of determining if there was a concentration gradient of constituents extending out from the creek.

A review of the data indicate that Dead Creek is not serving as a source of constituents to soils in the surrounding flood plain. The COPCs identified in transect soils in Section 3.0 are likely representative of background conditions in the area, as discussed in Section 3.0.

No COPCs were identified in surface or subsurface soil in Transects 1 and 2, which are the transects located closest to the fill areas. In addition, no COPCs were identified in subsurface soils in Transects 3, 5, and 7. Therefore, these areas are not further evaluated in the HHRA.

COPCs identified in surface and subsurface soils in the remaining transects are included for quantitative evaluation in the HHRA. Constituents in surface soils may be suspended as dust in outdoor air, and this pathway is evaluated in the HHRA (no VOCs were identified as COPCs in transect soils). COPCs in soils may also be taken up by garden produce, therefore, exposure to COPCs in outdoor air and garden produce as well as direct contact with soils are evaluated as potential exposure pathways in the HHRA (Figure 5-1).

The exposure scenarios (exposure pathways, exposure routes, and receptors) quantitatively evaluated in the risk assessment have been identified based on this current CSM. They are discussed in the next section.

## 5.2 Identification of Potential Exposure Scenarios and Receptors

Exposure scenarios are developed on the basis of the CSM for a site. A general identification of exposure pathways, exposure routes, and receptors is provided in the CSM (Figure 5-1). A more detailed summary is provided in Table 5-1, the receptor/area matrix. Table 5-1 was derived from Table (Appendix A) 5-1, based on the updated CSM presented above and results of the COPC identification process presented in Section 3.0.

### 5.2.1 Sites

Sauget Area 1 sites have been used for industrial purposes for many years (since the 1930s or earlier) and use of these areas is expected to remain industrial. The sites within Sauget Area 1 are zoned commercial/industrial and it is likely that the sites will continue to be used well into the reasonably foreseeable future for commercial/industrial purposes. Therefore, the sites were evaluated for non-residential use scenarios. However, at the request of USEPA, Site N was evaluated for both a nonresidential as well as a hypothetical future residential scenario.

Receptors were identified for the sites based on the CSM and the COPCs identified in media in the areas. COPCs were identified in groundwater in Site G and in soils and groundwater in Sites H, I, and L. COPCs were identified in Site N surface soil for the residential scenario only. Therefore, Site N exposure scenarios are addressed in Section 5.2.3 with the transect soils.

An on-site outdoor industrial worker and a trespassing teen are evaluated for potential exposure to COPCs in surface soil via incidental ingestion and dermal contact, and via inhalation of COPCs that

may be suspended as dusts from soils and to COPCs that may volatilize into outdoor air from underlying groundwater.

An on-site construction/utility worker is evaluated for potential exposure to COPCs in surface and subsurface soil via incidental ingestion and dermal contact, and via inhalation of particulates suspended during excavation activity. Construction/utility work is assumed to occur up to depths of 30 feet bgs as noted above. Due to the shallow depth of groundwater, the construction/utility worker may contact groundwater during excavation. Therefore, the construction worker is assumed to be exposed to COPCs in groundwater via incidental ingestion and dermal contact, and via inhalation of COPCs volatilized from standing water in an excavation trench. Because the sites are areas of known waste disposal, it is assumed that appropriate safeguards are used when excavating in waste areas (gas monitoring, appropriate personal protective equipment). This assumption is addressed in the remedy discussion in Section 8, where the use of institutional controls to enforce these safeguards is discussed.

Due to the presence of VOCs in groundwater in Sites G, H, I and L, an on-site indoor industrial worker will be evaluated for potential exposure to COPCs via inhalation of volatile constituents present in indoor air due to vapor intrusion from groundwater. It is unlikely that the indoor worker receptor would be exposed to soils to the same extent as an outdoor worker, therefore, this pathway was concluded to be insignificant and was not quantitatively evaluated in the risk assessment for this receptor.

### 5.2.2 Dead Creek and Borrow Pit Lake

Access to Dead Creek is generally uncontrolled except for CS-B, which is secured with a fence. Since sediments in CS-B, C, D and E and the upstream portion of F will be excavated and contained on-site as part of a Time Critical Removal Action, exposure to sediments is not considered a potential exposure scenario in these creek segments. The Borrow Pit Lake is located on private property, and access is uncontrolled. Recreational fishing may occur in Borrow Pit Lake. Borrow Pit Lake and the majority of CS-F that are not included in the sediment removal action are evaluated as one area in the HHRA.

COPCs were identified in sediment but not in surface water. Therefore, a recreational receptor (i.e., teenager) could be exposed to COPCs in sediment of CS-F and the Borrow Pit Lake while wading or swimming. This scenario was evaluated in the HHRA.

One COPC was identified in fish tissue collected from Borrow Pit Lake. Therefore, a recreational fisher receptor potentially exposed to COPCs in sediment while wading and via ingestion of fish was evaluated in the HHRA.

### 5.2.3 Transect Areas

The transect areas consist of residential, commercial and undeveloped land. Therefore, both residential and non-residential exposure scenarios were evaluated for these areas. COPCs for a residential scenario were identified in surface soil in Transects 3 through 7 and Site N. COPCs for an industrial scenario were identified in surface soil in Transects 3, 4, 6, and 7, and in subsurface soil in Transects 4 and 6. The only COPC identified in groundwater in the transect area was lead in a non-potable use well.

An indoor industrial worker was not evaluated in the transect areas as no VOCs were identified as COPCs in groundwater. An outdoor industrial worker was evaluated for potential exposure to COPCs in surface soil via incidental ingestion and dermal contact, and via inhalation of COPCs that may be suspended as dusts from soils.

A construction worker receptor was evaluated for potential exposure to COPCs in surface and subsurface soil via incidental ingestion and dermal contact, and via inhalation of particulates suspended during excavation activity. Construction/utility work is assumed to occur up to depths of 30 feet bgs as noted above. Due to the shallow depth of groundwater, the construction/utility worker may contact groundwater during excavation. Therefore, the construction worker is assumed to be exposed to COPCs in groundwater via incidental ingestion and dermal contact with standing water in an excavation trench. Volatile inhalation is not included as no VOCs were identified in groundwater in this area.

A resident receptor is evaluated for potential exposure to COPCs in surface soils via incidental ingestion and dermal contact, and via inhalation of COPCs that may be suspended as dusts from soils. Inspection of the area indicated that some residences have vegetable gardens. As COPCs may be taken up by plant material and subsequently ingested, a produce consumption pathway is included in the HHRA. A trespassing teen receptor was not evaluated in the transects and Site N due to the inclusion of the residential scenario in these areas; the residential scenario provides a more conservative evaluation.

Groundwater is not used as a source of drinking water in the area. However, there are some private wells in the area that may be used for outdoor household activities. As noted above, a single COPC, lead, was identified in a non-potable use well in this area. Therefore, potential exposure to groundwater via incidental ingestion and dermal contact during outdoor use of water from a well is evaluated in the HHRA.

## 5.3 Quantification of Potential Exposures

To estimate the potential risk to human health that may be posed by the presence of COPCs at the site, it is first necessary to estimate the potential exposure dose of each COPC. The exposure dose is estimated for each constituent via each exposure pathway by which the receptor is assumed to be exposed. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day).

Exposure doses are defined differently for potential carcinogenic and noncarcinogenic effects. The Chronic Average Daily Dose (CADD) is used to estimate a receptor's potential intake from exposure to a COPC with noncarcinogenic effects. According to USEPA (1989a), the CADD should be calculated by averaging the dose over the period of time for which the receptor is assumed to be exposed. Therefore, the averaging period is the same as the exposure duration. For COPCs with potential carcinogenic effects, however, the Lifetime Average Daily Dose (LADD) is employed to estimate potential exposures. In accordance with USEPA (1989a) guidance, the LADD is calculated by averaging exposure over the receptor's assumed lifetime (70 years). Therefore, the averaging period is the same as the receptor's assumed lifetime. The standardized equations for estimating a receptor's average daily dose (both lifetime and chronic) are presented below, followed by descriptions of receptor-specific exposure parameters (Section 5.4) and constituent-specific parameters (Section 5.5).

### 5.3.1 Estimating Potential Exposure from Ingestion of and Dermal Contact with Soil or Sediment

Average Daily Dose (Lifetime and Chronic) Following Incidental Ingestion of Soil or Sediment (mg/kg-day):

$$ADD = \frac{CS \times IR \times EF \times ED \times AAF_0 \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CS | = | Soil concentration (mg/kg soil) |
| IR | = | Ingestion rate (mg soil/day) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |

| | | |
|---|---|---|
| $AAF_o$ | = | Oral-Soil Absorption Adjustment Factor (AAF) (unitless) |
| CF | = | Unit conversion factor (kg soil/$10^6$ mg soil) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

Average Daily Dose (Lifetime and Chronic) Following Dermal Contact with Soil or Sediment (mg/kg-day):

$$ADD = \frac{CS \times SA \times AF \times EF \times ED \times AAF_d \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CS | = | Soil concentration (mg/kg soil) |
| SA | = | Exposed skin surface area ($cm^2$/day) |
| AF | = | Soil to skin adherence factor (mg soil/$cm^2$) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| $AAF_d$ | = | Dermal-Soil AAF (unitless) |
| CF | = | Unit conversion factor (kg soil/$10^6$ mg soil) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

### 5.3.2 Estimating Potential Exposure via Inhalation

Average Daily Dose (Lifetime and Chronic) Following Inhalation of COPC (mg/kg-day):

$$ADD = \frac{CA \times IR \times AAF_i \times ET \times EF \times ED}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CA | = | Air concentration (mg/$m^3$) |

| | | |
|---|---|---|
| IR | = | Inhalation rate ($m^3$ /hr) |
| $AAF_i$ | = | Inhalation AAF (unitless) |
| ET | = | Exposure time (hours/day) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

### 5.3.3 Estimating Potential Exposure from Groundwater/Surface Water

Average Daily Dose (Lifetime and Chronic) Following Ingestion of Water (mg/kg-day):

$$ADD = \frac{CW \times IR \times EF \times ED \times AAF_o \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CW | = | Water concentration (mg/L) |
| IR | = | Water ingestion rate (L/day) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| $AAF_o$ | = | Oral-water AAF (unitless) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

Average Daily Dose (Lifetime and Chronic) Following Dermal Contact with Water (mg/kg-day):

$$ADD = \frac{CW \times SA \times PC \times ET \times EF \times ED \times AAF_d \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CW | = | Water concentration (mg/L) |
| SA | = | Exposed skin surface area ($cm^2$/day) |

| | | |
|---|---|---|
| PC | = | Dermal permeability constant (cm/hr) |
| ET | = | Exposure time (hours/day) |
| EF | = | Days exposed per year (day/365 day) |
| ED | = | Years exposed (year) |
| $AAF_d$ | = | Dermal-water AAF (unitless) |
| CF | = | Unit conversion factor ($L/10^3cm^3$) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (year) |

### 5.3.4 Estimating Potential Exposure From Food Consumption

Average Daily Dose (Lifetime and Chronic) Following Food Consumption (mg/kg-day):

$$ADD = \frac{CF \times IR \times AAF \times EF \times ED}{AT \times BW}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CF | = | Concentration in food (mg/kg) |
| IR | = | Ingestion rate (kg/day) |
| AAF | = | Oral-diet AAF (unitless) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (days) |
| AT | = | Averaging time (days) |
| BW | = | Body weight (kg) |

## 5.4 Receptor-Specific Exposure Parameters

The following subsections present the parameters that were used to evaluate each of the potential receptors in the HHRA. Both RME and MLE scenarios were evaluated for each receptor. Receptor-specific exposure parameters are presented in Section 5.4.1. Exposure factors common to several of the receptors are discussed in Section 5.4.2 and 5.4.3. Both the receptor-specific and the common exposure parameters were presented in the HHRA Workplan (Appendix A).

### 5.4.1 Receptor-Specific Exposure Parameters

Exposure assumptions for the indoor industrial worker under the RME and MLE scenarios are shown in Table 5-2.

Exposure assumptions for the outdoor industrial worker under the RME and MLE scenarios are shown in Table 5-3.

Exposure assumptions for the trespassing teenager under the RME and MLE scenarios are shown in Table 5-4.

Exposure assumptions for the construction/utility worker under the RME and MLE scenarios are shown in Table 5-5.

Table 5-6 presents the exposure assumptions for evaluation of a child resident (0 to 6 yrs of age) and an adult resident under RME and MLE scenarios. Because of the differences in activity patterns and sensitivity to potential constituent exposures, two age groups for the resident receptor are evaluated: the young child (age 0 to 6 years, 15 kg body weight) and the adult resident, 70 kg body weight) (USEPA, 1991b). The young child's lower body weight, combined with a high intake rate for soil exposures results in a higher dose per kilogram of body weight than for other age groups. This receptor is then the most sensitive to the noncarcinogenic health effects of constituents and is, therefore, the target receptor for the noncarcinogenic analysis. Because carcinogenic effects are assumed to be additive over a lifetime, it is more conservative to evaluate potentially carcinogenic effects of COPC over the period of residence at the site. The resident, as both child and adult, is thus evaluated for potential carcinogenic effects of COPC.

Exposure assumptions for the recreational teenager under the RME and MLE scenarios are shown in Table 5-7.

The exposure assumptions for the recreational adult fish ingestion pathway for the RME and MLE receptors are summarized in Table 5-8.

### 5.4.2 Soil Ingestion Rate – Adult Construction Worker

Incidental soil ingestion occurs at all ages as a result of hand-to-mouth activities. Currently, there are little or no reliable quantitative data available for estimating adult soil ingestion rates. USEPA risk assessment guidance suggests a soil ingestion rate of 100 mg/day for adults in a residential scenario (USEPA, 1989a, 1991b), and a soil ingestion rate of 50 mg/day for adults in an industrial scenario (USEPA, 1991b).

USEPA presented an estimate of a soil ingestion rate for adults doing yard work of 480 mg/day in their supporting evidence for the commercial/industrial soil ingestion rate of 50 mg/day in the "Standard Default Exposure Factors" Directive (USEPA, 1991b); the 480 mg/day value was not presented in the table of default exposure factors. The Agency states: "For certain outdoor activities in the commercial/industrial setting (e.g., construction or landscaping), a soil ingestion rate of 480 mg/day may be used; however, this type of work is usually short-term and is often dictated by the weather. Thus, exposure frequency would generally be less than one year and exposure duration would vary according to site-specific construction/maintenance plans." However, some regions and state agencies have stipulated the use of this value to evaluate a construction worker exposure scenario. The Hawley (1985) study, which is the basis for the soil ingestion rate of 480 mg/day, was recently reviewed by the USEPA (USEPA, 1997a), which stated that, "Given the lack of supporting measurements, these estimates must be considered conjectural."

In the Hawley (1985) study, the author assumed that soil adheres to the surface area of the hands at a loading of 3.5 mg/cm$^2$. This value was based on a layer of soil on skin assumed to be 0.005 cm deep, a soil density of 1.5 g/cm$^2$, and 50% void space. Using the author's derived soil-to-skin adherence loading of 3.5 mg/cm$^2$ and assuming that the amount of soil covering a fraction of the hands (approximately 70 cm$^2$) is ingested twice a day, Hawley calculated a soil ingestion rate of 480 mg/day.

Hawley's 1985 analysis was one of the first published health risk assessments and was performed before any of the quantitative fecal tracer soil ingestion studies for either children or adults were conducted (Calabrese et al., 1989; Davis et al., 1990; Clausing et al., 1987; Calabrese et al., 1990). Thus, the estimate of 480 mg/day predates all of our current knowledge about soil ingestion among both children and adults, as well as recent published data on soil-to-skin adherence rates.

In 1993, USEPA sponsored a workshop to evaluate soil-to-skin adherence data. As a result, a study to determine a more accurate characterization of soil-to-skin adherence was sponsored by the USEPA and conducted by John C. Kissel and associates at the University of Washington (Kissel et al., 1996; Holmes et al., 1998). The intent of this study was to resolve uncertainties and develop more accurate measures of soil-to-skin loading rates for individuals involved in various occupational and recreational activities. As reported in the Exposure Factors Handbook (EFH) (USEPA ,1997a), soil loading on skin surfaces as a result of various occupational and recreational activities was directly measured. This study indicates that soil loadings vary with the type of activity and the body parts contacted. As one would expect, adherence appears to be greatest during outdoor activities such as farming and gardening, and more soil/dust tends to adhere to the hands and knees than to other areas of the body.

Average hand soil loading factors are presented in the EFH (USEPA, 1997a) for the adult outdoor workers evaluated by Kissel and Holmes. In every case, soil adherence during occupational exposure was measured to be considerably lower than Hawley's estimate of 3.5 mg/cm$^2$. The range of soil adherence loadings measured by Kissel and Holmes falls within the USEPA range of 0.2 to 1.0 mg/cm$^2$ (USEPA, 1992b).

For this evaluation, the construction worker receptor is assumed to be exposed to COPC in surface and subsurface soils during excavation activity. Based on this exposure scenario, the "farmer" receptor provided in the EFH is considered to provide an upper-bound estimate of soil adherence. A soil ingestion rate can be calculated by substituting the soil adherence value for the receptor for the estimated value derived by Hawley (1985), as follows:

$$\frac{480\ mg/day}{3.5\ mg/cm^2} = \frac{ingestion\ rate\ (mg/day)}{soil\ adherence\ (mg/cm^2)}$$

The soil adherence value for the "farmer" is 0.47 mg/cm$^2$. The calculated soil ingestion value is 64 mg/day; therefore, a soil ingestion rate of 64 mg/day is used for the MLE construction worker receptor in this risk evaluation.

Additional support for this value comes from a new paper by Kissel and coworkers (Kissel et al., 1998) that presents the results of a study of the transfer of soil from hand to mouth by intentional licking. Soil was loaded onto the skin by pressing the hand onto soil, and the amount transferred to the mouth was measured. The thumb sucking, finger mouthing, and palm licking activities resulted in geometric mean soil mass transfers of 7.4 to 16 mg per event. The author concludes that "transfer of 10 mg or more of soil from a hand to the oral cavity in one event is possible, but requires moderate soil loading and more than incidental hand-to-mouth contact." However, "the fraction of soil transferred from hand to mouth that is subsequently swallowed is unknown but may be less than 100 percent." In addition, "the adult volunteers in this study reported that the presence of roughly 10 mg of soil in the mouth is readily detected (and unpleasant). Repeated unintentional ingestion of that mass of soil by adults therefore seems unlikely. In light of this observation, the 480 mg per day estimate [of Hawley, 1985] would require hundreds or perhaps thousands of hand-to-mouth contacts that resulted in soil transfer per day."

For the RME scenario, a soil ingestion rate of 100 mg/day is assumed for the construction worker. This is the adult soil ingestion rate provided by USEPA (1991b). For the MLE scenario, the soil ingestion rate of 64 mg/kg derived above was used.

### 5.4.3 Frequency of Exposure to COPC in Soil

A meteorological factor is generally used to account for the fraction of the year during which exposure to constituents in soils may occur (Sheehan et al., 1991; USEPA, 1989a). It is reasonable to assume that direct contact with soil or intrusive activities will not occur for residential receptors during inclement weather, i.e., when it is raining or snowing, when the ground is wet or frozen, or when snow or ice (32 degrees F) are covering the ground. This is not to say that workers or residents would not be outdoors on such days, only that the soil would not be available for significant contact either because it is wet or

frozen. Thus the frequency of contact with potentially impacted soil is adjusted for these site-specific meteorological conditions (USEPA, 1989a).

There are only a few metrics that can be used to describe the fraction of the year when meteorological conditions are likely to limit exposure. These include temperature and the amount of precipitation per day and per year, which includes rain, snow and ice. While measures are collected hourly, the National Weather Service (NWS, 1986-1995) reports the number of days when precipitation is greater than 0.01 inches (one one-hundredth), greater than 0.1 inches (one tenth), and greater than 1 inch in their annual summary data. The number of days with precipitation greater than 0.1 inches is selected as the best representation of when exposure is likely to be limited by snow, rain, or ice. The National Oceanographic and Atmospheric Administration (NOAA) provides daily temperature data. It is assumed that exposure to soils is limited by temperatures less than 32 degrees F. Therefore, limiting the assumption of exposure to soils to those days with less than 0.1 inch of precipitation and temperatures above 32 degrees F is reasonable.

Based on ten years of meteorological data (1986-1995) provided by NOAA (1996), a meteorological factor is derived for use in the exposure equations. On the average, 66 days/year in this area receive 0.1 or greater inches of precipitation, and there are typically 27 days/year with a mean temperature of 32 degrees F or below. Accounting for days when both events occur (assumed to be 10% of the rain days or 6 days/year), the number of inclement days, 87, can be calculated (27 + 66 – 6 = 87). It is assumed that these days are evenly spaced throughout the course of the year. The meteorological factor is then calculated (87/365 = 24%). Thus it is assumed that exposure to soils will not occur for the "receptor" 24% of the assumed days of exposure (exposure frequency) due to weather restrictions.

The choice of a precipitation target of 0.1 inches is in keeping with guidance provided in the Compilation of Air Pollution Emission Factors, which assumes that soil suspension will not occur on days with more than 0.01 inches of precipitation (USEPA, 1995b). It is probable, however, that this metric both over- and under-estimates the potential exposure in some conditions. For, example, it is possible that some exposure to soils may occur on days when it rains just over 0.1 inches in the early morning and then the ground dries during the course of the day. Alternatively, significant rainfall, such as greater than 1 inch, is likely to saturate the soil for consecutive days, and several inches of snow (which may fall all on one day with one storm) may cover the ground and inhibit direct contact for several days. With both of these considerations in mind, it is likely that a meteorological factor based on inclement days defined as precipitation greater than 0.1 inches and average temperatures less than 32 degrees F is reasonable.

## 5.5 Constituent-Specific Parameters

There are several constituent-specific parameters used in the exposure equations above. These parameters are discussed below.

### 5.5.1 Exposure Point Concentrations

Exposure points are located where potential receptors may contact COPCs at or from the site. The concentration of COPCs in the environmental medium that receptors may contact must be estimated in order to determine the magnitude of potential exposure. The estimation of exposure point concentrations (EPCs) in media evaluated for the HHRA is discussed below.

#### 5.5.1.1 Measured EPCs

The EPC for a human health risk assessment is defined as the 95% upper confidence limit (95% UCL) on the arithmetic mean concentration, or the maximum concentration, whichever is lower (USEPA, 1992a), for the RME scenario and the arithmetic mean concentration for the MLE scenario.

Summary statistics have been calculated for each COPC in each medium, as presented in Appendix B. As discussed in Section 3.0, before summary statistics were calculated, the following steps were taken for each COPC. If a constituent was detected in at least once in an area/medium combination, one-half the constituent's quantitation limit was used as a proxy concentration in the estimation of exposure point concentrations for those instances in which the constituent was reported as not detected. However, if the proxy concentration is greater than any detected value in that area/medium, the proxy concentration was removed from the calculation. This is consistent with USEPA guidance (USEPA, 1989a) which recognizes that high sample quantitation limits can lead to unrealistic concentration estimates. Duplicate sample analytical results were averaged, and the average used as the sample point concentration (USEPA, 1989b).

The equation used to calculate the 95% UCL is dependent upon the distribution of the data set. If data are normally distributed, the following equation is used (U.S. EPA, 1992a):

$$95\%\ UCL = \bar{x} + t(s / \sqrt{n})$$

where:

$\bar{x}$ = mean of data
s = standard deviation of the data
t = student t-statistic
n = number of samples

If the data are lognormally distributed, the 95% UCL is calculated using the transformed data set and the H-statistic (U.S. EPA, 1992a). The data are "transformed" by using the natural logarithmic function, i.e., by calculating ln(x) for each x value in the data set.

$$e^{(\bar{x} + 0.5s^2 + sH / \sqrt{n-1})}$$

Where:

| | | |
|---|---|---|
| e | = | base of the natural log, equal to 2.718 |
| $\bar{x}$ | = | mean of the transformed data |
| s | = | standard deviation of the transformed data |
| H | = | H-statistic |
| n | = | the number of samples in the population |

H-statistic and t-statistic values were obtained from Gilbert (1987). Gilbert (1987) provides a subset of all H-statistic values. Where a specific value was not available, the H-statistic was estimated based on linear interpolation using the Table A12 from Gilbert (1987). The H-statistic is a function of the standard deviation of the log-transformed data (Sy) and the number of samples in the statistical data set (n). The table presents values for H based on specific combinations of Sy and n. If the Sy and n for the specific analyte did not correspond to the values represented on the table, then the value of H was estimated based on interpolation. First, the values were interpolated based on the relative Sy, and then based on the relative n. For example, a constituent with Sy of 0.59 and n of 9 results has an interpolated H of 2.55. Although other interpolation methods are available, the resulting 95% UCL values would not differ significantly from those reported here.

The Shapiro-Wilk Test for Normality (W-test) is used to determine which 95% UCL value is appropriate for use as an EPC for each COPC. The results of the W-test indicate whether the data set is more likely to be normally or lognormally distributed. The UCL based on the student t-statistic is selected where the data set is more likely to be normally distributed, while the UCL based on the H-statistic is selected where the data set is more likely to be lognormally distributed. The W-test values were calculated and compared for the log-transformed and untransformed data sets. If the log-transformed data have the higher W-test value, the data are assumed to be more lognormally distributed, and the H-statistic 95% UCL value is the appropriate UCL. Similarly, if the untransformed data have the higher W-test value, the data are assumed to be more normally distributed, and the t-statistic 95% UCL is the appropriate UCL.

EPCs for each of the COPC identified in Section 3.0 have been selected using the above described procedure. The tables in Appendix B (Summary Statistics) present for each constituent detected the W-test results, the log-transformed and untransformed 95% UCLs, the selected 95% UCL, and the selected EPC. The EPCs for each medium and scenario are presented in Tables 5-14 through 5-28

for the RME scenario. The EPCs for each medium and scenario are presented in Tables 5-29 through 5-40 for the MLE scenario.

#### 5.5.1.2 Modeled EPCs

Some pathways required modeling to derive the EPCs. These pathways include volatile constituents in groundwater migrating upwards and infiltrating into indoor air, outdoor air and excavation air, and generation of fugitive dusts from undisturbed soils as well as during construction activities.

The model used to predict indoor air concentrations of VOCs for evaluation of the indoor worker receptor was the model of Johnson and Ettinger recommended by the USEPA (1996a and 1997c) to predict concentrations of COPCs migrating from groundwater to indoor air of an overlying building. Appendix K presents the model calculations and output.

Calculation of outdoor air concentrations of VOCs in groundwater due to exposure to groundwater in an excavation trench is presented in Appendix L. These concentrations were used to evaluate the construction worker receptor.

Concentrations of volatile COPCs in outdoor air due to migration from groundwater was estimated using the methodology recommended by the American Society for Testing and Materials (ASTM, 1995). Appendix M presents the model calculations and output. These concentrations were used to evaluate the outdoor worker and the trespasser receptors.

MLE groundwater concentrations used as the source term in the aforementioned three volatilization models are provided in Table 5-44. These MLE concentrations are averages of the groundwater concentrations within a given site, as noted in the table.

The calculation of concentrations of inorganic and semivolatile organic COPCs bound to soil in fugitive dust involves multiplying the soil exposure point concentrations by the concentration of dust in air as follows:

1) Ambient Air:

COPC concentration in ambient air ($mg/m^3$) = Exposure point concentration in soil (mg/kg soil) x Dust concentration (kg soil/$m^3$)

The dust concentration in air used in the evaluation of ambient outdoor air pathways in this risk evaluation is the inverse of the particulate emission factor (PEF) derived in accordance with USEPA guidance (USEPA, 1996a). Tables 5-18, 5-19 and 5-20 present the PEF calculations used for the various fill areas and transects.

2) Excavation Air (i.e., during construction activities):

COPC concentration in excavation air (mg/m$^3$) = Exposure point concentration in soil (mg/kg soil) x Dust concentration (mg soil/m$^3$) x Unit correction factor (1 kg/10$^6$ mg)

The dust concentration in air used in the evaluation of excavation air pathways in this risk evaluation is 60 ug/m$^3$. This value is the recommended concentration of respirable particulate with a mean diameter of 10 microns or less (PM10) for excavation activities (MADEP, 1995).

COPC concentrations in homegrown produce are dependent upon the potential for direct uptake of COPCs from soil through plant roots and will be estimated via the following equation:

COPC Concentration in Produce (mg COPC/kg plant tissue) = Concentration of COPC in soil (mg COPC/kg Soil) x Root Uptake Factor (unitless)

The root uptake factor accounts for uptake from soil to the homegrown produce. Constituent-specific root uptake factors were obtained from USEPA (1998d). Methodology provided by USEPA (1998d) was used. The calculation of produce EPCs is discussed in Appendix N.

### 5.5.2 Absorption Adjustment Factors

Bioavailability is the measure of the degree to which a chemical may be systemically absorbed following exposure. In accordance with USEPA guidance (USEPA, 1989a, 1992c), absorption adjustment factors (AAFs) for bioavailability will be used in conducting this risk evaluation. To estimate the potential risk to human health that may be posed by the presence of COPCs in various environmental media (such as soil, sediment, water or air), it is first necessary to estimate the human exposure dose of each chemical. The exposure dose is then combined with an estimate of the toxicity of the chemical to produce an estimate of risk posed to human health.

The estimate of toxicity of a chemical, termed the toxicity value, can be derived from human epidemiological data, but it is most often derived from experiments with laboratory animals. The toxicity value can be calculated based on the administered dose of the chemical (similar to the human exposure dose) or, when data are available, based on the absorbed dose, or internal dose, of the chemical.

In animals, as in humans, the administered dose of a chemical is not necessarily completely absorbed. Moreover, differences in absorption exist between laboratory animals and humans, as well as between different media and routes of exposure. Therefore, it is not always appropriate to directly apply a toxicity value to the human exposure dose. In many cases, a correction factor in the calculation of risk

is needed to account for differences between absorption in the toxicity study and absorption likely to occur upon human exposure to a chemical. Without such a correction, the estimate of human health risk could be over- or under-estimated.

This correction factor is termed the absorption adjustment factor, or AAF. The AAF is used to adjust the human exposure dose so that it is expressed in the same terms as the doses used to generate the dose-response curve in the dose-response study. The AAF is the ratio between the estimated human absorption for the specific medium and route of exposure, and the known or estimated absorption for the laboratory study from which the dose-response value was derived.

$$\mathbf{AAFs} = \frac{\textbf{fraction absorbed in humans for the environmental exposure}}{\textbf{fraction absorbed in the dose - response study}}$$

The use of an AAF allows appropriate adjustments to be made to the administered dose of a chemical when the efficiency of absorption between environmental exposure and experimental exposure is known or expected to differ because of physiological effects and/or matrix or vehicle effects.

AAFs can have numerical values less than one or greater than one. When the toxicity curve is based on administered dose data, and if it is estimated that the fraction absorbed from the site-specific exposure or medium is the same as the fraction absorbed in the laboratory study, then the AAF is 1.0. This does not mean that there is 100% absorption, only that the magnitude of absorption is the same in both cases. There are situations in which it is expected that the fraction absorbed from a site-related exposure would be higher than that in the laboratory study. There are also situations where the reverse could occur. Thus, use of AAFs provides more accurate and more realistic estimates of potential human health risk. In the absence of detailed toxicological information on a COPC, the following default AAF values are generally employed. A default AAF value of 0.01 is used for dermal exposure to organics, a value of 0.001 is used for dermal exposure to inorganics (USEPA, 2000a), and a value of 1.0 is employed for all other routes of exposure.

Support for the Use of AAFs in Agency Guidance

The use of absorption factors is recommended by USEPA for use in risk assessment when the "medium of exposure in the site exposure assessment differs from the medium of exposure assumed by the toxicity value" (USEPA, 1989a). In more recent guidance (USEPA, 1992c), USEPA states:

> The applied dose, or the amount that reaches exchange boundaries of the skin, lung or gastrointestinal tract, may often be less than the potential dose if the material is only partly bioavailable. Where data on bioavailability are known, adjustments to the potential dose to convert it to applied dose and internal dose may be made.

This may be done by adding a bioavailability factor (range: 0 to 1) to the dose equation. The bioavailability factor would then take into account the ability of the chemical to be extracted from the matrix, absorption through the exchange boundary, and any other losses between ingestion and contact with lung or gastrointestinal tract.

AAFs used in this risk assessment are presented in Table 5-41. Appendix O presents the derivations of the AAFs.

### 5.5.3 Skin Permeability Constants

The estimation of exposure doses resulting from incidental dermal contact with groundwater requires the use of a dermal permeability constant (PC) in units of centimeters per hour (cm/hr). This method assumes that the behavior of constituents dissolved in water is described by Fick's Law. In Fick's Law, the steady-state flux of the solute across the skin ($mg/cm^2/hr$) equals the permeability constant (kp, cm/hr) multiplied by the concentration difference of the solute across the membrane ($mg/cm^3$). This approach is discussed by USEPA (USEPA, 1989a; 1992b).

The PC values were derived from USEPA's Guidance for Dermal Exposure Assessment: Principles and Applications (USEPA, 1992b). Tables 5-3 and 5-7 of this guidance document list PC values for constituents commonly found at disposal sites. PC's used in this risk assessment are presented in Table 5-42. Calculated PC's are presented in Table 5-43.

## 5.6 Exposure Dose Calculations

Appendix P presents the exposure dose and risk calculation spreadsheets. The risk results are discussed in Section 6.0.

TABLE 5-1
RECEPTOR/AREA MATRIX
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Receptor / Medium / Secondary Medium (Pathways) | EXPOSURE AREAS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SITES | | | | | BPL and CS-F | TRANSECTS | | | | | Total |
| | G (a) | H (b) | I (b) | L (b) | N (c) | | 3 (d) | 4 (d) | 5 (d) | 6 (d) | 7 (d) | |
| ***Indoor Industrial Worker (IW)*** | | | | | | | | | | | | |
| Groundwater | IW-RME-G | IW-RME-H | IW-RME-I | IW-RME-L | | | | | | | | |
| *Indoor Air (inh)* | IW-MLE-G | IW-MLE-H | IW-MLE-I | IW-MLE-L | | | | | | | | 8 |
| ***Outdoor Industrial Worker (OW)*** | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | |
| Groundwater | OW-RME-G | OW-RME-H | OW-RME-I | OW-RME-L | | | OW-RME-T-3 | OW-RME-T-4 | | OW-RME-T-6 | OW-RME-T-7 | |
| *Outdoor Air (inh)* | OW-MLE-G | OW-MLE-H | OW-MLE-I | OW-MLE-L | | | OW-MLE-T-3 | OW-MLE-T-4 | | OW-MLE-T-6 | OW-MLE-T-7 | 16 |
| ***Construction Worker (CW)*** | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | |
| Subsurface Soil (ing/derm) | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | |
| Groundwater (ing/derm) | CW-RME-G | CW-RME-H | CW-RME-I | CW-RME-L | | | CW-RME-T-3 | CW-RME-T-4 | | CW-RME-T-6 | CW-RME-T-7 | |
| *Outdoor Air (inh)* | CW-MLE-G | CW-MLE-H | CW-MLE-I | CW-MLE-L | | | CW-MLE-T-3 | CW-MLE-T-4 | | CW-MLE-T-6 | CW-MLE-T-7 | 16 |
| ***Trespassing Teenager (TT)*** | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | |
| Groundwater | TT-RME-G | TT-RME-H | TT-RME-I | TT-RME-L | | | | | | | | |
| *Outdoor Air (inh)* | TT-MLE-G | TT-MLE-H | TT-MLE-I | TT-MLE-L | | | | | | | | 8 |
| ***Recreational Teen (RT)*** | | | | | | | | | | | | |
| Sediment (ing/derm) | | | | | | RT-RME-CS-F | | | | | | |
| | | | | | | RT-MLE-CS-F | | | | | | 2 |
| ***Recreational Fisher (RF)*** | | | | | | | | | | | | |
| Sediment (ing/derm) | | | | | | RF-RME-F | | | | | | |
| Fish Tissue (ing) | | | | | | RF-MLE-F | | | | | | 2 |
| ***Resident (RES)*** | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | |
| Groundwater (ing/derm) | | | | | RES-RME-N | | RES-RME-T-3 | RES-RME-T-4 | RES-RME-T-5 | RES-RME-T-6 | RES-RME-T-7 | |
| Produce (ing) | | | | | RES-MLE-N | | RES-MLE-T-3 | RES-MLE-T-4 | RES-MLE-T-5 | RES-MLE-T-6 | RES-MLE-T-7 | 12 |
| **Total:** | 8 | 8 | 8 | 8 | 2 | 4 | 6 | 6 | 2 | 6 | 6 | 64 |

Notes:
BPL - Borrow Pit Lake. ing - ingestion
COPC - Constituent of Potential Concern. inh - inhalation
CS-F - Creek Segment F. MLE - Most Likely Exposure
derm - dermal contact RME - Reasonable Maximum Exposure
(a) - In Site G, COPCs identified in groundwater only.
(b) - In Sites H, I, and L, COPCs identified in groundwater and soil for industrial scenario.
(c) - In Site N, COPCs identified in soil for residential scenario only
(d) - In Transect areas, no volatile organic constituents identified as COPCs in groundwater.

TABLE 5-2
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - INDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | RME On-Site Indoor Worker | | MLE On-Site Indoor Worker | |
|---|---|---|---|---|
| Parameters Used in the Indoor Air Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 250 | (b) | 250 | (b) |
| Exposure Duration (yr) | 25 | (b) | 7 | (c) |
| Inhalation Rate (m^3/hour) | 1.6 | (d) | 1.0 | (e) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - USEPA, 1991b. *Standard Default Exposure Factors.*
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended value for occupational tenure listed in Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for moderate activity.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for light activity.

1/2/01

TABLE 5-3
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - OUTDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | RME Future Outdoor Industrial Worker | | MLE Future Outdoor Industrial Worker | |
|---|---|---|---|---|
| Parameters Used in the Outdoor Air Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 190 | (i) | 190 | (i) |
| Exposure Duration (yr) | 25 | (b) | 7 | (c) |
| Inhalation Rate (m^3/hour) | 1.6 | (d) | 1 | (e) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |
| Parameters Used in the Surface Soil Pathway | | | | |
| Exposure Frequency (days/year) | 190 | (i) | 190 | (i) |
| Exposure Duration (yr) | 25 | (b) | 7 | (c) |
| Soil Ingestion Rate (mg/day) | 50 | (f) | 30 | (j) |
| Skin Contacting Medium (cm^2) | 3339 | (g) | 3339 | (g) |
| Soil on Skin (mg/cm^2) | 0.02 | (h) | 0.02 | (h) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - USEPA, 1991b. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended value for occupational tenure listed in Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for moderate activity.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for light activity.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(g) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, forearms, and face.
(h) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-9 for calculation.
(i) - Exposure frequency of 250 days (USEPA, 1991b) adjusted for percentage of days with inclement weather (24%), [250-(250*0.24) = 190]; see text.
(j) - Calabrese, E.J., et. al. 1990. *Preliminary adult soil ingestion estimates; results of a pilot study. Regul. Toxicol. Pharmacol.* 12L88-95. As cited in USEPA, 1997a. Exposure Factors Handbook. Low end of range.

1/2/01

TABLE 5-4
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - TRESPASSING TEENAGER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | RME Trespassing Teenager (7 to 18 yrs) | | MLE Trespassing Teenager (7 to 18 yrs) | |
|---|---|---|---|---|
| Parameters Used in the Outdoor Air Pathway | | | | |
| Exposure Time (hr/day) | 2 | (i) | 2 | (i) |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Inhalation Rate (m^3/hour) | 1.2 | (j) | 1 | (k) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Parameters Used in the Surface Soil Pathway | | | | |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Soil Ingestion Rate (mg/day) | 100 | (d) | 50 | (e) |
| Skin Contacting Medium (cm^2) | 3677 | (f) | 3677 | (f) |
| Soil on Skin (mg/cm^2) | 0.02 | (g) | 0.02 | (g) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - 1 day per week for 26 weeks (6 months) of the year.
(b) - 1 day per 2 weeks for 26 weeks (6 months) of the year.
(c) - Trespassing teenager is assumed to range in age from 7 to 18. Therefore, total exposure duration is 11 years.
(d) - USEPA, 1991b. Standard Default Exposure Factors.
(e) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rate for an adult listed in Table 1-2.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average surface are of hands, forearms and lower legs of males and females aged 7 to 18.
(g) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-13 for calculation.
(h) - USEPA, 1997a. Exposure Factors Handbook. Body weight is the average of males and females aged 7 to 18.
(i) - The trespassing teen is assumed to stay in the fill area for two hours.
(j) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates is the value for moderate activity (children) listed in Table 5-23.
(k) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates is the value for light activity (children) listed in Table 5-23.

1/2/01

TABLE 5-5
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - CONSTRUCTION WORKER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | RME Future Construction/Utility Worker | | MLE Future Construction/Utility Worker | |
|---|---|---|---|---|
| Parameters Used in the Surface Soil and Subsurface Soil Inhalation Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 40 | (b) | 20 | (c) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Inhalation Rate (m^3/hour) | 2.5 | (e) | 1.5 | (f) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |
| Parameters Used in the Surface and Subsurface Soil Pathway | | | | |
| Exposure Frequency (days/year) | 40 | (b) | 20 | (c) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Soil Ingestion Rate (mg/day) | 100 | (g) | 64 | (h) |
| Skin Contacting Medium (cm^2) | 3339 | (i) | 3339 | (i) |
| Soil on Skin (mg/cm^2) | 0.19 | (j) | 0.19 | (j) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |
| Parameters Used in the Groundwater Pathway | | | | |
| Exposure Time (hr/event) | 1 | (k) | 1 | (k) |
| Exposure Frequency (days/year) | 10 | (k) | 5 | (k) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Water Ingestion Rate (l/event) | 0.005 | (l) | 0.005 | (l) |
| Skin Contacting Medium (cm^2) | 3339 | (i) | 3339 | (i) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |
| Parameters Used in the Groundwater Inhalation Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 40 | (b) | 20 | (c) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Inhalation Rate (m^3/hour) | 2.5 | (e) | 1.5 | (f) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - Exposure frequency is equivalent to 5 days per week for 2 months.
(c) - Exposure frequency is equivalent to five days per week for one month.
(d) - Construction activities are assumed to occur over a 1 year period.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate is the value for heavy activity for an outdoor worker listed in Table 5-23.
(f) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate is the value for moderate activity for an outdoor worker listed in Table 5-23.
(g) - USEPA, 1991b. Standard Default Exposure Factors.
(h) - ENSR-derived value; described briefly in the text.
(i) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, forearms, and face.
(j) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-10 for calculation.
(k) - Assumed that contact with water occurs only for a fraction of the total exposure duration and time.
(l) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.

1/2/01

TABLE 5-6
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RESIDENT
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | RME Resident | | | | MLE Resident | | | |
|---|---|---|---|---|---|---|---|---|
| | Adult | | Child (0 to 6 yrs) | | Adult | | Child (0 to 6 yrs) | |
| Parameters Used in the Outdoor Air Inhalation Pathway | | | | | | | | |
| Exposure Time (hr/day) | 2 | (a) | 6 | (a) | 2 | (a) | 6 | (a) |
| Exposure Frequency (days/year) | 266 | (c) | 266 | (c) | 178 | (e) | 178 | (e) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Inhalation Rate (m^3/hour) | 1.6 | (g) | 1.2 | (g) | 0.55 | (h) | 0.32 | (i) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Surface Soil Pathway | | | | | | | | |
| Exposure Frequency (days/year) | 266 | (c) | 266 | (c) | 178 | (e) | 178 | (e) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Soil Ingestion Rate (mg/day) | 100 | (b) | 200 | (b) | 50 | (j) | 100 | (j) |
| Skin Contacting Medium (cm^2) | 5729 | (k) | 2058 | (k) | 5729 | (k) | 2058 | (k) |
| Soil on Skin (mg/cm^2) | 0.12 | (l) | 0.06 | (l) | 0.12 | (l) | 0.06 | (l) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Homegrown Produce Pathway | | | | | | | | |
| Exposure Frequency (days/year) | 365 | (p) | 365 | (p) | 365 | (p) | 365 | (p) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Produce Ingestion Rate (g/day) | 454 | (m) | 15 | (m) | 125 | (n) | 4 | (n) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Indoor Air Inhalation Pathway | | | | | | | | |
| Exposure Time (hr/day) | 16.4 | (o) | 18 | (o) | 16.4 | (o) | 18 | (o) |
| Exposure Frequency (days/year) | 266 | (c) | 266 | (c) | 178 | (e) | 178 | (e) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Inhalation Rate (m^3/hour) | 1.6 | (g) | 1.2 | (g) | 0.55 | (h) | 0.32 | (i) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Groundwater Pathway | | | | | | | | |
| Exposure Time (hr/event) | 1 | (r) | 1 | (r) | 1 | (r) | 1 | (r) |
| Exposure Frequency (days/year) | 26 | (s) | 26 | (s) | 13 | (t) | 13 | (t) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Water Ingestion Rate (l/event) | 0.005 | (q) | 0.005 | (q) | 0.001 | (u) | 0.001 | (u) |
| Skin Contacting Medium (cm^2) | 5729 | (k) | 2058 | (k) | 5729 | (k) | 2058 | (k) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. Values for time spent outdoors listed in Table 1-2 (average of weekends /weekdays for children).
(b) - USEPA, 1991b. Standard Default Exposure Factors.
(c) - Exposure frequency of 350 days (USEPA, 1991b) adjusted for percentage of days with inclement weather (24%), [350-(350*0.24) = 266]; See text.
(d) - USEPA, 1993b. Central tendency residential exposure frequency = 234 days.
(e) - Exposure frequency of 234 days (USEPA, 1993b) adjusted for percentage of days with inclement weather (24%), [234 - (234*0.24) = 178]; See text.
(f) - USEPA, 1997a. Exposure Factors Handbook. Recommended average for time residing in a household, Table 1-2. (9 years total, assuming 7 years as an adult and 2 as a child - assumes that the 2 years as a child can occur anywhere between the ages of 0 to 6. Therefore, exposure factors for a 0 to 6 year old child are employed).
(g) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates are the values for moderate activity listed in Table 5-23.
(h) - USEPA, 1997a. Exposure Factors Handbook. Average daily inhalation rate for men and women, Table 5-23.
(i) - USEPA, 1997a. Exposure Factors Handbook. Average of recommended inhalation rates for children age 0-6 years, Table 5-23.
(j) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(k) - USEPA, 1997a. Exposure Factors Handbook. Represents average 50th percentile surface area for males and females of hands, forearms, lower legs, and feet.
(l) - USEPA, 1997a. *Exposure Factors Handbook. See Tables 5-11 and 5-12 for calculation.*
(m) - USEPA, 1997a. Exposure Factors Handbook. Based on recommended 95th percentile homegrown vegetable intake of 7.5 g/kg body weight-day, Table 1-2. Adjusted for cooking loss and dry weight.
(n) - USEPA, 1997a. Exposure Factors Handbook. Based on average homegrown vegetable intake of 2.1 g/kg body weight-day, Table 1-2. Adjusted for cooking loss and dry weight.
(o) - USEPA, 1997a. Exposure Factors Handbook. Values for time spent indoors listed in Table 1-2 (average of weekends /weekdays for children; assumes that adult spends time away from the household).
(p) - Produce ingestion rate is based on 365 days per year.
(q) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.
(r) - The adult and child are assumed to be in contact with groundwater outdoors for one hour per event.
(s) - Two days per week for three months.
(t) - One day per week for three months.
(u) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fiftieth of that assumed to occur during a swimming event.

TABLE 5-7
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RECREATIONAL TEENAGER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | RME Recreational Teenager (7 to 18 yrs) | | MLE Recreational Teenager (7 to 18 yrs) | |
|---|---|---|---|---|
| *Parameters Used in the Dead Creek Sediment Pathway - Wading* | | | | |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Soil Ingestion Rate (mg/day) | 100 | (d) | 50 | (e) |
| Skin Contacting Medium (cm^2) | 2029 | (f) | 2029 | (f) |
| Sediment on Skin (mg/cm^2) | 1 | (g) | 1 | (g) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Parameters Used in the Dead Creek Surface Water Pathway - Wading | | | | |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Surface Water Ingestion Rate (l/event) | 0.01 | (i) | 0.005 | (j) |
| Skin Contacting Medium (cm^2) | 2029 | (f) | 2029 | (f) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Paramaters Used in the Borrow Pit Lake Sediment Pathway - Swimming | | | | |
| Exposure Frequency (days/year) | 12 | (k) | 6 | (l) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Soil Ingestion Rate (mg/day) | 100 | (d) | 50 | (e) |
| Skin Contacting Medium (cm^2) | 2029 | (f) | 2029 | (f) |
| Sediment on Skin (mg/cm^2) | 1 | (g) | 1 | (g) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Parameters Used in the Borrow Pit Lake Surface Water Pathway - Swimming | | | | |
| Exposure Frequency (days/year) | 12 | (k) | 6 | (l) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Surface Water Ingestion Rate (l/event) | 0.05 | (m) | 0.01 | (i) |
| Skin Contacting Medium (cm^2) | 13533 | (n) | 13533 | (n) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - 1 day per week for 26 weeks (6 months) of the year.
(b) - 1 day per 2 weeks for 26 weeks (6 months) of the year.
(c) - Recreational teenager is assumed to range in age from 7 to 18. Therefore, total exposure duration is 11 years.
(d) - USEPA, 1991b. Standard Default Exposure Factors.
(e) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rate for an adult listed in Table 1-2.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average surface are of feet and 1/4 the legs of males and females aged 7-18.
(g) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.
(h) - USEPA, 1997a. Exposure Factors Handbook. Body weight is the average of males and females aged 7-18.
(i) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fifth of that assumed to occur during a swimming event.
(j) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.
(k) - Two events per month for the 6 warmest months of the year.
(l) - One events per month for the 6 warmest months of the year.
(m) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value for a swimming event.
(n) - Value represents average total body surface area of males and females aged 7 to 18. Assumed 100% of skin surface exposed while swimming.

1/2/01

TABLE 5-8
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RECREATIONAL FISHER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | RME Adult Recreational Fisher | | MLE Adult Recreational Fisher | |
|---|---|---|---|---|
| Parameters Used in the Fish Ingestion Pathway | | | | |
| Exposure Frequency (days/year) | 365 | (a) | 365 | (a) |
| Exposure Duration (yr) | 30 | (b) | 9 | (c) |
| Fish Ingestion Rate (g/day) | 8 | (d) | 1 | (e) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |
| Parameters Used in the Surface Water Pathway - Wading | | | | |
| Exposure Frequency (days/year) | 22 | (k) | 3 | (l) |
| Exposure Duration (yr) | 30 | (b) | 9 | (c) |
| Surface Water Ingestion Rate (l/event) | 0.01 | (f) | 0.005 | (m) |
| Skin Contacting Medium (cm^2) | 4500 | (g) | 4500 | (g) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |
| Paramaters Used in the Sediment Pathway - Wading | | | | |
| Exposure Frequency (days/year) | 22 | (k) | 3 | (l) |
| Exposure Duration (yr) | 30 | (b) | 9 | (c) |
| Sediment Ingestion Rate (mg/day) | 100 | (h) | 50 | (i) |
| Skin Contacting Medium (cm^2) | 4500 | (g) | 4500 | (g) |
| Sediment on Skin (mg/cm^2) | 1 | (j) | 1 | (j) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - Fish ingestion rates are based on 365 days per year.
(b) - USEPA, 1991b. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended average for time residing in a household. Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. 8 g/day is equivalent to approximately 22 fish meals of 129 g per year.
(e) - 1 g/day is equivalent to approximately three 129 g fish meals per year (equivalent to one fish meal per month in the three summer months).
(f) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fifth of that assumed to occur during a swimming event.
(g) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, lower legs, and feet.
(h) - USEPA, 1991b. Standard Default Exposure Factors.
(i) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(j) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.
(k) - One day per month for 5 months.
(l) - One day per month during the three summer months.
(m) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.

1/2/01

TABLE 5-9
SOIL ADHERENCE FACTORS- OUTDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Outdoor Industrial Worker Scenario | | |
|---|---|---|---|
| **Body Part** | **Surface Area 50th percentile ($cm^2$) (a)** | **Soil Loading Groundskeeper ($mg/cm^2$) (b)** | **Total Soil Mass (mg)** |
| Head | 1,205 | 0.005 | 5.543 |
| Hands | 904 | 0.071 | 64.1485 |
| Forearms | 1,230 | 0.009 | 11.1438 |
| Total | 3,339 | | 80.8 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.02 |

Notes:
(a) - Data from USEPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from USEPA (1997a), Table 6-12. Average of Groundskeeper Nos. 1,2,3,4, and 5.

TABLE 5-10
SOIL ADHERENCE FACTORS- CONSTRUCTION WORKER
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Construction Worker Scenario | | |
|---|---|---|---|
| **Body Part** | **Surface Area 50th percentile ($cm^2$) (a)** | **Soil Loading Farmer ($mg/cm^2$) (a)** | **Total Soil Mass (mg)** |
| Head | 1,205 | 0.041 | 49.405 |
| Hands | 904 | 0.47 | 424.645 |
| Forearms | 1,230 | 0.13 | 159.9 |
| Total | 3,339 | | 634.0 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.19 |

Notes:
(a) - Data from USEPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from USEPA (1997a), Table 6-12. Average of Farmer Nos. 1 and 2.

TABLE 5-11
SOIL ADHERENCE FACTORS- RESIDENT ADULT
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Body Part | Adult Resident | | |
|---|---|---|---|
| | Surface Area 50th percentile (a) ($cm^2$) | Soil Loading Gardeners ($mg/cm^2$) (b) | Total Soil Mass (mg) |
| Hands | 904 | 0.19 | 171.76 |
| Forearms | 1,230 | 0.052 | 63.96 |
| Lower legs | 2,370 | 0.047 | 111.39 |
| Feet | 1,225 | 0.215 | 263.38 |
| Total | 5,729 | -- | 610.49 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.11 |

Notes:
(a) - Data from USEPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from USEPA (1997a) Table 6-12. Average of gardeners Nos. 1 and 2.

TABLE 5-12
SOIL ADHERENCE FACTORS- RESIDENT CHILD
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Body Part | Child Resident (0 to 6 years old) | | |
|---|---|---|---|
| | Surface Area 50th percentile (a) ($cm^2$) | Soil Loading Day Care Kids ($mg/cm^2$) (b) | Total Soil Mass (mg) |
| Hands | 358 | 0.0923 | 33.04 |
| Forearms | 437 | 0.0230 | 10.05 |
| Lower legs | 812 | 0.0195 | 15.83 |
| Feet | 451 | 0.0646 | 29.13 |
| Total | 2,058 | -- | 88.06 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.04 |

Notes:
(a) - Data from USEPA (1997a). Based on average of boys (Table 6-6) and girls (Table 6-7) total body surface area (6,557 cm2), and mean percentages of total surface area for individual body parts Table 6-8).
(b) - Data from USEPA (1997a), Table 6-12, Daycare kids Nos. #1a, #1b ,#2c, #3.

TABLE 5-13
SOIL ADHERENCE FACTORS- TRESPASSING TEENAGER (7 TO 18)
SAUGET AREA 1 EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Trespassing Teenager (7 to 18) | | |
|---|---|---|---|
| **Body Part** | **Surface Area 50th percentile (a) ($cm^2$)** | **Soil Loading Soccer Kids ($mg/cm^2$) (b)** | **Total Soil Mass (mg)** |
| Hands | 715 | 0.0547 | 39.09 |
| Forearms | 894 | 0.0061 | 5.42 |
| Lower legs | 2,068 | 0.0177 | 36.60 |
| Total | 3,677 | -- | |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.02 |

Notes:
(a) - Data from USEPA (1997a). Based on average of boys (Table 6-6) and girls (Table 6-7) total body surface area , and mean percentages of total surface area for individual body parts Table 6-8).
(b) - Data from USEPA (1997a) Table 6-12. Average of Soccer Kids Nos. 1, 2, and 3.

TABLE 5-14
EXPOSURE POINT CONCENTRATIONS (RME) - TRANSECT SOILS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS | Residential Scenario EPCs | | | | | Industrial Scenario EPCs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Surface Soil (mg/kg) | | | | | Surface Soil (mg/kg) | | | | Subsurface Soil (mg/kg) | |
| | | T3 | T4 | T5 | T6 | T7 | T3 | T4 | T6 | T7 | T4 | T6 |
| Arsenic | 7440-38-2 | -- | -- | -- | -- | 14.98 | -- | -- | -- | 14.98 | -- | -- |
| Benzo(a)anthracene | 56-55-3 | -- | 4.30 | -- | 4.20 | 1.90 | -- | -- | -- | -- | 5.90 | -- |
| Benzo(a)pyrene | 50-32-8 | 0.26 | 3.50 | 0.34 | 3.60 | 2.10 | 0.26 | 3.50 | 3.60 | 2.10 | 1.92 | 0.75 |
| Benzo(b)fluoranthene | 205-99-2 | 0.40 | 2.81 | -- | 4.40 | 2.20 | -- | -- | -- | -- | 3.30 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.10 | 0.23 | 0.19 | 0.33 | 0.20 | -- | 0.23 | -- | -- | 0.52 | -- |
| Dieldrin | 60-57-1 | -- | -- | 0.10 | -- | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | -- | 0.96 | -- | 0.59 | 0.63 | -- | -- | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
T - Transect.

TABLE 5-15
EXPOSURE POINT CONCENTRATIONS (RME) - SITE SOILS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Residential Scenario EPCs Site (mg/kg) | Industrial Scenario EPCs Site (mg/kg) | | |
|---|---|---|---|---|---|
| | | N | H | I | L |
| Arsenic | 7440-38-2 | -- | 64 | -- | 37 |
| Benzo(a)pyrene | 50-32-8 | 0.33 | -- | 2.2 | 7 |
| Copper | 7440-50-8 | -- | -- | 13000 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.11 | -- | -- | 1.3 |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | -- | 0.0013 | 0.012 | -- |
| Total PCBs | 1336-36-3 | -- | 1.52 | 121.3 | 1.07 |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.

TABLE 5-16
EXPOSURE POINT CONCENTRATIONS (RME) - TRANSECT SOILS - OUTDOOR AIR PARTICULATES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSEMENT

| Constituent | CAS | Residential Scenario EPCs for Air | | | | | Industrial Scenario EPCs for Air | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Particulates from Surface Soil (mg/m3) (a) | | | | | Particulates from Surface Soil (mg/m3) (a) | | | |
| | | T3 | T4 | T5 | T6 | T7 | T3 | T4 | T6 | T7 |
| Arsenic | 7440-38-2 | -- | -- | -- | -- | 1.27E-08 | -- | -- | -- | 1.27E-08 |
| Benzo(a)anthracene | 56-55-3 | -- | 3.63E-09 | -- | 3.55E-09 | 1.61E-09 | -- | -- | -- | -- |
| Benzo(a)pyrene | 50-32-8 | 2.20E-10 | 2.96E-09 | 2.87E-10 | 3.04E-09 | 1.77E-09 | 2.20E-10 | 2.96E-09 | 3.04E-09 | 1.77E-09 |
| Benzo(b)fluoranthene | 205-99-2 | 3.38E-10 | 2.37E-09 | -- | 3.72E-09 | 1.86E-09 | -- | -- | -- | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 8.45E-11 | 1.94E-10 | 1.61E-10 | 2.79E-10 | 1.69E-10 | -- | 1.94E-10 | -- | -- |
| Dieldrin | 60-57-1 | -- | -- | 8.45E-11 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | -- | 8.07E-10 | -- | 4.99E-10 | 5.32E-10 | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
T - Transect.
(a) - Concentration in outdoor air is equal to the concentration in soil (mg/kg) divided by the particulate emission factor (1.18E+09 m^3/kg) calculated for the transects in Table 5-18.

TABLE 5-17
EXPOSURE POINT CONCENTRATIONS (RME)- SITE SOILS - OUTDOOR AIR PARTICULATES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Residential Scenario EPCs for Air Site (mg/m3) | Industrial Scenario EPCs for Air Site (mg/m3) | | |
|---|---|---|---|---|---|
| | | N (a) | H (a) | I (a) | L (a) |
| Arsenic | 7440-38-2 | -- | 8.11E-08 | -- | 3.13E-08 |
| Benzo(a)pyrene | 50-32-8 | 4.18E-10 | -- | 3.64E-09 | 5.91E-09 |
| Copper | 7440-50-8 | -- | -- | 2.15E-05 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 1.39E-10 | -- | -- | 1.10E-09 |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | -- | 1.65E-12 | 1.99E-11 | -- |
| Total PCBs | 1336-36-3 | -- | 1.93E-09 | 2.01E-07 | 9.04E-10 |
| Particulate Emission Factor ($m^3$/kg) (b) | | 7.90E+08 | 7.90E+08 | 6.04E+08 | 1.18E+09 |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
(a) - Concentration in outdoor air is equal to the concentration in soil (mg/kg) divided by the particulate emission factor.
(b) - Particulate emission factor is calculated for each site in Tables 5-18, 5-19, and 5-20.

TABLE 5-18
CALCULATION OF PARTICULATE EMISSION FACTOR FOR TRANSECTS AND SITE L
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | Definition | Units | Value | Source |
|---|---|---|---|---|
| Q/C | Inverse of mean concentration at center of source | $g/m^2$-s per $kg/m^3$ | 81.64 | (a) |
| V | Fraction of vegetative cover | unitless | 0.5 | (b) |
| $U_m$ | Mean annual windspeed | m/s | 4.69 | (b) |
| $U_t$ | Equivalent threshold value of windspeed at 7 m | m/s | 11.32 | (b) |
| F(x) | Function dependent on $U_m/U_t$ | unitless | 0.194 | (b) |
| PEF | Particulate emmission factor | $m^3/kg$ | 1.18E+09 | (c) |

Notes:
(a) - USEPA, 1996a. Soil Screening Guidance: User's Guide. Exhibit 11.
Value for Lincoln, Nebraska, 0.5 acre source area.
(b) - USEPA, 1996a. Soil Screening Guidance: User's Guide. Default value. Equation 5.
(c) -USEPA, 1996a. Soil Screening Guidance: User's Guide. Calculated using above parameters and Equation 5:

$$\text{PEF (m^3/kg)} = \text{Q/C (g/m^2-s per kg/m^3)} \times \frac{\text{3600s/h}}{\text{0.036 x (1-V) x (Um/Ut)^3 x F(x)}}$$

TABLE 5-19
CALCULATION OF PARTICULATE EMISSION FACTOR FOR SITES H AND N
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | Definition | Units | Value | Source |
|---|---|---|---|---|
| Q/C | Inverse of mean concentration at center of source | $g/m^2$-s per $kg/m^3$ | 54.47 | (a) |
| V | Fraction of vegetative cover | unitless | 0.5 | (b) |
| $U_m$ | Mean annual windspeed | m/s | 4.69 | (b) |
| $U_t$ | Equivalent threshold value of windspeed at 7 m | m/s | 11.32 | (b) |
| F(x) | Function dependent on $U_m/U_t$ | unitless | 0.194 | (b) |
| PEF | Particulate emmission factor | $m^3/kg$ | 7.90E+08 | (c) |

Notes:
(a) - USEPA, 1996a. Soil Screening Guidance: User's Guide. Exhibit 11.
Value for Lincoln, Nebraska, 5 acre source area.
(b) - USEPA, 1996a. Soil Screening Guidance: User's Guide. Default value. Equation 5.
(c) -USEPA, 1996a. Soil Screening Guidance: User's Guide. Calculated using above parameters and Equation 5:

$$PEF\ (m^3/kg) = Q/C\ (g/m^2\text{-}s\ per\ kg/m^3) \times \frac{3600 s/h}{0.036 \times (1-V) \times (Um/Ut)^3 \times F(x)}$$

TABLE 5-20
CALCULATION OF PARTICULATE EMISSION FACTOR FOR SITE I
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Parameter | Definition | Units | Value | Source |
|---|---|---|---|---|
| Q/C | Inverse of mean concentration at center of source | $g/m^2$-s per $kg/m^3$ | 41.65 | (a) |
| V | Fraction of vegetative cover | unitless | 0.5 | (b) |
| $U_m$ | Mean annual windspeed | m/s | 4.69 | (b) |
| $U_t$ | Equivalent threshold value of windspeed at 7 m | m/s | 11.32 | (b) |
| F(x) | Function dependent on $U_m/U_t$ | unitless | 0.194 | (b) |
| PEF | Particulate emmission factor | $m^3/kg$ | 6.04E+08 | (c) |

Notes:
(a) - USEPA, 1996a. Soil Screening Guidance: User's Guide. Exhibit 11.
Value for Lincoln, Nebraska, 30 acre source area.
(b) - USEPA, 1996a. Soil Screening Guidance: User's Guide. Default value. Equation 5.
(c) -USEPA, 1996a. Soil Screening Guidance: User's Guide. Calculated using above parameters and Equation 5:

$$PEF\ (m^3/kg) = Q/C\ (g/m^2\text{-}s\ per\ kg/m^3) \times \frac{3600 s/h}{0.036 \times (1-V) \times (Um/Ut)^3 \times F(x)}$$

TABLE 5-21
EXPOSURE POINT CONCENTRATIONS (RME) - TRANSECT AREA SOILS - OUTDOOR EXCAVATION AIR
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS | Construction Scenario EPCs for Air (a) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Surface Soil (mg/m3) | | | | Subsurface Soil (mg/m3) | |
| | | T3 | T4 | T6 | T7 | T4 | T6 |
| Arsenic | 7440-38-2 | -- | -- | -- | 8.99E-07 | -- | -- |
| Benzo(a)anthracene | 56-55-3 | -- | -- | -- | -- | 3.54E-07 | -- |
| Benzo(a)pyrene | 50-32-8 | 1.56E-08 | 2.10E-07 | 2.16E-07 | 1.26E-07 | 1.15E-07 | 4.50E-08 |
| Benzo(b)fluoranthene | 205-99-2 | -- | -- | -- | -- | 1.98E-07 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | -- | 1.38E-08 | -- | -- | 3.12E-08 | -- |
| Dieldrin | 60-57-1 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | -- | -- | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
T - Transect.
(a) - Excavation air concentrations are the soil concentration (mg/kg) multiplied by the PM10 (Particulate Matter of 10 microns in diameter) dust concentration (0.06 mg/m3) (MADEP, 1995) multiplied by a unit correction factor (1E-6 kg/mg).

TABLE 5-22
EXPOSURE POINT CONCENTRATIONS (RME) - SITE SOILS - OUTDOOR EXCAVATION AIR
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Construction Scenario EPCs for Air Site (mg/m3) (a) | | |
|---|---|---|---|
| | H | I | L |
| Arsenic | 3.84E-06 | -- | 2.22E-06 |
| Benzo(a)pyrene | -- | 1.32E-07 | 4.20E-07 |
| Copper | -- | 7.80E-04 | -- |
| Dibenzo(a,h)anthracene | -- | -- | 7.80E-08 |
| Total 2,3,7,8-TCDD TEQ | 7.80E-11 | 7.20E-10 | -- |
| Total PCBs | 9.12E-08 | 7.28E-06 | 6.42E-08 |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
(a) - Excavation air concentrations are the soil concentration (mg/kg) multiplied by the PM10 (Particulate Matter of 10 microns in diameter) dust concentration (0.06 mg/m3) (MADEP, 1995) multiplied by a unit correction factor (1E-6 kg/mg).

TABLE 5-23
EXPOSURE POINT CONCENTRATIONS (RME) - SEDIMENT AND FISH FILLET
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS | Dead Creek and Borrow Pit Lake | |
|---|---|---|---|
| | | EPC Sediment (mg/kg) | EPC Fish Fillet (mg/kg) |
| Arsenic | 7440-38-2 | 17.93 | 0.45 |
| Total PCBs | 1336-36-3 | 1.24 | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.

TABLE 5-24
EXPOSURE POINT CONCENTRATIONS (RME) - GROUNDWATER
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent / Site Location | CAS Number | Groundwater EPCs (mg/L) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site G | | | Site H | | | Site I | | | | | | Site L | RES |
| | | EE-05 | EEG-106 | EEG-107 | EE-01 | EE-02 | EE-03 | AA-I-S1 | AA-I-S2 | EE-12 | EE-13 | EE-14 | EE-15 | EEG-109 | DW-MCDO |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | -- | -- | 1.20E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 106-46-7 | -- | -- | 8.50E-01 | 2.20E+00 | 6.35E-01 | -- | 4.40E+00 | 4.20E+00 | -- | -- | 1.40E+01 | 4.30E-01 | -- | -- |
| 2,4,5-TP (Silvex) | 93-72-1 | 3.90E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 88-06-2 | -- | -- | -- | 2.70E-01 | 4.65E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 120-83-2 | -- | -- | 3.60E+00 | -- | 3.70E-01 | -- | -- | -- | -- | -- | -- | -- | 2.60E-02 | -- |
| 2-Chlorophenol | 95-57-8 | -- | -- | 6.30E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 88-74-4 | -- | -- | -- | -- | 1.35E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3-Methylphenol/4-Methylphenol | (a) | -- | -- | 2.40E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4,4-DDE | 72-55-9 | -- | -- | -- | -- | -- | -- | -- | -- | 2.20E-03 | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 106-47-8 | 1.60E+00 | -- | 2.30E+01 | 1.80E+00 | 7.75E-01 | -- | 4.10E+00 | 6.80E-01 | 1.40E+00 | -- | 1.80E+00 | -- | 5.50E-02 | -- |
| 4-Methyl-2-pentanone | 108-10-1 | -- | -- | 1.30E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Nitroaniline | 100-01-6 | 8.40E-03 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| alpha-BHC | 319-84-6 | -- | 8.30E-03 | 6.00E-03 | -- | 4.95E-04 | -- | -- | -- | 2.45E-03 | -- | 1.10E-03 | -- | -- | -- |
| Antimony | 7440-36-0 | -- | -- | -- | -- | 1.05E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | 7440-38-2 | -- | -- | -- | -- | 1.25E+00 | -- | -- | -- | -- | -- | -- | -- | 4.30E+00 | -- |
| Benzene | 71-43-2 | 1.10E-01 | -- | 3.70E+00 | 1.50E+00 | 2.25E+00 | -- | 6.20E-01 | 1.20E-01 | 6.80E-01 | -- | 7.50E-01 | -- | 4.40E-02 | -- |
| Benzo(k)fluoranthene | 207-08-9 | -- | -- | -- | -- | -- | -- | -- | 1.20E-03 | -- | -- | -- | -- | -- | -- |
| beta-BHC | 319-85-7 | -- | 3.60E-04 | -- | -- | -- | -- | -- | -- | -- | -- | 1.00E-03 | -- | -- | -- |
| Cadmium | 7440-43-9 | -- | -- | -- | -- | -- | -- | -- | 7.00E-02 | -- | -- | -- | -- | -- | -- |
| Carbazole | 86-74-8 | -- | -- | -- | 5.20E-03 | -- | -- | -- | -- | 3.50E-03 | -- | 2.60E-02 | -- | -- | -- |
| Chlorobenzene | 108-90-7 | 6.20E-01 | -- | 4.30E+00 | 1.20E+00 | 4.35E+00 | -- | 8.70E+00 | 3.20E+00 | 1.40E+00 | -- | 3.80E+00 | -- | -- | -- |
| Chloroform | 67-66-3 | -- | -- | -- | -- | 4.25E-01 | -- | -- | -- | -- | -- | -- | -- | 7.60E-02 | -- |
| Cis/Trans-1,2-Dichloroethene | 107-06-2 | -- | -- | -- | -- | -- | -- | 1.20E+00 | 5.10E-01 | -- | -- | -- | -- | -- | -- |
| delta-BHC | 319-86-8 | 3.60E-04 | -- | 1.70E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethylbenzene | 100-41-4 | -- | -- | -- | 1.80E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Heptachlor | 76-44-8 | -- | -- | -- | -- | -- | -- | -- | -- | 2.50E-03 | -- | -- | -- | -- | -- |
| Heptachlor epoxide | 1024-57-3 | -- | -- | -- | -- | 4.40E-03 | -- | -- | -- | 5.60E-03 | -- | -- | -- | -- | -- |
| Lead | 7439-92-1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.29E-01 |
| Molybdenum | 7439-98-7 | 4.50E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | 91-20-3 | 3.90E-01 | -- | 2.10E+00 | 2.30E+00 | 1.95E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Nickel | 7440-02-0 | -- | -- | -- | -- | -- | -- | -- | 7.80E+00 | -- | -- | -- | -- | 1.80E+02 | -- |
| Nitrobenzene | 98-95-3 | -- | -- | -- | -- | 5.65E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pentachlorophenol | 87-86-5 | -- | -- | 2.00E+00 | 4.30E+00 | 6.70E-01 | -- | -- | -- | -- | -- | 5.00E-01 | -- | -- | -- |
| Phenol | 108-95-2 | 3.80E-01 | -- | 1.40E+01 | -- | 3.15E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 127-18-4 | -- | -- | 1.70E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Toluene | 108-88-3 | -- | -- | 8.50E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | 1.78E-07 | -- | 3.60E-06 | 4.57E-08 | -- | 5.02E-08 | -- | -- | 3.05E-06 | 4.74E-08 | 7.69E-07 | -- | -- | -- |
| Total PCBs | 1336-36-3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 5.88E-03 | -- | -- | -- |
| Trichloroethene | 79-01-6 | -- | -- | 2.00E-01 | -- | 4.95E-02 | -- | -- | 1.80E-01 | -- | -- | -- | -- | -- | -- |
| Vanadium | 7440-62-2 | -- | -- | 3.30E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride | 75-01-4 | -- | -- | 4.10E-02 | -- | -- | -- | 9.70E-01 | 2.40E-01 | -- | -- | -- | -- | -- | -- |
| Zinc | 7440-66-6 | -- | -- | -- | -- | -- | -- | -- | 3.30E+01 | -- | -- | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RES - Residential non-potable use well.
RME - Reasonable Maximum Exposure.

TABLE 5-25
EXPOSURE POINT CONCENTRATIONS (RME) - INDOOR AIR VOCs
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent / Site Location | CAS Number | Site Indoor Air VOC EPCs (mg/m3) (a) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | G | | H | | I | | | | L |
| | | EE-05 | EEG-107 | EE-01 | EE-02 | AA-I-S1 | AA-I-S2 | EE-12 | EE-14 | EEG-109 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | -- | 5.79E-07 | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone | 108-10-1 | -- | 4.20E-04 | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 71-43-2 | 5.74E-05 | 1.98E-03 | 8.23E-04 | 1.23E-03 | 3.29E-04 | 6.37E-05 | 3.61E-04 | 3.98E-04 | 2.38E-05 |
| Chlorobenzene | 108-90-7 | 1.89E-04 | 1.35E-03 | 3.89E-04 | 1.41E-03 | 2.71E-03 | 9.96E-04 | 4.36E-04 | 1.18E-03 | -- |
| Chloroform | 67-66-3 | -- | -- | -- | 1.89E-04 | -- | -- | -- | -- | 3.34E-05 |
| Ethylbenzene | 100-41-4 | -- | -- | 9.90E-04 | -- | -- | -- | -- | -- | -- |
| Naphthalene | 91-20-3 | 1.79E-05 | 1.01E-04 | 1.16E-04 | 9.83E-06 | -- | -- | -- | -- | -- |
| Tetrachloroethene | 127-18-4 | -- | 1.89E-04 | -- | -- | -- | -- | -- | -- | -- |
| Toluene | 108-88-3 | -- | 4.70E-03 | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | 79-01-6 | -- | 1.58E-04 | -- | 4.01E-05 | -- | 1.41E-04 | -- | -- | -- |
| Vinyl chloride | 75-01-4 | -- | 1.17E-04 | -- | -- | 2.76E-03 | 6.83E-04 | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
VOCs - Volatile Organic Compounds.
(a) Calculated from Location groundwater concentration in Appendix K.

TABLE 5-26
EXPOSURE POINT CONCENTRATIONS (RME) - EXCAVATION AIR, VOLATILIZATION FROM EXPOSED GROUNDWATER
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent / Site Location | CAS Number | Site Excavation Air EPCs (mg/m3) (a) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | G | | H | | I | | | | L |
| | | EE-05 | EEG-107 | EE-01 | EE-02 | AA-I-S1 | AA-I-S2 | EE-12 | EE-14 | EEG-109 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | -- | 2.80E-04 | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone | 108-10-1 | -- | 1.25E-01 | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 71-43-2 | 2.98E-03 | 1.00E-01 | 4.06E-02 | 6.09E-02 | 1.68E-02 | 3.25E-03 | 1.84E-02 | 2.03E-02 | 1.19E-03 |
| Chlorobenzene | 108-90-7 | 1.55E-02 | 1.07E-01 | 3.00E-02 | 1.09E-01 | 2.17E-01 | 7.99E-02 | 3.50E-02 | 9.49E-02 | -- |
| Chloroform | 67-66-3 | -- | -- | -- | 1.16E-02 | -- | -- | -- | -- | 2.08E-03 |
| Ethylbenzene | 100-41-4 | -- | -- | 4.19E-02 | -- | -- | -- | -- | -- | -- |
| Naphthalene | 91-20-3 | 8.51E-03 | 4.58E-02 | 5.02E-02 | 4.26E-03 | -- | -- | -- | -- | -- |
| Tetrachloroethene | 127-18-4 | -- | 4.10E-03 | -- | -- | -- | -- | -- | -- | -- |
| Toluene | 108-88-3 | -- | 2.24E-01 | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | 79-01-6 | -- | 2.62E-02 | -- | 6.48E-03 | -- | 2.35E-02 | -- | -- | -- |
| Vinyl chloride | 75-01-4 | -- | 1.30E-03 | -- | -- | 3.07E-02 | 7.59E-03 | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
(a) Excavation air concentration (mg/m3) = groundwater concentration (mg/l) * groundwater-to-air attenuation factor (l/m$^3$) calculated in Appendix L.

TABLE 5-27
EXPOSURE POINT CONCENTRATIONS (RME) - OUTDOOR AIR VOCs
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent / Site Location | CAS Number | Site Outdoor Air VOC EPCs (mg/m3) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | G | | H | | I | | | | L |
| | | EE-05 | EEG-107 | EE-01 | EE-02 | AA-I-S1 | AA-I-S2 | EE-12 | EE-14 | EEG-109 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | -- | 2.50E-07 | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone | 108-10-1 | -- | 9.50E-06 | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 71-43-2 | 3.80E-06 | 1.40E-04 | 9.10E-05 | 1.40E-04 | 9.60E-05 | 1.90E-05 | 1.10E-04 | 1.20E-04 | 1.00E-06 |
| Chlorobenzene | 108-90-7 | 1.30E-05 | 9.50E-05 | 4.40E-05 | 1.60E-04 | 8.10E-04 | 3.00E-04 | 1.30E-04 | 3.50E-04 | -- |
| Chloroform | 67-66-3 | -- | -- | -- | 2.50E-05 | -- | -- | -- | -- | 1.40E-06 |
| Ethylbenzene | 100-41-4 | -- | -- | 1.20E-04 | -- | -- | -- | -- | -- | -- |
| Naphthalene | 91-20-3 | 1.20E-06 | 6.90E-06 | 1.30E-05 | 1.10E-06 | -- | -- | -- | -- | -- |
| Tetrachloroethene | 127-18-4 | -- | 1.50E-05 | -- | -- | -- | -- | -- | -- | -- |
| Toluene | 108-88-3 | -- | 3.40E-04 | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | 79-01-6 | -- | 1.70E-05 | -- | 7.00E-06 | -- | 6.40E-05 | -- | -- | -- |
| Vinyl chloride | 75-01-4 | -- | 2.30E-05 | -- | -- | 2.30E-03 | 5.70E-04 | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
RME - Reasonable Maximum Exposure.
VOCs - Volatile Organic Compounds.
(a) Calculated from Location groundwater concentration, as shown in Appendix M.

TABLE 5-28
EXPOSURE POINT CONCENTRATIONS (RME) - PRODUCE GROWN IN TRANSECT SOILS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Constituent Specific Inputs for Prediction of Produce Concentrations (a) | | | Transect 7 Predicted Produce Concentrations | |
|---|---|---|---|---|---|---|
| | | Log Kow | $Br_{ag}$ | $Br_{rootveg}$ | Above Ground (mg/kg FW) | Below Ground (mg/kg FW) |
| Arsenic | 7440-38-2 | NA | 6.33E-03 | 8.00E-03 | 1.42E-02 | 1.80E-02 |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
FW - Fresh Weight
NA - Not Applicable.
RME - Reasonable Maximum Exposure.
(a) USEPA, 1998d. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume Two. Appendix A. United States Environmental Protection Agency. Solid Waste and Emergency Response. EPA530-D-98-001B. July 1998. Calculations discussed in Appendix N.
(b) USEPA, 1998. Methodology for Assessing Health Risks Associated with Multiple Pathways of Exposure to Combustor Emissions. USEPA National Center for Environmental Assessment. EPA600/R-98/137.
Above Ground Produce Concentration = $C_s$ x $Br_{ag}$ x 0.15, where vegetable moisture content is assumed to be an average 85% (b).
Below Ground Produce Concentration = $C_s$ x $Br_{rootveg}$ x 0.15, where vegetable moisture content is assumed to be an average 85% (b).
$C_s$ = Concentration of constituent in soil.
$Br_{ag}$ = Plant-soil bioconcentration factor for above ground produce.
$Br_{rootveg}$ = Plant-soil bioconcentration factor for below ground produce.

TABLE 5-29
EXPOSURE POINT CONCENTRATIONS (MLE) - TRANSECT SOILS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS | Residential Scenario EPCs | | | | | Industrial Scenario EPCs | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Surface Soil (mg/kg) | | | | | Surface Soil (mg/kg) | | | | Subsurface Soil (mg/kg) | |
| | | T3 | T4 | T5 | T6 | T7 | T3 | T4 | T6 | T7 | T4 | T6 |
| Arsenic | 7440-38-2 | -- | -- | -- | -- | 9.99 | -- | -- | -- | 9.99 | -- | -- |
| Benzo(a)anthracene | 56-55-3 | -- | 0.70 | -- | 0.61 | 0.34 | -- | -- | -- | -- | 1.28 | -- |
| Benzo(a)pyrene | 50-32-8 | 0.14 | 0.59 | 0.14 | 0.50 | 0.37 | 0.14 | 0.59 | 0.50 | 0.37 | 0.61 | 0.19 |
| Benzo(b)fluoranthene | 205-99-2 | 0.16 | 0.60 | -- | 0.63 | 0.41 | -- | -- | -- | -- | 1.07 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.07 | 0.13 | 0.10 | 0.12 | 0.10 | -- | 0.13 | -- | -- | 0.24 | -- |
| Dieldrin | 60-57-1 | -- | -- | 0.02 | -- | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | -- | 0.36 | -- | 0.22 | 0.24 | -- | -- | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
T - Transect.

TABLE 5-30
EXPOSURE POINT CONCENTRATIONS (MLE) - SITE SOILS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Residential Scenario EPCs Site (mg/kg) | Industrial Scenario EPCs Site (mg/kg) | | |
|---|---|---|---|---|---|
| | | N | H | I | L |
| Arsenic | 7440-38-2 | -- | 23 | -- | 33 |
| Benzo(a)pyrene | 50-32-8 | 0.19 | -- | 0.63 | 2.3 |
| Copper | 7440-50-8 | -- | -- | 6660 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 0.07 | -- | -- | 0.5 |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | -- | 0.0005 | 0.003 | -- |
| Total PCBs | 1336-36-3 | -- | 0.66 | 31.3 | 0.49 |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.

TABLE 5-31
EXPOSURE POINT CONCENTRATIONS (MLE) - TRANSECT SOILS - OUTDOOR AIR PARTICULATES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSEMENT

| Constituent | CAS | Residential Scenario EPCs for Air | | | | | Industrial Scenario EPCs for Air | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Surface Soil (mg/m3) (a) | | | | | Surface Soil (mg/m3) (a) | | | |
| | | T3 | T4 | T5 | T6 | T7 | T3 | T4 | T6 | T7 |
| Arsenic | 7440-38-2 | -- | -- | -- | -- | 8.44E-09 | -- | -- | -- | 8.44E-09 |
| Benzo(a)anthracene | 56-55-3 | -- | 5.91E-10 | -- | 5.12E-10 | 2.89E-10 | -- | -- | -- | -- |
| Benzo(a)pyrene | 50-32-8 | 1.16E-10 | 4.99E-10 | 1.17E-10 | 4.26E-10 | 3.16E-10 | 1.16E-10 | 4.99E-10 | 4.26E-10 | 3.16E-10 |
| Benzo(b)fluoranthene | 205-99-2 | 1.35E-10 | 5.07E-10 | -- | 5.36E-10 | 3.43E-10 | -- | -- | -- | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 5.91E-11 | 1.10E-10 | 8.33E-11 | 9.97E-11 | 8.70E-11 | -- | 1.10E-10 | -- | -- |
| Dieldrin | 60-57-1 | -- | -- | 1.34E-11 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | -- | 3.04E-10 | -- | 1.86E-10 | 2.03E-10 | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
(a) - Concentration in outdoor air is equal to the concentration in soil (mg/kg) divided by the particulate emission factor (1.18E+09 m^3/kg) calculated for the transects in Table 5-18.

TABLE 5-32
EXPOSURE POINT CONCENTRATIONS (MLE)- SITE SOILS - OUTDOOR AIR PARTICULATES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Residential Scenario EPCs for Air Site (mg/m3) | Industrial Scenario EPCs for Air Site (mg/m3) | | |
|---|---|---|---|---|---|
| | | N (a) | H (a) | I (a) | L (a) |
| Arsenic | 7440-38-2 | -- | 2.89E-08 | -- | 2.81E-08 |
| Benzo(a)pyrene | 50-32-8 | 2.37E-10 | -- | 1.04E-09 | 1.94E-09 |
| Copper | 7440-50-8 | -- | -- | 1.10E-05 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | 9.18E-11 | -- | -- | 3.84E-10 |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | -- | 6.75E-13 | 5.53E-12 | -- |
| Total PCBs | 1336-36-3 | -- | 8.36E-10 | 5.18E-08 | 4.14E-10 |
| Particulate Emission Factor ($m^3$/kg) (b) | | 7.90E+08 | 7.90E+08 | 6.04E+08 | 1.18E+09 |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
(a) - Concentration in outdoor air is equal to the concentration in soil (mg/kg) divided by the particulate emission factor.
(b) - Particulate emission factor is calculated for each site in Tables 5-18, 5-19, and 5-20.

TABLE 5-33
EXPOSURE POINT CONCENTRATIONS (MLE) - TRANSECT AREA SOILS - OUTDOOR EXCAVATION AIR
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS | Construction Scenario EPCs for Air | | | | | |
|---|---|---|---|---|---|---|---|
| | | Surface Soil (mg/m3) | | | | Subsurface Soil (mg/m3) | |
| | | T3 | T4 | T6 | T7 | T4 | T6 |
| Arsenic | 7440-38-2 | -- | -- | -- | 5.99E-07 | -- | -- |
| Benzo(a)anthracene | 56-55-3 | -- | -- | -- | -- | 7.68E-08 | -- |
| Benzo(a)pyrene | 50-32-8 | 8.22E-09 | 3.54E-08 | 3.02E-08 | 2.24E-08 | 3.65E-08 | 1.11E-08 |
| Benzo(b)fluoranthene | 205-99-2 | -- | -- | -- | -- | 6.42E-08 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | -- | 7.80E-09 | -- | -- | 1.43E-08 | -- |
| Dieldrin | 60-57-1 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | -- | -- | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
T - Transect.
(a) - Excavation air concentrations are the soil concentration (mg/kg) multiplied by the PM10 (Particulate Matter of 10 microns in diameter) dust concentration (0.06 mg/m3) (MADEP, 1995) multiplied by a unit correction factor (1E-6 kg/mg).

TABLE 5-34
EXPOSURE POINT CONCENTRATIONS (MLE) - FILL AREA SOILS - OUTDOOR EXCAVATION AIR
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Construction Scenario EPCs for Air Site (mg/m3) (a) | | |
|---|---|---|---|---|
| | | H | I | L |
| Arsenic | 7440-38-2 | 1.37E-06 | -- | 2.00E-06 |
| Benzo(a)pyrene | 50-32-8 | -- | 3.77E-08 | 1.38E-07 |
| Copper | 7440-50-8 | -- | 4.00E-04 | -- |
| Dibenzo(a,h)anthracene | 53-70-3 | -- | -- | 2.73E-08 |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | 3.20E-11 | 2.00E-10 | -- |
| Total PCBs | 1336-36-3 | 3.96E-08 | 1.88E-06 | 2.94E-08 |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
(a) - Excavation air concentrations are the soil concentration (mg/kg) multiplied by the PM10 (Particulate Matter of 10 microns in diameter) dust concentration (0.06 mg/m3) (MADEP, 1995) multiplied by a unit correction factor (1E-6 kg/mg).

TABLE 5-35
EXPOSURE POINT CONCENTRATIONS (MLE) - SEDIMENT AND FISH FILLET
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS | EPC Sediment (mg/kg) | EPC Fish Fillet (mg/kg) |
|---|---|---|---|
| Arsenic | 7440-38-2 | 14.80 | 0.45 |
| Total PCBs | 1336-36-3 | 0.40 | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.

TABLE 5-36
EXPOSURE POINT CONCENTRATIONS (MLE) - GROUNDWATER
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Site / Constituent | CAS Number | Groundwater EPCs (mg/L) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site G | | | Site H | | | Site I | | | | | | Site L | RES |
| Location | | EE-05 | EEG-106 | EEG-107 | EE-01 | EE-02 | EE-03 | AA-I-S1 | AA-I-S2 | EE-12 | EE-13 | EE-14 | EE-15 | EEG-109 | DW-MCDO |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | -- | -- | 1.20E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene | 106-46-7 | -- | -- | 8.50E-01 | 2.20E+00 | 6.35E-01 | -- | 2.21E+00 | 2.15E+00 | -- | -- | 1.40E+01 | 4.30E-01 | -- | -- |
| 2,4,5-TP (Silvex) | 93-72-1 | 3.90E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4,6-Trichlorophenol | 88-06-2 | -- | -- | -- | 2.70E-01 | 4.65E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2,4-Dichlorophenol | 120-83-2 | -- | -- | 3.60E+00 | -- | 3.70E-01 | -- | -- | -- | -- | -- | -- | -- | 2.60E-02 | -- |
| 2-Chlorophenol | 95-57-8 | -- | -- | 6.30E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Nitroaniline | 88-74-4 | -- | -- | -- | -- | 1.35E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 3-Methylphenol/4-Methylphenol | (a) | -- | -- | 2.40E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4,4-DDE | 72-55-9 | -- | -- | -- | -- | -- | -- | -- | -- | 2.20E-03 | -- | -- | -- | -- | -- |
| 4-Chloroaniline | 106-47-8 | 1.60E+00 | -- | 2.30E+01 | 1.80E+00 | 7.75E-01 | -- | 3.25E+00 | 3.51E-01 | 1.40E+00 | -- | 1.80E+00 | -- | 5.50E-02 | -- |
| 4-Methyl-2-pentanone | 108-10-1 | -- | -- | 1.30E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 4-Nitroaniline | 100-01-6 | 8.40E-03 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| alpha-BHC | 319-84-6 | -- | 8.30E-03 | 6.00E-03 | -- | 4.95E-04 | -- | -- | -- | 2.40E-03 | -- | 1.10E-03 | -- | -- | -- |
| Antimony | 7440-36-0 | -- | -- | -- | -- | 1.05E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | 7440-38-2 | -- | -- | -- | -- | 1.25E+00 | -- | -- | -- | -- | -- | -- | -- | 4.30E+00 | -- |
| Benzene | 71-43-2 | 1.10E-01 | -- | 3.70E+00 | 1.50E+00 | 2.25E+00 | -- | 4.55E-01 | 6.13E-02 | 6.80E-01 | -- | 7.50E-01 | -- | 4.40E-02 | -- |
| Benzo(k)fluoranthene | 207-08-9 | -- | -- | -- | -- | -- | -- | -- | 1.20E-03 | -- | -- | -- | -- | -- | -- |
| beta-BHC | 319-85-7 | -- | 3.60E-04 | -- | -- | -- | -- | -- | -- | -- | -- | 1.00E-03 | -- | -- | -- |
| Cadmium | 7440-43-9 | -- | -- | -- | -- | -- | -- | -- | 3.63E-02 | -- | -- | -- | -- | -- | -- |
| Carbazole | 86-74-8 | -- | -- | -- | 5.20E-03 | -- | -- | -- | -- | 3.50E-03 | -- | 2.60E-02 | -- | -- | -- |
| Chlorobenzene | 108-90-7 | 6.20E-01 | -- | 4.30E+00 | 1.20E+00 | 4.35E+00 | -- | 5.15E+00 | 1.66E+00 | 1.40E+00 | -- | 3.80E+00 | -- | -- | -- |
| Chloroform | 67-66-3 | -- | -- | -- | -- | 4.25E-01 | -- | -- | -- | -- | -- | -- | -- | 7.60E-02 | -- |
| delta-BHC | 319-86-8 | 3.60E-04 | -- | 1.70E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethylbenzene | 100-41-4 | -- | -- | -- | 1.80E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Heptachlor | 76-44-8 | -- | -- | -- | -- | -- | -- | -- | -- | 2.50E-03 | -- | -- | -- | -- | -- |
| Heptachlor epoxide | 1024-57-3 | -- | -- | -- | -- | 4.40E-03 | -- | -- | -- | 5.60E-03 | -- | -- | -- | -- | -- |
| Lead | 7439-92-1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.29E-01 |
| Molybdenum | 7439-98-7 | 4.50E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | 91-20-3 | 3.90E-01 | -- | 2.10E+00 | 2.30E+00 | 1.95E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Nickel | 7440-02-0 | -- | -- | -- | -- | -- | -- | -- | 4.40E+00 | -- | -- | -- | -- | 1.80E+02 | -- |
| Nitrobenzene | 98-95-3 | -- | -- | -- | -- | 5.65E-02 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pentachlorophenol | 87-86-5 | -- | -- | 1.01E+00 | 3.35E+00 | 6.50E-01 | -- | -- | -- | -- | -- | 3.30E-01 | -- | -- | -- |
| Phenol | 108-95-2 | 3.80E-01 | -- | 1.40E+01 | -- | 3.15E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene | 127-18-4 | -- | -- | 1.70E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Toluene | 108-88-3 | -- | -- | 8.50E+00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total 2,3,7,8-TCDD TEQ | 1746-01-6 | 1.78E-07 | -- | 3.60E-06 | 4.57E-08 | -- | 5.02E-08 | -- | -- | 3.05E-06 | 4.74E-08 | 7.69E-07 | -- | -- | -- |
| Total PCBs | 1336-36-3 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 5.88E-03 | -- | -- | -- |
| Trichloroethene | 79-01-6 | -- | -- | 2.00E-01 | -- | 4.95E-02 | -- | -- | 1.04E-01 | -- | -- | -- | -- | -- | -- |
| Vanadium | 7440-62-2 | -- | -- | 3.30E-01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride | 75-01-4 | -- | -- | 4.10E-02 | -- | -- | -- | 7.35E-01 | 2.00E-01 | -- | -- | -- | -- | -- | -- |
| Zinc | 7440-66-6 | -- | -- | -- | -- | -- | -- | -- | 1.83E+01 | -- | -- | -- | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
RES - Residential non-potable use well.

TABLE 5-37
EXPOSURE POINT CONCENTRATIONS (MLE) - INDOOR AIR VOCs
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Site Indoor Air EPCs (mg/m3) (a) | | | |
|---|---|---|---|---|---|
| | | G | H | I | L |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | 2.24E-07 | -- | -- |
| 4-Methyl-2-pentanone | 108-10-1 | 4.20E-05 | -- | -- | -- |
| Benzene | 71-43-2 | 4.45E-04 | 4.45E-04 | 1.33E-04 | 4.21E-06 |
| Chlorobenzene | 108-90-7 | 1.43E-04 | 3.88E-04 | 4.80E-04 | -- |
| Chloroform | 67-66-3 | -- | 4.72E-05 | -- | 6.49E-06 |
| Ethylbenzene | 100-41-4 | -- | 2.42E-04 | -- | -- |
| Naphthalene | 91-20-3 | 1.07E-05 | 2.52E-05 | -- | -- |
| Tetrachloroethene | 127-18-4 | 2.24E-05 | 1.43E-05 | -- | -- |
| Toluene | 108-88-3 | 4.67E-04 | -- | -- | -- |
| Trichloroethene | 79-01-6 | 1.62E-05 | -- | 2.26E-05 | -- |
| Vinyl chloride | 75-01-4 | 2.43E-05 | -- | 4.18E-04 | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
VOCs - Volatile Organic Compounds.
(a) Calculated from average groundwater concentration for wells in each site in Appendix K.

TABLE 5-38
EXPOSURE POINT CONCENTRATIONS (MLE) - EXCAVATION AIR, VOLATILIZATION FROM EXPOSED GROUNDWATER
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent / Site Location | CAS Number | Site Excavation Air EPCs (mg/m3) (a) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | G | | H | | I | | | | L |
| | | EE-05 | EEG-107 | EE-01 | EE-02 | AA-I-S1 | AA-I-S2 | EE-12 | EE-14 | EEG-109 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | -- | 2.80E-04 | -- | -- | -- | -- | -- | -- |
| 4-Methyl-2-pentanone | 108-10-1 | -- | 1.25E-01 | -- | -- | -- | -- | -- | -- | -- |
| Benzene | 71-43-2 | 2.98E-03 | 1.00E-01 | 4.06E-02 | 6.09E-02 | 1.23E-02 | 1.66E-03 | 1.84E-02 | 2.03E-02 | 1.19E-03 |
| Chlorobenzene | 108-90-7 | 1.55E-02 | 1.07E-01 | 3.00E-02 | 1.09E-01 | 1.29E-01 | 4.14E-02 | 3.50E-02 | 9.49E-02 | -- |
| Chloroform | 67-66-3 | -- | -- | -- | 1.16E-02 | -- | -- | -- | -- | 2.08E-03 |
| Ethylbenzene | 100-41-4 | -- | -- | 4.19E-02 | -- | -- | -- | -- | -- | -- |
| Naphthalene | 91-20-3 | 8.51E-03 | 4.58E-02 | 5.02E-02 | 4.26E-03 | -- | -- | -- | -- | -- |
| Tetrachloroethene | 127-18-4 | -- | 4.10E-03 | -- | -- | -- | -- | -- | -- | -- |
| Toluene | 108-88-3 | -- | 2.24E-01 | -- | -- | -- | -- | -- | -- | -- |
| Trichloroethene | 79-01-6 | -- | 2.62E-02 | -- | 6.48E-03 | -- | 1.36E-02 | -- | -- | -- |
| Vinyl chloride | 75-01-4 | -- | 1.30E-03 | -- | -- | 2.32E-02 | 6.32E-03 | -- | -- | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
(a) Excavation air concentration (mg/m3) = groundwater concentration (mg/l) * groundwater-to-air attenuation factor (l/m$^3$) calculated in Appendix L.

TABLE 5-39
EXPOSURE POINT CONCENTRATIONS (MLE) - OUTDOOR AIR VOCs
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Site Outdoor Air EPCs (mg/m3) (a) | | | |
|---|---|---|---|---|---|
| | | G | H | I | L |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | -- | 5.50E-08 | -- | -- |
| 4-Methyl-2-pentanone | 108-10-1 | 9.40E-07 | -- | -- | -- |
| Benzene | 71-43-2 | 1.20E-05 | 2.70E-05 | 7.90E-06 | 3.00E-07 |
| Chlorobenzene | 108-90-7 | 9.70E-06 | 2.40E-05 | 2.90E-05 | -- |
| Chloroform | 67-66-3 | -- | 2.60E-06 | -- | 4.30E-07 |
| Ethylbenzene | 100-41-4 | -- | 1.70E-05 | -- | -- |
| Naphthalene | 91-20-3 | 7.00E-07 | 1.50E-06 | -- | -- |
| Tetrachloroethene | 127-18-4 | 1.70E-06 | -- | -- | -- |
| Toluene | 108-88-3 | 3.20E-05 | 1.20E-06 | -- | -- |
| Trichloroethene | 79-01-6 | 1.60E-06 | -- | 1.90E-06 | -- |
| Vinyl chloride | 75-01-4 | 4.60E-06 | -- | 7.10E-05 | -- |

Notes:
-- - Not a COPC in this area/medium.
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
VOCs - Volatile Organic Compounds.
(a) Calculated from average groundwater concentration for wells in each site, as shown in Appendix M.

TABLE 5-40
EXPOSURE POINT CONCENTRATIONS (MLE)- PRODUCE GROWN IN TRANSECT SOILS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | CAS Number | Constituent Specific Inputs for Prediction of Produce Concentrations (a) | | | Transect 7 Predicted Produce Concentrations | |
|---|---|---|---|---|---|---|
| | | Log Kow | $Br_{ag}$ | $Br_{rootveg}$ | Above Ground (mg/kg DW) | Below Ground (mg/kg DW) |
| Arsenic | 7440-38-2 | NA | 6.33E-03 | 8.00E-03 | 9.49E-03 | 1.20E-02 |

Notes:
CAS - Chemical Abstracts Service.
COPC - Constituent of Potential Concern.
FW - Fresh Weight.
EPC - Exposure Point Concentration.
MLE - Most Likely Exposure.
NA - Not Applicable.
(a) USEPA, 1998d. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume Two. Appendix A. United States Environmental Protection Agency. Solid Waste and Emergency Response. EPA530-D-98-001B. July 1998. Calculations discussed in Appendix N.
(b) USEPA, 1998. Methodology for Assessing Health Risks Associated with Multiple Pathways of Exposure to Combustor Emissions. USEPA National Center for Environmental Assessment. EPA600/R-98/137.
Above Ground Produce Concentration = $C_s$ x $Br_{ag}$ x 0.15, where vegetable moisture content is assumed to be an average 85% (b).
Below Ground Produce Concentration = $C_s$ x $Br_{rootveg}$ x 0.15, where vegetable moisture content is assumed to be an average 85% (b).
$C_s$ = Concentration of constituent in soil.
$Br_{ag}$ = Plant-soil bioconcentration factor for above ground produce.
$Br_{rootveg}$ = Plant-soil bioconcentration factor for below ground produce.

TABLE 5-41
ABSORPTION ADJUSTMENT FACTORS (AAFs) FOR CHRONIC EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Exposure Route (Medium) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oral | (Water) | Oral | (Soil) | Oral | (Diet) | Dermal | (Water) | Dermal | (Soil) | Inhalation | |
| Constituent | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. |
| 1,1,2,2-Tetrachloroethane | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | NA |
| 1,4-Dichlorobenzene | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | 1 |
| 2,4,5-TP (Silvex) | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| 2,4,6-Trichlorophenol | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 | NA |
| 2,4-Dichlorophenol | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | 1 | 1 |
| 2-Chlorophenol | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 1 |
| 3-Methylphenol/4-Methylphenol | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| 4,4-DDE | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA | NA |
| 4-Chloroaniline | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| 4-Methyl-2-pentanone | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 |
| 4-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 1 |
| Acetone | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| alpha-BHC | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 | NA |
| Antimony | NA | 1 | NA | 1 | NA | 1 | NA | 6.7 | NA | 0.007 | NA | NA |
| Arsenic | 1 | 1 | 0.3 | 0.3 | 1 | 1 | 1 | 1 | 0.001 | 0.001 | 1 | NA |
| Benzene | 1 | 1 | 1 | 1 | 1 | 1 | 2.13 | 2.13 | 0.02 | 0.02 | 1 | 1 |
| Benzo(a)anthracene | 1 | NA | 0.29 | NA | 1 | NA | 1 | NA | 0.02 | NA | 1 | NA |
| Benzo(a)pyrene | 1 | NA | 0.29 | NA | 1 | NA | 1 | NA | 0.02 | NA | 1 | NA |
| Benzo(b)fluoranthene | 1 | NA | 0.29 | NA | 1 | NA | 1 | NA | 0.02 | NA | 1 | NA |
| Benzo(k)fluoranthene | 1 | NA | 0.29 | NA | 1 | NA | 1 | NA | 0.02 | NA | 1 | NA |
| beta-BHC | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 | NA |
| Cadmium | NA | 1 | NA | 1 | NA | 1 | NA | 40 | NA | 0.04 | 1 | NA |
| Carbazole | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA | NA |
| Chlorobenzene | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 |
| Chloroform | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 0.66 | 1 |
| Cis/Trans-1,2-Dichloroethene | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| Copper | NA | 1 | NA | 1 | NA | 1 | NA | 1.67 | NA | 0.002 | NA | NA |
| delta-BHC | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| Dibenzo(a,h)anthracene | 1 | NA | 0.29 | NA | 1 | NA | 1 | NA | 0.02 | NA | 1 | NA |
| Dieldrin | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | NA |
| Ethylbenzene | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 |
| gamma-BHC | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | NA | NA |
| Heptachlor | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | NA |
| Heptachlor epoxide | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | NA |
| Indeno(1,2,3-cd)pyrene | 1 | NA | 0.29 | NA | 1 | NA | 1 | NA | 0.02 | NA | 1 | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Molybdenum | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.001 | NA | NA |
| Naphthalene | NA | 1 | NA | 0.29 | NA | 1 | NA | 1 | NA | 0.1 | NA | 1 |
| Nickel | NA | 1 | NA | 1 | NA | 1 | NA | 77 | NA | 0.08 | NA | NA |

TABLE 5-41
ABSORPTION ADJUSTMENT FACTORS (AAFs) FOR CHRONIC EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Exposure Route (Medium) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oral | (Water) | Oral | (Soil) | Oral | (Diet) | Dermal | (Water) | Dermal | (Soil) | Inhalation | |
| Constituent | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. | Carc. | Noncarc. |
| Nitrobenzene | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 |
| Pentachlorophenol | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | NA | NA |
| Phenol | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | NA |
| Tetrachloroethene | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | 1 |
| Toluene | NA | 1 | NA | 1 | NA | 1 | NA | 1 | NA | 0.01 | NA | 1 |
| Total 2,3,7,8-TCDD TEQ | 1 | NA | 0.5 | NA | 1 | NA | 1.8 | NA | 0.05 | NA | 1 | NA |
| Total PCBs | 1 | 1 | 0.83 | 0.83 | 1 | 1 | 1.1 | 1.1 | 0.04 | 0.04 | 1 | NA |
| Trichloroethene | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | NA |
| Vanadium | NA | 1 | NA | 1 | NA | 1 | NA | 10 | NA | 0.01 | NA | NA |
| Vinyl chloride | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.01 | 0.01 | 1 | 1 |
| Zinc | NA | 1.6 | NA | 1 | NA | 1 | NA | 3.03 | NA | 0.003 | NA | NA |

Notes:
All Absorption Adjustment Factors were derived by ENSR.
Carc. - The value derived is for assessing the compound's carcinogenic potential.
Noncarc. - The value derived is for assessing the compound's noncarcinogenic potential.

TABLE 5-42
DERMAL PERMEABILITY CONSTANTS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dermal Permeability Constant (cm/hr) (a) | |
|---|---|---|
| 1,1,2,2-Tetrachloroethane | 9.00E-03 | |
| 1,4-Dichlorobenzene | 6.20E-02 | |
| 2,4,5-TP (Silvex) | 2.33E-03 | (k) |
| 2,4,6-Trichlorophenol | 5.00E-02 | |
| 2,4-Dichlorophenol | 2.30E-02 | |
| 2-Chlorophenol | 1.10E-02 | |
| 2-Nitroaniline | 5.45E-03 | (k) |
| 3-Methylphenol/4-Methylphenol | 1.00E-02 | (b) |
| 4,4-DDE | 2.40E-01 | |
| 4-Chloroaniline | 6.33E-03 | (k) |
| 4-Methyl-2-pentanone | 2.77E-03 | (k) |
| 4-Nitroaniline | 2.66E-03 | (k) |
| Acetone | 5.69E-04 | (k) |
| alpha-BHC | 1.63E-02 | (k) |
| Antimony | 1.60E-04 | (d) |
| Arsenic | 1.60E-04 | (d) |
| Benzene | 2.10E-02 | |
| Benzo(a)anthracene | 8.10E-01 | |
| Benzo(a)pyrene | 1.20E+00 | |
| Benzo(b)fluoranthene | 1.20E+00 | |
| Benzo(k)fluoranthene | 1.20E+00 | (c) |
| beta-BHC | 1.60E-02 | (k) |
| Cadmium | 1.00E-03 | (e) |
| Carbazole | 7.97E-02 | (k) |
| Chlorobenzene | 4.10E-02 | |
| Chloroform | 8.90E-03 | |
| Cis/Trans-1,2-Dichloroethene | 1.00E-02 | |
| Copper | 1.60E-04 | (d) |
| delta-BHC | 1.60E-02 | (k) |
| Dibenzo(a,h)anthracene | 2.70E+00 | |
| Dieldrin | 1.60E-02 | |
| Ethylbenzene | 7.40E-02 | |
| gamma-BHC | 1.40E-02 | |
| Heptachlor | 1.10E-02 | |
| Heptachlor epoxide | 1.10E-02 | (f) |
| Indeno(1,2,3-cd)pyrene | 1.90E+00 | |

TABLE 5-42
DERMAL PERMEABILITY CONSTANTS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dermal Permeability Constant (cm/hr) (a) | |
|---|---|---|
| Lead | 4.00E-06 | (g) |
| Molybdenum | 1.60E-04 | (d) |
| Naphthalene | 6.90E-02 | |
| Nickel | 5.45E-05 | (h) |
| Nitrobenzene | 6.96E-03 | (k) |
| Pentachlorophenol | 6.50E-01 | |
| Phenol | 5.50E-03 | |
| Tetrachloroethene | 4.80E-02 | |
| Toluene | 4.50E-02 | |
| Total 2,3,7,8-TCDD TEQ | 1.40E+00 | |
| Total PCBs | 7.10E-01 | (i) |
| Trichloroethene | 1.60E-02 | |
| Vanadium | 1.60E-04 | (d) |
| Vinyl chloride | 7.30E-03 | |
| Zinc | 6.00E-04 | (j) |

Notes:
(a) All values are from USEPA, 1992b, Dermal Exposure Assessment: Principles and Applications, Table 5-7, unless otherwise noted.
(b) Average value of 3-Methylphenol and 4-methylphenol
(c) Due to structural similarity, the value for benzo(b)fluoranthene is used to evaluate this constituent.
(d) Value for water (USEPA, 1992b, Table 5-7)
(e) Value for cadmium chloride (USEPA, 1992b, Table 5-3)
(f) Due to structural similarity, the value for heptachlor is used to evaluate this constituent.
(g) Value for lead acetate (USEPA, 1992b, Table 5-3)
(h) Average of values for nickel chloride and nickel sulfate (USEPA, 1992b, Table 5-3)
(i) Value for PCB hexachlorobiphenyl (USEPA, 1992b, Table 5-7)
(j) Value for zinc chloride (USEPA, 1992b, Table 5-3)
(k) Calculated in Table 5-43 using logKow, molecular weight, and equation 5.8 from USEPA, 1992b.

TABLE 5-43
DERMAL PERMEABILITY CONSTANTS - CALCULATED VALUES (d)
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Molecular Weight (g) | Log Kow | | Log PC | Dermal Permeability Constant (cm/hr) (b) |
|---|---|---|---|---|---|
| 2,4,5- TP (Silvex) | 269.53 | 2.44 | (a) | -2.631733 | 2.33E-03 |
| 2-Nitroaniline | 138.13 | 1.83 | (a) | -2.263293 | 5.45E-03 |
| 4-Chloroaniline | 127.57 | 1.83 | (a) | -2.198877 | 6.33E-03 |
| 4-Methyl-2-Pentanone | 100.16 | 1.09 | (a) | -2.557076 | 2.77E-03 |
| 4-Nitroaniline | 138.13 | 1.39 | (a) | -2.575693 | 2.66E-03 |
| Acetone | 58.08 | -0.24 | (a) | -3.244688 | 5.69E-04 |
| Alpha-BHC | 290.83 | 3.81 | (a) | -1.788963 | 1.63E-02 |
| Beta-BHC | 290.83 | 3.8 | (a) | -1.796063 | 1.60E-02 |
| Carbazole | 167.21 | 3.72 | (c) | -1.098781 | 7.97E-02 |
| Delta-BHC | 290.83 | 4.14 | (a) | -1.554663 | 2.79E-02 |
| Nitrobenzene | 123.11 | 1.85 | (a) | -2.157471 | 6.96E-03 |

Notes:
Kow - Octanol-Water Partition Coefficient.
PC - Permeability Constant.
(a) Handbook of RCRA Groundwater Monitoring Constituents. Physical and Chemical Properties. USEPA. September 1992d.
(b) USEPA, 1992b Dermal Exposure Equation 5.8: Log Kp = -2.72 + 0.71 log Kow - 0.0061 MW
(c) Handbook of Physical Properties of Organic Chemicals. Lyman, 1997
(d) Values not presented in USEPA, 1992b.

TABLE 5-44
EXPOSURE POINT CONCENTRATIONS (MLE) - GROUNDWATER WELL-BY-WELL AVERAGES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Consituent | Number of Wells with Detects | Total Number of Wells | Number of Well Averages Used in Statistics (a) | Average Concentration (ug/L) |
|---|---|---|---|---|
| **Site G** | | | | |
| 4-Methyl-2-pentanone (MIB | 1 | 11 | 11 | 139.8 |
| Benzene | 4 | 11 | 11 | 347.8 |
| Chlorobenzene | 6 | 11 | 11 | 466.1 |
| Naphthalene | 2 | 11 | 11 | 230.5 |
| Tetrachloroethene | 2 | 11 | 11 | 20.5 |
| Toluene | 3 | 11 | 11 | 862.8 |
| Trichloroethene | 4 | 11 | 11 | 20.9 |
| Vinyl chloride | 1 | 11 | 10 | 8.6 |
| **Site H** | | | | |
| 1,1,2,2-Tetrachloroethane | 1 | 4 | 3 | 5.7 |
| Benzene | 2 | 4 | 4 | 937.8 |
| Chlorobenzene | 3 | 4 | 4 | 1391.6 |
| Chloroform | 1 | 4 | 4 | 120.0 |
| Ethylbenzene | 1 | 4 | 4 | 498.1 |
| Naphthalene | 2 | 4 | 4 | 626.3 |
| Trichloroethene | 1 | 4 | 4 | 19.8 |
| **Site I** | | | | |
| Benzene | 5 | 7 | 7 | 278.8 |
| Chlorobenzene | 5 | 7 | 7 | 1744.3 |
| Trichloroethene | 2 | 7 | 7 | 31.7 |
| Vinyl chloride | 2 | 7 | 7 | 157.9 |
| **Site L** | | | | |
| Benzene | 1 | 6 | 6 | 7.8 |
| Chloroform | 1 | 6 | 6 | 14.8 |

Notes:
(a) - Number of wells used in statistics differs from total number of wells if one-half the detection limit for any well average is greater than the maximum detected concentration in any well for that Site.

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Key:

● Pathway potentially complete, further evaluation recommended

○ Pathway evaluated and found incomplete or insignificant, no further evaluation recommended

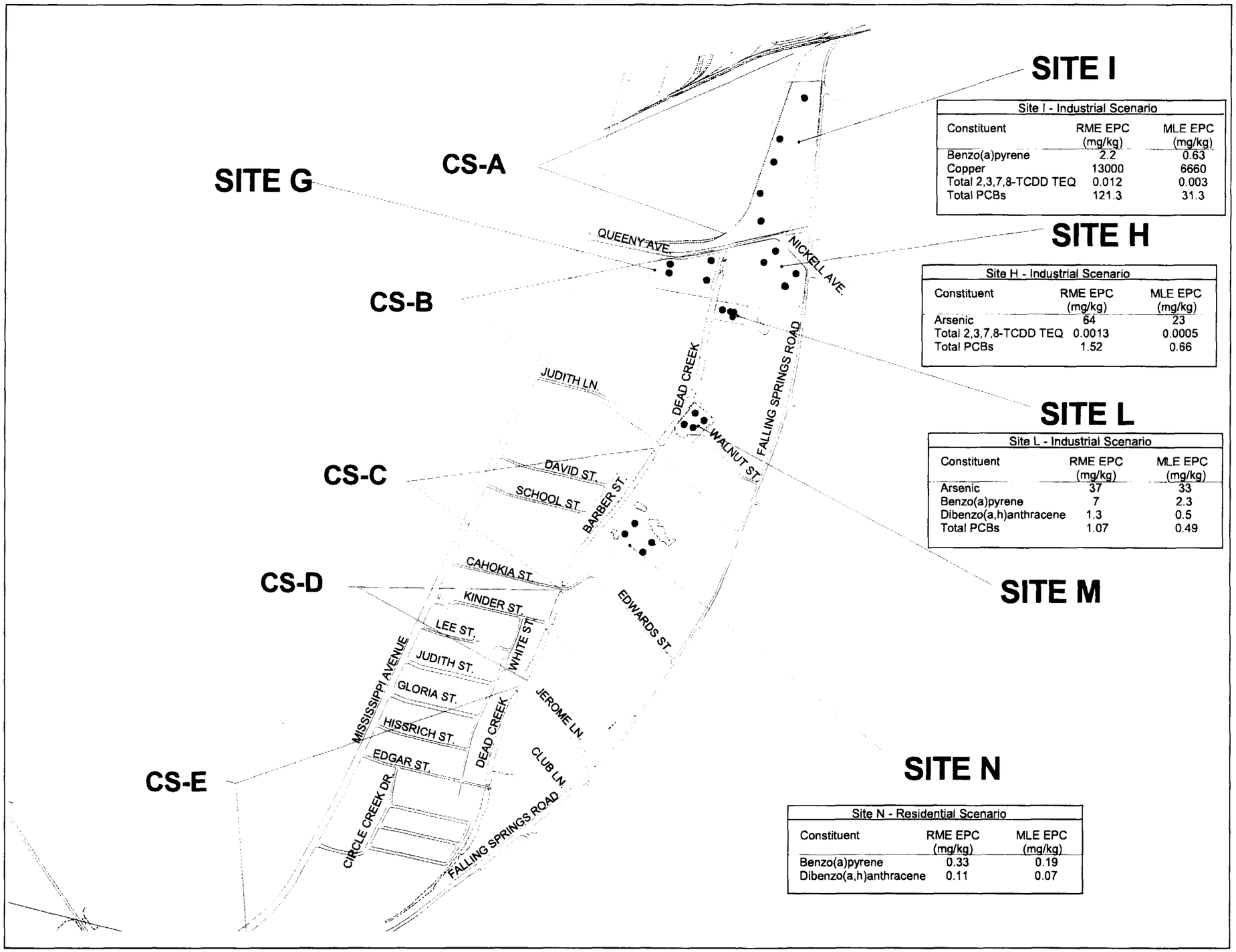
Boxes without circles indicate that pathway is not applicable to that receptor

(a) Sites
(b) Residential, commercial, undeveloped areas
(c) Dead Creek and Borrow Pit Lake - areas not included in the sediment removal action
(d) Fill Area N will be evaluated for potential residential receptors
(e) Dead Creek Segments adjacent to residential areas are included in the sediment removal action

December 29, 2000
Revision 0

**FIGURE 5-1**
Conceptual Site Model for Human Health Risk Assessment
Sauget Area 1 EE/CA and RI/FS, Sauget and Cahokia, Illinois Solutia, Inc.

M2K0266a




| Site I - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 2.2 | 0.63 |
| Copper | 13000 | 6660 |
| Total 2,3,7,8-TCDD TEQ | 0.012 | 0.003 |
| Total PCBs | 121.3 | 31.3 |

| Site H - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Arsenic | 64 | 23 |
| Total 2,3,7,8-TCDD TEQ | 0.0013 | 0.0005 |
| Total PCBs | 1.52 | 0.66 |

| Site L - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Arsenic | 37 | 33 |
| Benzo(a)pyrene | 7 | 2.3 |
| Dibenzo(a,h)anthracene | 1.3 | 0.5 |
| Total PCBs | 1.07 | 0.49 |

| Site N - Residential Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 0.33 | 0.19 |
| Dibenzo(a,h)anthracene | 0.11 | 0.07 |

N

LEGEND

- Site
- Water Body
- Roads
- Soil Sample Locations
- CS-A Dead Creek Segment Designations
- RME Reasonable Maximum Exposure
- MLE Most Likely Exposure

**FIGURE 5-2**

Direct Contact - Site Soils
Residential and Industrial Scenarios
Exposure Point Concentrations (EPCs)

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

2000 0 2000 Feet

ENSR INTERNATIONAL

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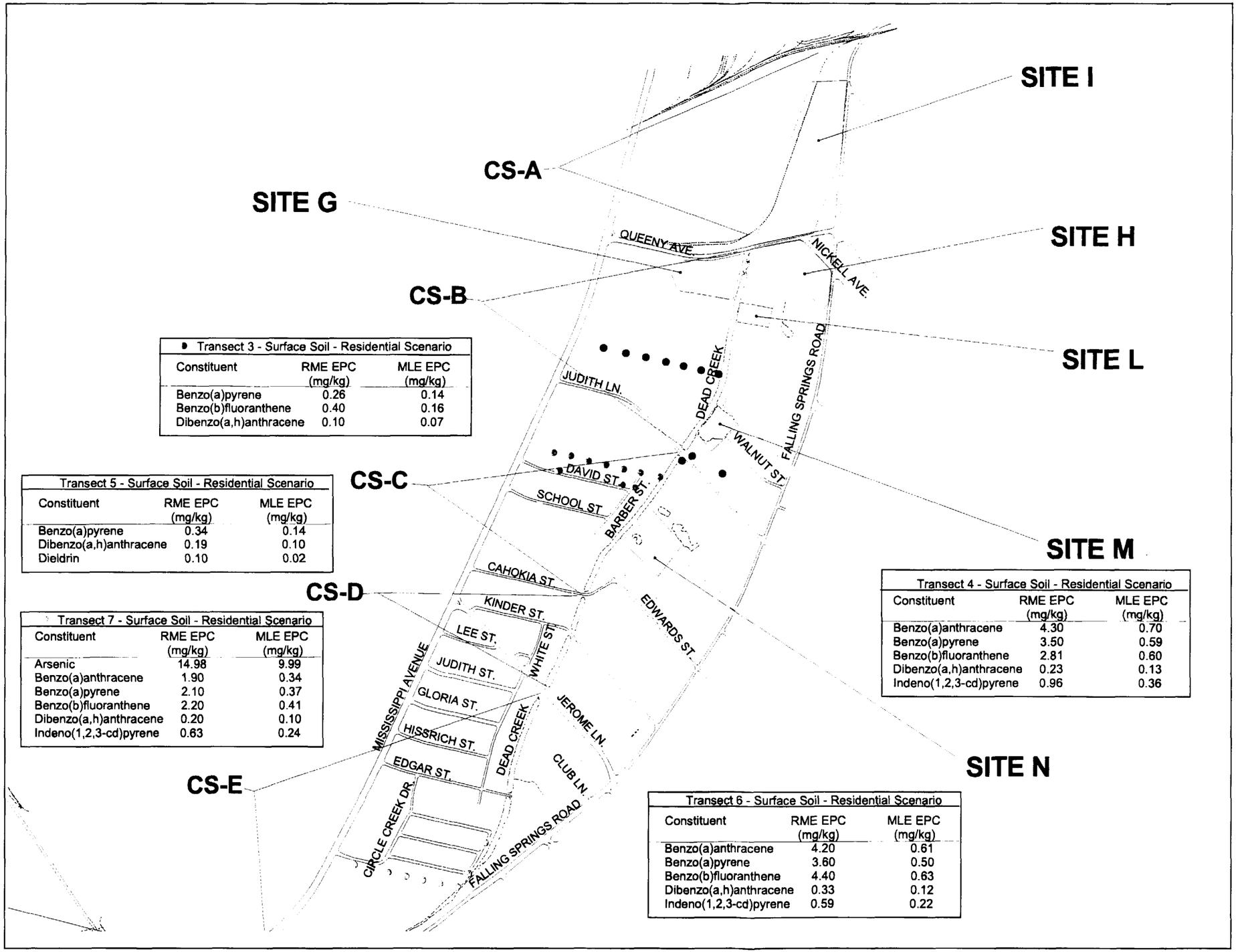
December 29, 2000
Revision 0




| Transect 3 - Surface Soil - Residential Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 0.26 | 0.14 |
| Benzo(b)fluoranthene | 0.40 | 0.16 |
| Dibenzo(a,h)anthracene | 0.10 | 0.07 |

| Transect 5 - Surface Soil - Residential Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 0.34 | 0.14 |
| Dibenzo(a,h)anthracene | 0.19 | 0.10 |
| Dieldrin | 0.10 | 0.02 |

| Transect 7 - Surface Soil - Residential Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Arsenic | 14.98 | 9.99 |
| Benzo(a)anthracene | 1.90 | 0.34 |
| Benzo(a)pyrene | 2.10 | 0.37 |
| Benzo(b)fluoranthene | 2.20 | 0.41 |
| Dibenzo(a,h)anthracene | 0.20 | 0.10 |
| Indeno(1,2,3-cd)pyrene | 0.63 | 0.24 |

| Transect 4 - Surface Soil - Residential Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)anthracene | 4.30 | 0.70 |
| Benzo(a)pyrene | 3.50 | 0.59 |
| Benzo(b)fluoranthene | 2.81 | 0.60 |
| Dibenzo(a,h)anthracene | 0.23 | 0.13 |
| Indeno(1,2,3-cd)pyrene | 0.96 | 0.36 |

| Transect 6 - Surface Soil - Residential Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)anthracene | 4.20 | 0.61 |
| Benzo(a)pyrene | 3.60 | 0.50 |
| Benzo(b)fluoranthene | 4.40 | 0.63 |
| Dibenzo(a,h)anthracene | 0.33 | 0.12 |
| Indeno(1,2,3-cd)pyrene | 0.59 | 0.22 |

N

LEGEND

- Site
- Water Body
- Roads
- Transect 1
- Transect 2
- Transect 3
- Transect 4
- Transect 5
- Transect 6
- Transect 7

CS-A Dead Creek Segment Designations

RME Reasonable Maximum Exposure

MLE Most Likely Exposure

**FIGURE 5-3**
Residential Scenario
Transect Surface Soil
Exposure Point Concentrations (EPCs)

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

2000 0 2000 Feet

ENSR INTERNATIONAL

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December 29, 2000
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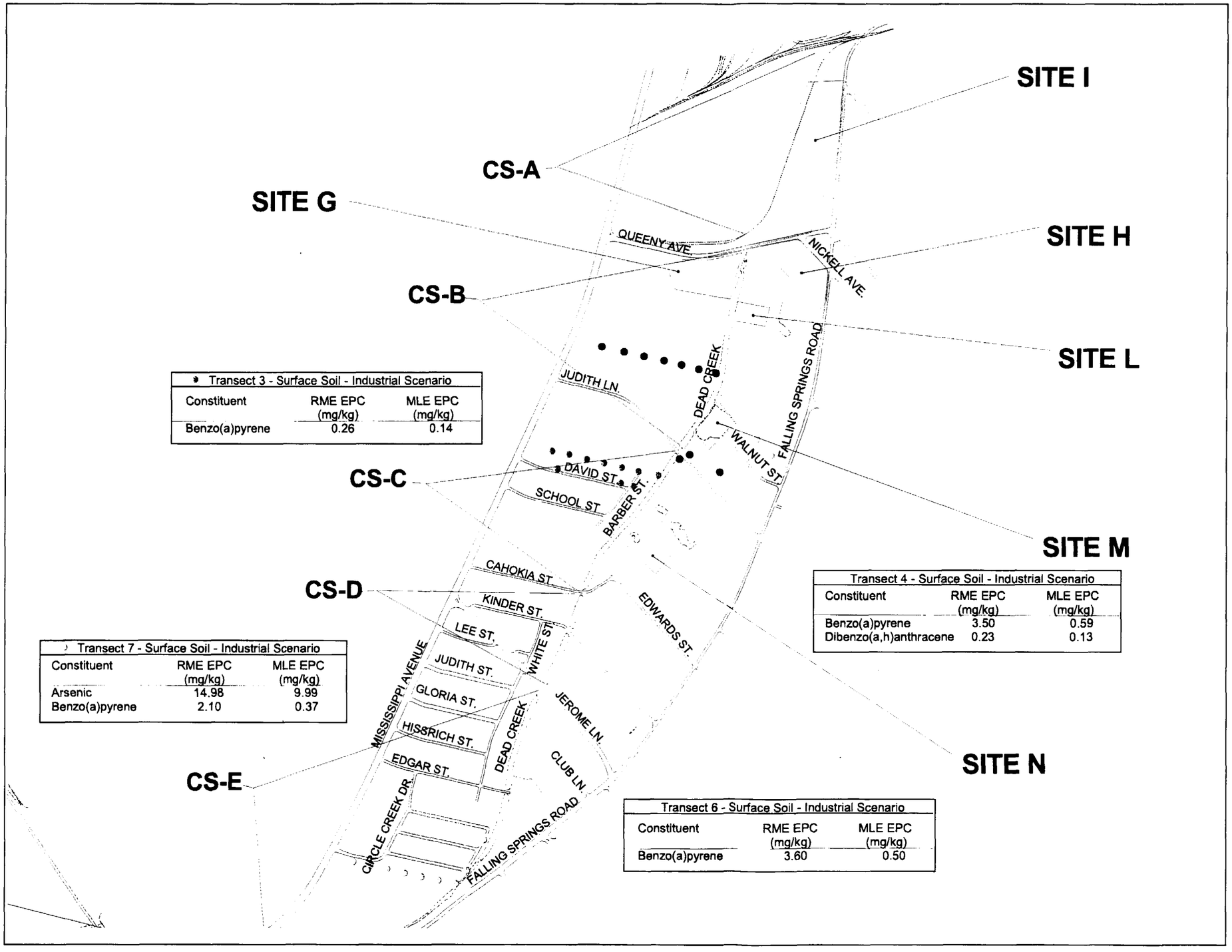


| Transect 3 - Surface Soil - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 0.26 | 0.14 |

| Transect 4 - Surface Soil - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 3.50 | 0.59 |
| Dibenzo(a,h)anthracene | 0.23 | 0.13 |

| Transect 7 - Surface Soil - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Arsenic | 14.98 | 9.99 |
| Benzo(a)pyrene | 2.10 | 0.37 |

| Transect 6 - Surface Soil - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 3.60 | 0.50 |

N

LEGEND

- Site
- Water Body
- Roads
- Transect 1
- Transect 2
- Transect 3
- Transect 4
- Transect 5
- Transect 6
- Transect 7

CS-A Dead Creek Segment Designations

RME Reasonable Maximum Exposure

MLE Most Likely Exposure

**FIGURE 5-4**

Industrial Scenario
Transect Surface Soil
Exposure Point Concentrations (EPCs)

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

2000 0 2000 Feet

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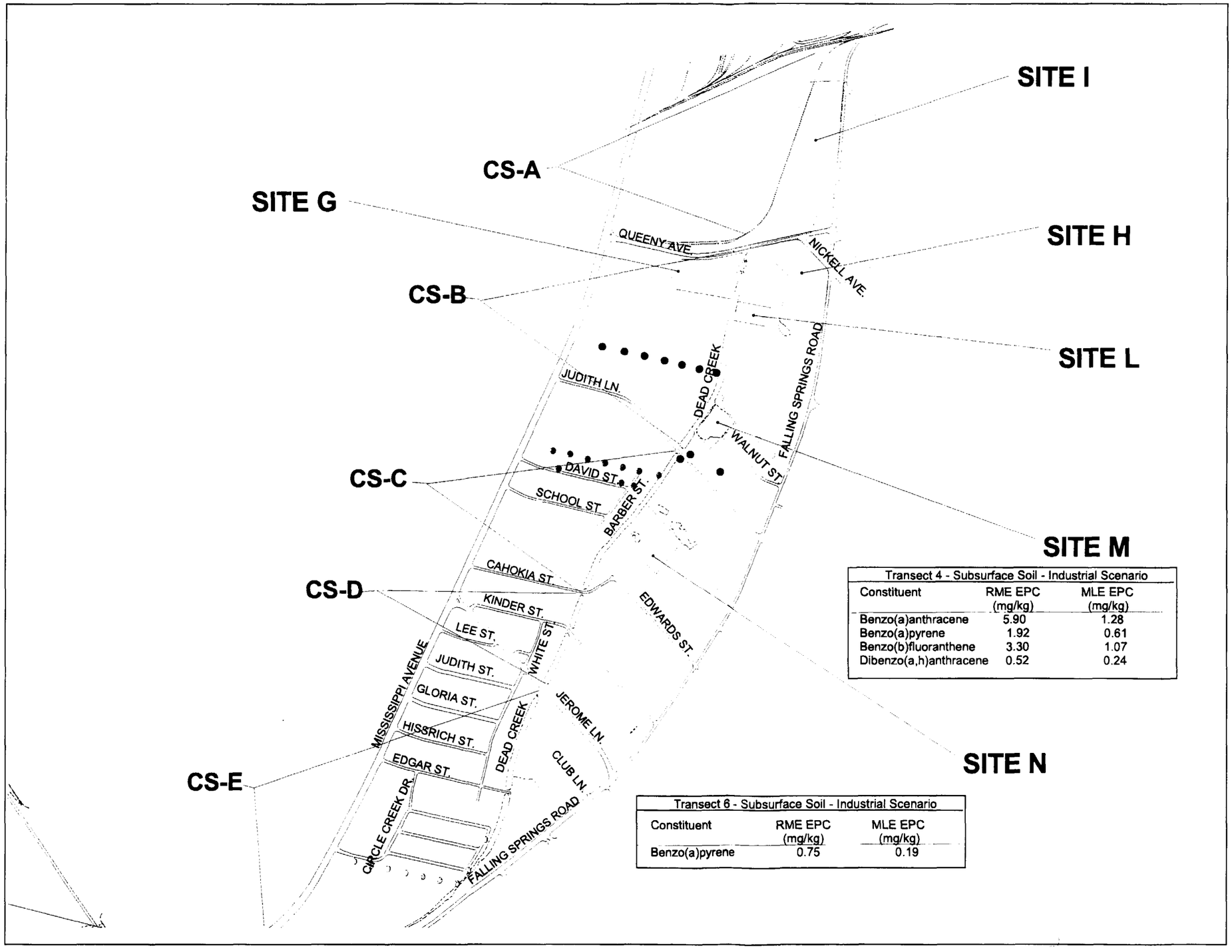
December 29, 2000
Revision 0




| Transect 4 - Subsurface Soil - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)anthracene | 5.90 | 1.28 |
| Benzo(a)pyrene | 1.92 | 0.61 |
| Benzo(b)fluoranthene | 3.30 | 1.07 |
| Dibenzo(a,h)anthracene | 0.52 | 0.24 |

| Transect 6 - Subsurface Soil - Industrial Scenario | | |
|---|---|---|
| Constituent | RME EPC (mg/kg) | MLE EPC (mg/kg) |
| Benzo(a)pyrene | 0.75 | 0.19 |

N

LEGEND

- Site
- Water Body
- Roads
- Transect 1
- Transect 2
- Transect 3
- Transect 4
- Transect 5
- Transect 6
- Transect 7

CS-A Dead Creek Segment Designations

RME Reasonable Maximum Exposure

MLE Most Likely Exposure

**FIGURE 5-5**

Industrial Scenario
Transect Subsurface Soil
Exposure Point Concentrations (EPCs)

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

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**AA-I-S2 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 1,4-Dichlorobenzene | 4.2 | 2.15 |
| 4-Chloroaniline | 0.68 | 0.351 |
| Benzene | 0.12 | 0.0613 |
| Chlorobenzene | 3.2 | 1.66 |
| Trichloroethene | 0.18 | 0.104 |
| Vinyl chloride | 0.24 | 0.2 |

**EE-15 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 1,4-Dichlorobenzene | 0.43 | 0.43 |

**EE-13 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| Total 2,3,7,8-TCDD TEQ | 4.74E-08 | 4.74E-08 |

**EEG-106 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| alpha-BHC | 0.0083 | 0.0083 |
| beta-BHC | 0.00036 | 0.00036 |

**AA-I-S1 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 1,4-Dichlorobenzene | 4.4 | 2.21 |
| 4-Chloroaniline | 4.1 | 3.25 |
| Benzene | 0.62 | 0.455 |
| Chlorobenzene | 8.7 | 5.15 |
| Vinyl chloride | 0.97 | 0.735 |

**EE-12 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 4-Chloroaniline | 1.4 | 1.4 |
| alpha-BHC | 0.00245 | 0.00245 |
| Benzene | 0.68 | 0.68 |
| Carbazole | 0.0035 | 0.0035 |
| Chlorobenzene | 1.4 | 1.4 |
| Total 2,3,7,8-TCDD TEQ | 3.05E-06 | 3.05E-06 |

**EE-01 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 1,4-Dichlorobenzene | 2.2 | 2.2 |
| 2,4,6-Trichlorophenol | 0.27 | 0.27 |
| 4-Chloroaniline | 1.8 | 1.8 |
| Benzene | 1.5 | 1.5 |
| Carbazole | 0.0052 | 0.0052 |
| Chlorobenzene | 1.2 | 1.2 |
| Naphthalene | 2.3 | 2.3 |
| Pentachlorophenol | 4.3 | 3.35 |
| Total 2,3,7,8-TCDD TEQ | 4.57E-08 | 4.57E-08 |

**EE-14 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 1,4-Dichlorobenzene | 14 | 14 |
| 4-Chloroaniline | 1.8 | 1.8 |
| alpha-BHC | 0.0011 | 0.0011 |
| Benzene | 0.75 | 0.75 |
| beta-BHC | 0.001 | 0.001 |
| Carbazole | 0.026 | 0.026 |
| Chlorobenzene | 3.8 | 3.8 |
| Pentachlorophenol | 0.5 | 0.33 |
| Total 2,3,7,8-TCDD TEQ | 7.69E-07 | 7.69E-07 |
| Total PCBs | 0.00588 | 0.00588 |

**EE-02 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 1,4-Dichlorobenzene | 0.635 | 0.635 |
| 2,4,6-Trichlorophenol | 0.465 | 0.465 |
| 2,4-Dichlorophenol | 0.37 | 0.37 |
| 4-Chloroaniline | 0.775 | 0.775 |
| alpha-BHC | 0.000495 | 0.000495 |
| Benzene | 2.25 | 2.25 |
| Chlorobenzene | 4.35 | 4.35 |
| Chloroform | 0.425 | 0.425 |
| Naphthalene | 0.195 | 0.195 |
| Pentachlorophenol | 0.67 | 0.65 |
| Phenol | 0.315 | 0.315 |
| Trichloroethene | 0.0495 | 0.0495 |

**EE-05 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 4-Chloroaniline | 1.6 | 1.6 |
| Benzene | 0.11 | 0.11 |
| Chlorobenzene | 0.62 | 0.62 |
| delta-BHC | 0.00036 | 0.00036 |
| Naphthalene | 0.39 | 0.39 |
| Phenol | 0.38 | 0.38 |
| Total 2,3,7,8-TCDD TEQ | 1.78E-07 | 1.78E-07 |

**EE-03 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| Total 2,3,7,8-TCDD TEQ | 5.02E-08 | 5.02E-08 |

**EEG-107 - Groundwater**

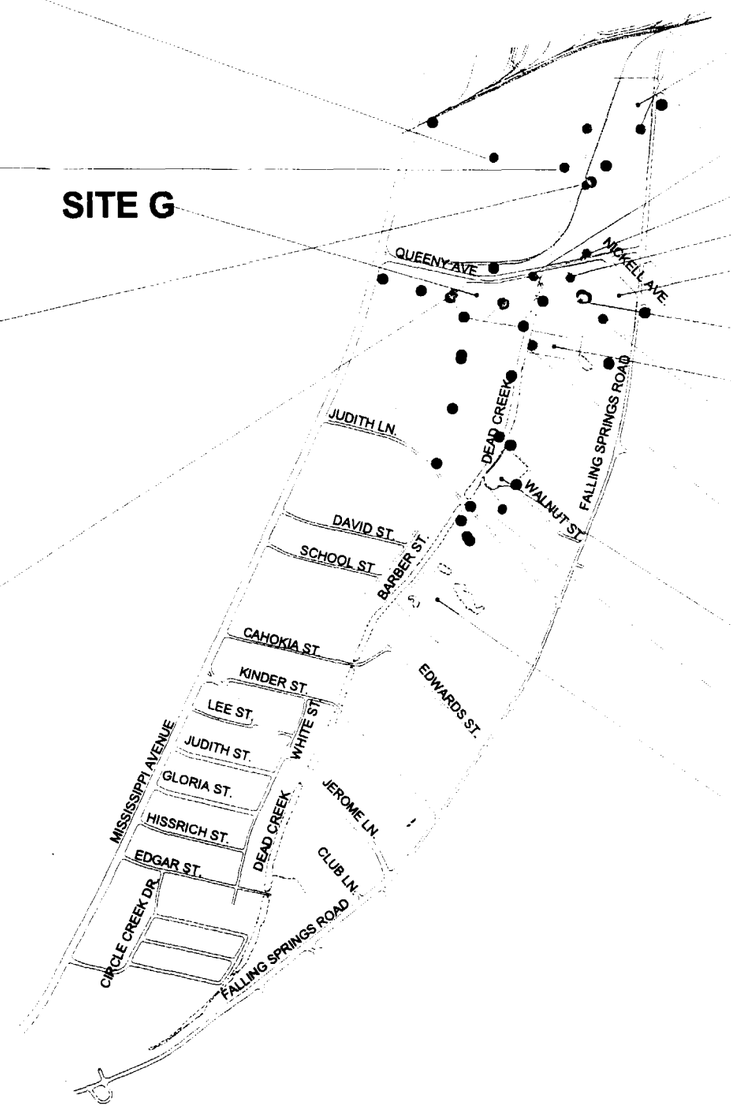
| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 1,4-Dichlorobenzene | 0.85 | 0.85 |
| 2,4-Dichlorophenol | 3.6 | 3.6 |
| 4-Chloroaniline | 23 | 23 |
| alpha-BHC | 0.006 | 0.006 |
| Benzene | 3.7 | 3.7 |
| Chlorobenzene | 4.3 | 4.3 |
| delta-BHC | 0.017 | 0.017 |
| Naphthalene | 2.1 | 2.1 |
| Pentachlorophenol | 2.0 | 1.01 |
| Phenol | 14 | 14 |
| Total 2,3,7,8-TCDD TEQ | 3.60E-06 | 3.60E-06 |
| Trichloroethene | 0.2 | 0.2 |
| Vinyl chloride | 0.041 | 0.041 |

**EEG-109 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| 2,4-Dichlorophenol | 0.026 | 0.026 |
| 4-Chloroaniline | 0.055 | 0.055 |
| Benzene | 0.044 | 0.044 |
| Chloroform | 0.076 | 0.076 |

**DW-MCDO-1 - Groundwater**

| Constituent | RME EPC (mg/l) | MLE EPC (mg/l) |
|---|---|---|
| Lead | 0.129 | 0.129 |




N

LEGEND

- Site
- Water Body
- Roads
- Groundwater Sample Locations
- Groundwater Sample Locations Quantitatively Evaluated in the HHRA

RME Reasonable Maximum Exposure

MLE Most Likely Exposure

# FIGURE 5-6

Groundwater - Selected Exposure Point Concentrations (EPCs)

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

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# 6.0 RISK CHARACTERIZATION

The potential risk to human health associated with potential exposure to COPC in environmental media at the site is evaluated in this step of the risk assessment process. Risk characterization is the process in which the dose-response information (Section 4.0) is integrated with quantitative estimates of human exposure derived in the Exposure Assessment (Section 5.0). The result is a quantitative estimate of the likelihood that humans will experience any adverse health effects given the exposure assumptions made. Two general types of health risk are characterized for each potential exposure pathway considered: potential carcinogenic risk and potential noncarcinogenic risk. Carcinogenic risk is evaluated by averaging exposure over a normal human lifetime, which, based on USEPA guidance (1989a), is assumed to be 70 years. Noncarcinogenic risk is evaluated by averaging exposure over the total exposure period.

Characterization of the potential impact of potential carcinogenic and noncarcinogenic constituents is approached in very different ways. The difference in approaches arises from the conservative assumption that substances with possible carcinogenic action proceed by a no-threshold mechanism, whereas other toxic actions may have a threshold, a dose below which few individuals would be expected to respond. Thus, under the no-threshold assumption, it is necessary to calculate a risk, but for constituents with a threshold, it is possible to simply characterize an exposure as above or below the threshold. In risk assessment, that threshold is termed a reference dose (RfD). Reference doses as well as cancer slope factors were discussed in Section 4.0. The approach to carcinogenic risk characterization is presented in Section 6.1, and the approach to noncarcinogenic risk characterization is presented in Section 6.2. The risk characterization results are presented in Section 6.3. The soil to groundwater pathway is discussed in Section 6.4. Uncertainties associated with the risk characterization are presented in Section 6.5. The risk calculation spreadsheets are presented in Appendix P.

## 6.1 Carcinogenic Risk Characterization

The purpose of carcinogenic risk characterization is to estimate the upper-bound likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of exposure to a constituent in environmental media at the site. This likelihood is a function of the dose of a constituent (described in the Exposure Assessment, Section 5.0) and the Cancer Slope Factor (CSF) (described in the Toxicity Assessment, Section 4.0) for that constituent. The Excess Lifetime Cancer Risk (ELCR) is the likelihood over and above the background cancer rate, which currently in the US is between 1 in 3 and 1 in 4 (Landis et al., 1998), that an individual will contract cancer in his or her lifetime. The risk value is expressed as a probability (e.g., $10^{-6}$, or one in one million). The relationship between the ELCR and the estimated Lifetime Average Daily Dose (LADD) of a constituent may be expressed as:

$$ELCR = 1 - e^{-(CSF \times LADD)}$$

When the product of the CSF and the LADD is much greater than 1, the ELCR approaches 1 (i.e., 100 percent probability). When the product is less than 0.01 (one chance in 100), the equation can be closely approximated by:

$$ELCR = LADD\ (mg/kg\text{-}day) \times CSF\ (mg/kg\text{-}day)^{-1}$$

The product of the CSF and the LADD is unitless, and provides an upper-bound estimate of the potential carcinogenic risk associated with a receptor's exposure to that constituent via that pathway.

The potential carcinogenic risk for each exposure pathway is calculated for each receptor. In current regulatory risk assessment, it is assumed that cancer risks are additive or cumulative. Pathway and area-specific risks are summed to estimate the total site potential cancer risk for each receptor. A summary of the total site cancer risks for each receptor group is presented in this section and compared to the USEPA's target risk range of $10^{-4}$ to $10^{-6}$. Any COPC that causes an exceedence of $10^{-4}$ risk level for a particular receptor is designated a COC. The target risk levels used for the identification of COCs are based on USEPA guidance and Illinois TACO guidance. Specifically, USEPA provides the following guidance (USEPA, 1991a):

> "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than $10^{-4}$, and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." and,
>
> "The upper boundary of the risk range is not a discrete line at $1 \times 10^{-4}$, although EPA generally uses $1 \times 10^{-4}$ in making risk management decisions. A specific risk estimate around $10^{-4}$ may be considered acceptable if justified based on site-specific conditions."

IEPA provides the following summary for the evaluation of cumulative risk for carcinogens (IEPA, 1998, Fact Sheet 13: Mixture Rule):

> "The cumulative risk of carcinogenic contaminants attacking the same target must not exceed 1 in 10,000 [$10^{-4}$]. Therefore, the risk from all on-site similar acting carcinogens must be added together. If this cumulative risk level is greater than 1 in 10,000, corrective action must be taken to reach an acceptable risk level."

Both RME and MLE results are considered in the identification of COCs. Remedial goals (RGs) are calculated for each COC in Section 8.0.

## 6.2 Noncarcinogenic Risk Characterization

The potential for exposure to a constituent to result in adverse noncarcinogenic health effects is estimated for each receptor by comparing the Chronic Average Daily Dose (CADD) for each COPC with the RfD for that COPC. The resulting ratio, which is unitless, is known as the Hazard Quotient (HQ) for that constituent. The HQ is calculated using the following equation:

$$HQ = \frac{CADD\ (mg/kg\text{-}day)}{RfD\ (mg/kg\text{-}day)}$$

The target HQ is defined as an HQ of less than or equal to one (USEPA, 1989a). When the HQ is less than or equal to 1, the RfD has not been exceeded, and no adverse noncarcinogenic effects are expected. If the HQ is greater than 1, there may be a potential for adverse noncarcinogenic health effects to occur; however, the magnitude of the HQ cannot be directly equated to a probability or effect level.

The total Hazard Index (HI) is calculated for each exposure pathway by summing the HQs for each individual constituent. The total site HI is calculated for each potential receptor by summing the HIs for each pathway associated with the receptor. Where the total site HI is greater than 1 for any receptor, a more detailed evaluation of potential noncarcinogenic effects based on specific health or target endpoints (e.g., liver effects, neurotoxicity) is performed (USEPA, 1989a; IEPA, 1998). The target HI is 1 on a per target endpoint basis.

A summary of all HIs for each receptor group is presented in this section and compared to the USEPA's target HI of 1. Each COPC that causes an exceedance of the HI of 1 for a particular receptor and for a particular target endpoint is designated a COC. Both RME and MLE results are considered in the identification of COCs. RGs are calculated for each COC in Section 8.0.

## 6.3 Risk Characterization Results

The results of the risk characterization are presented below by receptor.

### 6.3.1 Indoor Industrial Worker

Potential carcinogenic risks for the RME scenario are presented in Table 6-1, and the potential HIs for the RME scenario are presented in Table 6-2. Risks and HIs for the MLE scenario are presented in Tables 6-15 and 6-16, respectively. The indoor industrial worker is assumed to be exposed to COPCs in groundwater via inhalation of constituents volatilizied into indoor air.

As indicated in Table 6-1, the potential risk for the indoor industrial worker (RME) is below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$. Table 6-15 indicates that the potential risks for the MLE scenario are below the USEPA risk range of $10^{-4}$ to $10^{-6}$.

Table 6-2 indicates that the potential HIs for the indoor industrial worker (RME) are below the target HI of 1 in each area. Additionally, the HIs for the indoor industrial worker in the MLE scenario presented in Table 6-16 are below 1 for all areas.

### 6.3.2 Outdoor Industrial Worker

Potential carcinogenic risks for the RME scenario are presented in Table 6-3, and the potential HIs for the RME scenario are presented in Table 6-4. Risks and HIs for the MLE scenario are presented in Tables 6-17 and 6-18, respectively. The outdoor industrial worker is assumed to be exposed to COPCs in surface soil via incidental ingestion and dermal contact and inhalation of particulates, and to COPCs in groundwater via inhalation of constituents volatilized into outdoor air.

As indicated in Table 6-3, the potential risk for the outdoor industrial worker (RME) for all areas is below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$, with the exception of Site I where the potential carcinogenic risk for the outdoor industrial worker (RME) is 1.66E-04. The exceedance is due to potential ingestion and dermal contact exposure to 2,3,7,8-TCDD-TEQ in soil. Table 6-17 indicates that the potential risks for the MLE scenario for all areas are within or below the USEPA risk range of $10^{-4}$ to $10^{-6}$.

Table 6-4 indicates that the potential HIs for the outdoor industrial worker (RME) for all areas are below the target HI of 1 in each area with the exception of Site I. The HI exceeds 1 in this area, due to potential ingestion and dermal contact exposure to PCBs in surface soil. The HIs for the outdoor industrial worker for the MLE scenario presented in Table 6-18 are below 1 for all areas.

### 6.3.3 Construction Worker

Potential carcinogenic risks for the RME scenario are presented in Table 6-5, and the potential HIs for the RME scenario are presented in Table 6-6. Risks and HIs for the MLE scenario are presented in Tables 6-19 and 6-20, respectively. The construction worker is assumed to be exposed to COPCs in surface and subsurface soil via incidental ingestion and dermal contact and inhalation of particulate matter in excavation dust, and to COPCs in groundwater exposed in an excavation via incidental ingestion and dermal contact and inhalation of constituents volatilized into excavation air.

As indicated in Table 6-5, the potential risk for the construction worker (RME) for all areas is below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$. Table 6-19 indicates that the potential risks for the MLE scenario are also below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$.

Table 6-6 indicates that the potential HIs for the construction worker (RME) are below the target HI of 1 in each area with the exception of Sites G, H and I. The HI for the construction worker for the MLE scenario presented in Table 6-20 is below 1 for all areas with the exception of Site H.

The RME HI exceeds 1 in Site G primarily due to potential inhalation exposure to benzene and naphthalene in excavation air. The RME HI exceeds 1 in Site H due to potential inhalation exposure to benzene, chloroform, and naphthalene in excavation air due to volatilization from standing groundwater. The MLG HI for Site H exceeds 1 primarily due to chloroform in excavation air, and secondarily due to benzene in excavation air. The HI exceeds 1 for the RME scenario in Site I primarily due to potential ingestion and dermal contact exposure to PCBs in soil.

Section 8.0 and Appendix R discuss the target endpoint analyses for the scenarios with total HI exceedances.

#### 6.3.3.1 Summary of Additional Construction Worker Evaluation.

Pursuant to comments received from USEPA on the December 29, 2000 Human Health Risk Assessment for Sauget Area 1 (the HHRA), an additional evaluation has been conducted for the construction worker and is presented in Appendix T. This evaluation has been conducted to evaluate potential risks to the construction worker associated with constituents in subsurface soil and in leachate in Sites G, H, I and L, and follows the same methods as the HHRA.

Subsurface samples collected in the Sites as part of the SSP were analyzed for TCLP, not total constituent concentrations. Therefore, historical data collected for other investigations were employed to evaluate construction worker contact with COPCs in the subsurface. These data were obtained from the following: Sauget Area 1 Data Tables/Maps, Ecology and Environmental, Inc., February 1998, prepared for USEPA Region 5 Office of Superfund, Chicago, IL, ARCS Contract No. 68-W8-0086, Work Assignment No. 47-5N60. The historical data are unvalidated, and detection limits were not available for the majority of results reported as not detected. Therefore, only results reported as detected were used in this evaluation.

TCLP data from subsurface samples collected in the Sites were used to represent leachate concentrations, i.e., concentrations in groundwater within the fill material. In addition, unvalidated analytical data from leachate samples collected in the leachate well in Site I and the leachate well in Site G (one sample from each well) were included in this evaluation. This evaluation is separate from, and in addition to, the evaluation of the construction worker receptor's exposure to groundwater in the main text of the HHRA (in which the Site groundwater data were used).

The potential risk for the construction worker for both the RME and MLE scenarios for all Sites is below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$.

The potential HIs for the construction worker (RME) are above the target HI of 1 in each Site. The HI for the construction worker for the MLE scenario is above 1 for all Sites with the exception of Site L.

### 6.3.4 Trespassing Teen

Potential carcinogenic risks for the RME scenario are presented in Table 6-7, and the potential HIs for the RME scenario are presented in Table 6-8. Risks and HIs for the MLE scenario are presented in Tables 6-21 and 6-22, respectively. The trespassing teen is assumed to be exposed to COPCs in surface soil via incidental ingestion and dermal contact and inhalation of particulates, and to COPCs in groundwater via inhalation of constituents volatilized into outdoor air.

As indicated in Table 6-7, the potential risk for the trespassing teen (RME) is below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$. Table 6-21 indicates that the potential risks for the MLE scenario are also below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$.

Table 6-8 indicates that the potential HI for the trespassing teen (RME) is below the target HI of 1 in each area. The HIs for the trespassing teen in the MLE scenario presented in Table 6-22 are below 1 for all areas.

### 6.3.5 Recreational Teen

Potential carcinogenic risks for the RME scenario are presented in Table 6-9, and the potential HIs for the RME scenario are presented in Table 6-10. Risks and HIs for the MLE scenario are presented in Tables 6-23 and 6-24, respectively. The recreational teen is assumed to be exposed to COPCs in sediment (wading and swimming) in Dead Creek/Borrow Pit Lake via incidental ingestion and dermal contact.

As indicated in Table 6-9, the potential risk for the recreational teen (RME) is below the USEPA risk range of $10^{-4}$ to $10^{-6}$. Table 6-23 indicates that the potential risks for the MLE scenario are also below the USEPA risk range of $10^{-4}$ to $10^{-6}$.

Table 6-10 indicates that the potential HI for the recreational teen (RME) is below the target HI of 1. The HI for the recreational teen in the MLE scenario presented in Table 6-24 is also below 1.

### 6.3.6 Recreational Fisher

Potential carcinogenic risks for the RME scenario are presented in Table 6-11, and the potential HIs for the RME scenario are presented in Table 6-12. Risks and HIs for the MLE scenario are presented in Tables 6-25 and 6-26, respectively. The recreational fisher is assumed to be exposed to COPCs in

sediment in Dead Creek/Borrow Pit Lake via incidental ingestion and dermal contact, and to COPCs in consumed fish fillet caught in the creek and/or lake.

As indicated in Table 6-11, the potential risk for the recreational fisher (RME) is within the USEPA risk range of $10^{-4}$ to $10^{-6}$. Table 6-23 indicates that the potential risks for the MLE scenario are also within the USEPA risk range of $10^{-4}$ to $10^{-6}$.

Table 6-12 indicates that the potential HI for the recreational fisher (RME) is below the target HI of 1. The HI for the recreational fisher in the MLE scenario presented in Table 6-26 is also below 1.

### 6.3.7 Residential Adult and Child

The resident is evaluated as a young child for a 6-year exposure duration and as an adult for a 24-year exposure duration, for a total exposure period of 30 years. Noncancer effects are evaluated for the residential child receptor, and potential carcinogenic effects are evaluated for the adult and child combined, as discussed in Section 5.0. Potential carcinogenic risks for the RME scenario are presented in Table 6-13, and the potential HIs for the RME scenario are presented in Table 6-14. Risks and HIs for the MLE scenario are presented in Tables 6-27 and 6-28, respectively. The residential receptors are assumed to be exposed to COPCs in surface soil via incidental ingestion and dermal contact and inhalation of particulates and ingestion of homegrown produce, and to COPCs in non-potable groundwater via incidental ingestion and dermal contact.

As indicated in Table 6-13, the potential risk for the residential receptor (adult and child combined) (RME) is below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$ in all transects and Site N. Table 6-27 indicates that the potential risks for the MLE scenario are within the USEPA risk range of $10^{-4}$ to $10^{-6}$ for all areas.

Table 6-14 indicates that the potential HIs for the residential child (RME) are below the target HI of 1 in each area. The HIs for the residential child in the MLE scenario presented in Table 6-28 are also below 1 for all areas. The only COPC identified in groundwater in the residential area is lead. Potential exposures to lead are evaluated separately in Appendix Q, using USEPA biokinetic models. The results indicate that potential exposure to lead in groundwater does not present a health risk.

## 6.4 Soil to Groundwater Pathway Analysis

Analysis of the soil to groundwater pathway identified six COPCs. Five of these were common to the transect and site soils: beta-BHC (Transect 6 and Site L surface soil), dieldrin (Transect 5 and Site I surface soil), pentachlorophenol (all sites and transects) and selenium (Transect 3 and Sites H and L surface soil). Benzo(a)anthracene was also identified as a COPC in Transect 4 subsurface soil, and 4-chloroaniline was also identified as a COPC in Site I surface soil (see Tables 3-3 and 3-4).

In groundwater in the transect areas, dieldrin and beta-BHC were each detected once in a transect area groundwater sampling location (i.e., locations south of Site L). Both concentrations were below groundwater screening values. None of the remaining COPCs were detected in groundwater in this area.

In the site areas, dieldrin and selenium were not identified as COPCs in groundwater. The remaining soil to groundwater pathway COPCs were not identified as COCs in the risk assessment, i.e., did not pose direct contact risks that would cause an exceedence of the target risk range or hazard index. In addition, these soil to groundwater pathway COPCs were identified in surface soil; the shallow depth of surface soil in these areas is unlikely to serve as a significant concentration source of these COPCs to groundwater.

Therefore, none of the soil to groundwater COPCs are identified as COCs for this pathway in this risk assessment.

## 6.5 Uncertainty Analysis

Within any of the four steps of the human health risk assessment process, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. Every assumption introduces some degree of uncertainty into the risk assessment process. Regulatory risk assessment methodology requires that conservative assumptions be made throughout the risk assessment to ensure that public health is protected. Therefore, when all of the assumptions are combined, it is much more likely that risks are overestimated rather than underestimated.

The assumptions that introduce the greatest amount of uncertainty in this risk assessment are discussed in this section. They are discussed in qualitative terms, because for most of the assumptions there is not enough information to assign a numerical value to the uncertainty that can be factored into the calculation of risk.

### 6.5.1 Selection of Constituents of Potential Concern

In the Hazard Identification step, information on constituents detected at the site is combined with criteria quantifying their potential toxicity to obtain a subset of constituents for quantitative evaluation in the risk assessment, the COPCs. The goal is to include in the quantitative portion of the risk assessment those constituents that are the most toxic, prevalent, environmentally-persistent, and mobile. The selection of the COPCs forms the basis of the quantitative risk assessment.

Generally in the site characterization phase of the site assessment, knowledge of past and current land use is used to determine which analytical parameters are analyzed and what analytical methods are

employed for the detection of constituents in the relevant environmental media at the site. However, for Sauget Area 1, the knowledge of past and current industrial practices was not used to limit the analyte list. Instead, the majority of environmental samples were analyzed for a full suite of constituents including VOCs, SVOCs, metals, cyanide, PCBs, pesticides, herbicides and dioxins, as detailed in Section 3.1.2.

In the Hazard Identification process, it is assumed that only those constituents detected are actually present at the site. However, it is possible that constituents not on the analyte list may be present at the site. Should this be the case, site risks may be underestimated depending on the nature of the constituents not included in the sample analyses. However, the full suite of USEPA analyte lists were used and are as inclusive as possible of constituents used in industry that are of potential public health concern. Therefore, it is unlikely that constituents not included on the analyte list would be present at the site at concentrations that would pose a risk to public health.

A subset of constituents detected at a site is generally selected for quantitative analysis for several reasons. Some constituents detected at a site may be naturally occurring and not related to site use. Other constituents may be present at concentrations that can be assumed with reasonable assurance not to pose a risk to human health. A review of the results of risk assessments demonstrate that in most cases risks are attributable only to one or a few constituents, and that many of the constituents quantitatively evaluated do not contribute significantly to total risk estimates (USEPA, 1993a). The screening process is conducted to identify the COPCs that may contribute the greatest to potential risk. The screening process used here is conservative. Although the excluded constituents may pose a finite level of risk, that risk would contribute negligibly to the total site risk. Therefore, not evaluating the excluded constituents will not measurably affect the numerical estimates of hazard or risk, and thus not affect remedial decision-making at the site.

In comparison with the list of constituents analyzed in each environmental sample (approximately 180 analytes), relatively few constituents were detected in transect and site soils, and of these, relatively few COPCs (a total of seven) were identified for quantitative evaluation in the risk assessment for the transect soils. The COPCs identified were PAHs, arsenic and dieldrin. PAHs and arsenic were also identified as COPCs in site soils (a total of 6 constituents were identified as COPCs in site soils). As discussed in Section 3.3.1.4, the levels of PAHs and arsenic are likely consistent with natural and anthropogenic background, i.e., the detected concentrations would not be expected to be very different in other areas of Sauget and Cahokia, or in other areas in the state of Illinois. Dieldrin is a pesticide that has been in common usage; it was identified as a COPC in a single transect (Transect 5) where it was detected in 2 of 9 samples, the concentration of only one of these samples exceeded the screening criteria. The presence of dieldrin may be due to past agricultural practices in the area. Therefore, these COPCs, although included in the risk assessment, may not necessarily be related to specific site-related releases.

#### 6.5.1.1 COPCs for Groundwater Based on TACO Tier I Class I Groundwater Criteria.

The last table in Appendix U (which presents the comparison of groundwater data to TACO Class I groundwater criteria) identifies Class I COPCs by groundwater sample location. Comparing the results to the Class II results, additional Class I COPCs were identified in most locations for which Class II COPCs occurred. In Site G, between 1 and 3 COPCs were identified in five additional locations. In Site H, one COPC was identified in one additional location. In Site I, two COPCs were identified in one additional location. In Site L, one and two COPCs were identified in two additional sampling locations, respectively. And in residential areas, lead was identified as a COPC in two residential non-potable use wells and one shallow groundwater sample location. Therefore, the Class I screening results were not very different from the Class II screening results.

#### 6.5.1.2 Drinking Water Evaluation of Residential Non-Potable Use Wells

Lead was identified as (the only) COPC in two of the non-potable use residential wells (DW-MCDO and DW-WRIG). No COPCs were identified in the other two non-potable use wells. A drinking water evaluation of lead was conducted and is presented in Appendix V. The results indicate that well DW-WRIG could be used as a source of drinking water; however, use of well DW-MCDO as a source of drinking water would not be appropriate.

### 6.5.2 Toxicity Assessment

The purpose of the toxicity assessment is to identify the types of adverse health effects a constituent may potentially cause and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response). Risk assessment methodologies typically divide potential health effects of concern into two general categories: effects with a threshold (noncarcinogenic) and effects assumed to be without a threshold (potentially carcinogenic). Toxicity assessments for both of these types of effects share many of the same sources of uncertainty. To compensate for these uncertainties, USEPA has developed the reference doses (RfDs) and cancer slope factors (CSF) that are biased to overestimate rather than under-estimate human health risks. Several of the more important sources of uncertainty and the resulting biases are discussed below.

#### 6.5.2.1 Animal-to-Human Extrapolation in Noncarcinogenic Dose-Response Evaluation

For many constituents, animal studies provide the only reliable information on which to base an estimate of adverse human health effects. Extrapolation from animals to humans introduces a great deal of uncertainty into the risk characterization. In most instances, it is not known how differently a human may react to the constituent compared to the animal species used to test the constituent. If a

constituent's fate and the mechanisms by which it causes adverse effects are known in both animals and humans, uncertainty is reduced. When the fate and mechanism for the constituent are unknown, uncertainty increases.

The procedures used to extrapolate from animals to humans involve conservative assumptions and incorporate uncertainty factors such that overestimation of effects in humans is more likely than underestimation. When data are available from several species, the lowest dose that elicits effects in the most sensitive species is used for the calculation of the reference dose (RfD). To this dose are applied uncertainty factors, generally of 1 to 10 each, to account for intraspecies variability, interspecies variability, study duration, and/or extrapolation of a low effect level to a no effect level. Thus, most reference doses used in risk assessment are 100- to 10,000-fold lower than the lowest effect level found in laboratory animals.

Nevertheless, because the fate of a constituent can differ in animals and humans, it is possible that animal experiments will not reveal an adverse effect that would manifest itself in humans. This can result in an underestimation of the effects in humans. The opposite may also be true: effects observed in animals may not be observed in humans, resulting in an overestimation of potential adverse human health effects.

#### 6.5.2.2 Evaluation of Carcinogenic Dose-Response

Significant uncertainties exist in estimating dose-response relationships for potential carcinogens. These are due to experimental and epidemiologic variability, as well as uncertainty in extrapolating both from animals to humans and from high to low doses. Three major issues affect the validity of toxicity assessments used to estimate potential excess lifetime cancer risks: (1) the selection of a study (i.e., data set, animal species, matrix the constituent is administered in) upon which to base the calculations, (2) the conversion of the animal dose used to an equivalent human dose, and (3) the mathematical model used to extrapolate from experimental observations at high doses to the very low doses potentially encountered at the site.

Study Selection

Study selection involves the identification of a data set (experimental species and specific study) that provides sufficient, well-documented dose-response information to enable the derivation of a valid cancer slope factor (CSF). Human data (e.g., from epidemiological studies) are preferable to animal data, although adequate human data sets are relatively uncommon. Therefore, it is often necessary to seek dose-response information from a laboratory species, ideally one that biologically resembles humans (e.g., with respect to metabolism, physiology, and pharmacokinetics), and where the route of administration is similar to the expected mode of human exposure (e.g., inhalation and ingestion). When multiple valid studies are available, the USEPA generally bases CSFs on the one study and site

that show the most significant increase in tumor incidence with increasing dose. In some cases this selection is done in spite of significant decreases with increasing dose of tumor incidence in other organs and total tumor incidence. Consequently, the current study selection criteria are likely to lead to overestimation of potential cancer risks in humans.

Interspecies Dose Conversion

The USEPA derivation of human equivalent doses by conversion of doses administered to experimental animals requires the assumption that humans and animals are equally sensitive to the toxic effects of a substance, if the same dose per unit body surface area is absorbed by each species. Although such an assumption may hold for direct-acting genotoxicants, it is not necessarily applicable to many indirect acting carcinogens and likely overestimates potential risk by a factor of 6 to 12 depending on the study species (USEPA, 1992e). Further assumptions for dose conversions involve standardized scaling factors to account for differences between humans and experimental animals with respect to life span, body size, breathing rates, and other physiological parameters. In addition, evaluation of risks associated with one route of administration (e.g., inhalation) when tests in animals involve a different route (e.g., ingestion) requires additional assumptions with corresponding additional uncertainties. Although USEPA has formally changed its default position for scaling animal data to humans from a per surface area to a per body weight basis (USEPA, 1992e), changes to existing CSF will only be made when the USEPA commits to a formal review of a constituent's dose-response profile, and as of this writing, few have been incorporated.

High-to-Low Dose Extrapolation

The concentration of constituents to which people are potentially exposed at industrial sites is usually much lower than the levels used in the studies from which dose-response relationships are developed. Estimating potential health effects at such sites, therefore, requires the use of models that allow extrapolation of health effects from high experimental doses in animals to low environmental doses. These models are generally statistical in character and have little or no biological basis. Thus the use of a model for dose extrapolation introduces uncertainty in the dose-response estimate. In addition, these models contain assumptions that may also introduce a large amount of uncertainty. Generally the models have been developed to err on the side of over-estimating rather than under-estimating potential health risks.

The USEPA CSFs are derived using the upper 95% confidence limit of the slope predicted by the linearized multi-stage (LMS) model used to extrapolate low dose risk from high dose experimental data. USEPA recognizes that this method produces very conservative risk estimates, and that other mathematical models exist. USEPA states that the upper-bound estimate generated by the LMS model leads to a plausible upper limit to the risk that is consistent with some of the proposed mechanisms of carcinogenesis. The true risk, however, is unknown and may be as low as zero. The

LMS model is very conservative as it assumes strict linearity between the lowest dose that produced an effect and zero dose. However, the body has many mechanisms to detoxify constituents, especially at low doses, and many mechanisms to repair damages if they should occur. Therefore, many scientists believe that most constituents can cause cancer only above a "threshold" dose. This phenomenon of a threshold for carcinogenic activity has recently been demonstrated for chloroform (as reviewed in Bradley, 1996).

An established policy does not yet exist for using "most likely" or "best" estimates of risk within the range of uncertainty defined by the upper- and lower-limit estimates defined by the models. USEPA has published a draft version of its cancer guidelines (USEPA, 1996c). These draft guidelines allow for much greater use of mechanistic data, however, the guidelines have not yet been finalized and it will take time before USEPA can apply the new methodology to existing CSF.

### 6.5.3 Exposure Assessment

Exposure assessment consists of three basic steps: 1) development of exposure scenarios, (2) estimation of exposure point concentrations, and 3) estimation of human dose.

Exposure Scenarios

Exposure scenarios in a risk assessment are selected to be representative of potential exposures to COPCs in media that may be experienced by human receptors based on current and reasonably foreseeable land use. These exposure scenarios are developed for a hypothetical receptor, but one that would represent the reasonable maximal exposure (RME) scenario for the site. Therefore, exposure levels are assumed for these receptors, i.e., residential, commercial/industrial, recreational, that are much greater than expected to occur in an actual population. The use of the most likely exposure (MLE) scenarios provides an estimate of exposures more likely to represent average exposures. The MLE risk estimates are used to put the RME risk estimates into context.

Estimation of Exposure Point Concentrations

Sample Statistics. Exposure to COPCs at the site is best estimated by the use of the arithmetic mean concentration of a COPC in each medium. Because of the uncertainty associated with estimating the true average concentration at a site, the USEPA has required the use of the 95% UCL on the arithmetic mean as the exposure point concentration (EPC) (USEPA, 1992a). Therefore, this is a very conservative estimate of the true arithmetic mean. RME EPCs in this risk assessment represent the lower of the maximum detected concentration or the 95% UCL on the mean (USEPA, 1992a). The appropriate UCL is selected based on the results of a Shapiro-Wilk Test for Normality, the results of which indicate whether a data set is more likely to be normally or lognormally distributed. Uncertainty can arise if the test results show the data set to be normally distributed when it is actually lognormally

distributed, or vice-versa. This source of uncertainty, however, would not lead to large differences in the calculated dose for a given receptor, based on a comparison of the two UCL values calculated for this risk assessment. Again to provide context, the MLE calculations have used the arithmetic mean concentration, not the upper bound, as the EPC.

Sample Location. In addition, the data used to calculate the EPCs are assumed to be representative of general site conditions. Sample locations in the sites and transects were identified to be as representative of site conditions as possible.

Environmental Degradation. Finally, it is assumed that the EPCs calculated in the risk assessment based on current site conditions remain constant for the assumed exposure duration – for an industrial or residential scenario this is a period of 25 to 30 years. However, it is well known in the scientific community that constituents in the environment are subject to natural attenuation and biodegradation processes. Organic constituents are naturally degraded in the environment by a variety of processes (i.e., photodegradation, microbial activity, hydrolysis, etc.). USEPA has recognized the validity and utility of natural attenuation and biodegradation as a remedial option and has recently published guidance for its site-specific implementation (USEPA, 1997d). Environmental half-lives vary for specific constituents based on environmental conditions (i.e., presence of bacteria, pH, exposures to sunlight and oxygen), and there are respected literature sources of such information. However, environmental degradation is not typically accounted for in the calculation of risks for the site. This has likely resulted in an over-estimation of site risks.

Calculated EPCs. Models were used to calculate the concentration of a volatile constituent in air based on its concentration in groundwater. Models were used to predict indoor air concentrations, outdoor air concentrations, and excavation trench air concentrations. Although assumptions are made about constituent behavior in each of these models, the assumptions used are conservative in that they tend to result in over-predictions rather than under-predictions of air concentrations.

Exposure Assumptions

When estimating potential human doses (i.e., intakes) from potential exposure to various media containing COPCs, several assumptions are made. Uncertainty may exist, for example, in assumptions concerning rates of ingestion, frequency and duration of exposure, and bioavailability of the constituents in the medium. Typically, when limited information is available to establish these assumptions, a conservative (i.e., health-protective) estimate of potential exposure is employed. Default exposure assumptions recommended by the USEPA are intended to be conservative and representative of an individual who consistently and frequently contacts environmental media at a site, a scenario that rarely occurs. Most individuals will contact media at non-site locations, while the risk assessment assumes that all exposure to environmental media will occur at the site. Moreover, it is often assumed that contact with environmental media occurs in the areas having the highest

constituent concentrations for the entire exposure frequency/duration used in the risk assessment, due to both statistical handling of the data and the original sampling plan.

The assumptions regarding exposure frequency and duration are very conservative. For example, while the agency default for working tenure is 25 years, the average occupational tenure for an industrial/commercial worker is 4.2 years. The use of conservative assumptions is likely to lead to an overestimate of potential risk.

A meteorological factor was used in the risk assessment to account for the number of days when direct contact with soil or intrusive activities will not occur for receptors during inclement weather, i.e., when it is raining or snowing, when the ground is wet or frozen, or when snow or ice (32 degrees F) are covering the ground. This is not to say that workers or residents would not be outdoors on such days, only that the soil would not be available for significant contact either because it is wet or frozen. Thus, the exposure frequency was adjusted for these site-specific meteorological conditions. A meteorological factor of 24% was calculated (see Section 5.4.3). The meteorological factor was applied only to the resident and outdoor industrial worker receptors (not to the indoor industrial worker, construction worker, trespassing teen, recreational teen or recreational fisher receptors). A review of the RME and MLE risk and hazard estimates for these receptors indicates that if a meteorological factor was not used in the risk assessment, all risks that are within the target risk range would remain within the target risk range, and all hazards that are below the target of one would remain below the target. Therefore, the conclusions and recommended response actions would not change based on the use of the meteorological factor.

Another conservative assumption used in the risk assessment has been the use of an adult produce consumption rate of 454 g per day, which is equivalent to 1 pound of homegrown produce per day. This value was obtained from the EFH (USEPA, 1997a), and represents an upper bound ingestion rate, especially considering that this rate applies to a year long (365 day per year) exposure. The methodology for evaluating the residential produce consumption pathway was obtained from a USEPA protocol (USEPA, 1998d). In this protocol, a 25% adjustment factor has been applied to the ingestion factor obtained from the EFH to represent the homegrown produce ingestion, an indication that the ingestion rates provided in the EFH are very high. Therefore, the produce consumption rates used in the Sauget Area 1 risk assessment are very conservative and likely overestimate risk via this pathway.

### 6.5.4 Risk Characterization

The potential risk of adverse human health effects is characterized based on estimated potential exposures and potential dose-response relationships. Three areas of uncertainty are introduced in this phase of the risk assessment: the evaluation of potential exposure to multiple constituents, the combination of upper-bound exposure estimates with upper-bound toxicity estimates, and the risk to sensitive populations.

### 6.5.5 Risk from Multiple Constituents

Once potential exposure to and potential risk from each COPC is estimated, the total upper-bound potential risk posed by the site is determined by combining the estimated potential health risk from each of the COPC. Presently, potential carcinogenic effects are added unless evidence exists indicating that the COPC interact synergistically (a combined effect that is greater than a simple addition of potential individual effects) or antagonistically (a combined effect that is less than a simple addition of potential individual effects) with each other. For most combinations of constituents, little if any evidence of interaction is available. Therefore, additivity is assumed. Although the IEPA TACO program provides a listing of groups of constituents that are considered to be additive in their carcinogenic potential, the USEPA approach of assuming additivity across all constituents was used in this risk assessment.

For noncarcinogenic effects, the Hazard Index (HI) should only be summed for constituents that have the same or similar toxic endpoints (USEPA, 1989a). The toxic endpoint is defined as the most sensitive noncarcinogenic health effect used to derive the RfD or other suitable toxicity value (USEPA, 1989a). Again, there is little evidence to suggest whether those COPCs associated with a common toxicity endpoint are additive, synergistic, antagonistic, or independent in terms of mechanism of action. Whether assuming additivity leads to an underestimation or overestimation of risk is unknown.

Combination of Several Upper-Bound Assumptions

Generally, the goal of a risk assessment is to estimate an upper-bound, but reasonable, potential exposure and risk. Most of the assumptions about exposure and toxicity used in this evaluation are representative of statistical upper-bounds or even maxima for each parameter. The result of combining several such upper-bound assumptions is that the final estimate of potential exposure or potential risk is extremely conservative (health-protective).

This is best illustrated by a simple example. Assume that potential risk depends upon three variables (soil consumption rate, COPC concentration in soil and CSF). The mean, upper 95% bound and maximum are available for each variable.

One way to generate a conservative estimate of potential risk is to multiply the upper 95% bounds of the three parameters in this example. Doing so assumes that the 5% of the people who are most sensitive to the potential carcinogenic effects of a COPC will also ingest soil at a rate that exceeds the rate for 95% of the population, and that all the soil these people eat will have a compound concentration that exceeds the concentration in 95% of the soil on site. The consequence of these assumptions is that the estimated potential risk is representative of 0.0125% of the population (0.05 x 0.05 x 0.05 = 0.000125 x 100 = 0.0125%). Put another way, these assumptions overestimate risks for 9,999 out 10,000 people, or 99.99% of the population. Thus, the majority of people will have a much

lower level of potential risk. The very conservative nature of the potential risks estimated by the risk assessment process is not generally recognized. In reality, the estimates are more conservative than outlined above, because usually more than three upper 95% assumptions are used to estimate potential risk(s).

Alternatively, if a single upper 95% assumption of the cancer slope factor is combined with average (50th percentile) assumptions for soil concentration and soil ingestion rate, the resulting estimates of potential risk still overpredict risk for 99% of the potentially exposed population. This is a conservative and health protective approach that substantially overestimates the "average" level and even the reasonable maximum level of potential risk.

The risk assessment approach used here employed upper 95% bounds or maxima for most RME exposure and toxicity assumptions. Thus, it produces estimates of potential risk two to three orders of magnitude greater than the risk experienced by the average member of the potentially exposed populations. The MLE scenarios have used average estimates of exposure where possible, but still use the conservative toxicity values, thus even the MLE risk estimates are likely to overestimate total risk.

### 6.5.6 Risk to Sensitive Populations

The health risks estimated in the risk characterization generally apply to the receptors whose activities and locations were described in the exposure assessment. Some people will always be more sensitive than the average person and, therefore, will be at greater risk. Dose-response values used to calculate risk, however, are frequently derived to account for additional sensitivity of subpopulations (e.g., the uncertainty factor of 10 used to account for intraspecies differences). Therefore, it is unlikely that this source of uncertainty contributes significantly to the overall uncertainty of the risk assessment.

### 6.5.7 Summary of Sources of Uncertainty in Human Health Risk Assessment

The large number of assumptions made in the risk characterization introduces uncertainty in the results. While this could potentially lead to underestimates of potential risk, the use of numerous conservative (i.e., protective of human health) assumptions, as was done here, results in overestimates of potential risks. Any one person's potential exposure and subsequent risk are influenced by all the parameters mentioned above and will vary on a case-by-case basis. Despite inevitable uncertainties associated with the steps used to derive potential risks, the use of numerous health-protective assumptions will most likely lead to a very large overestimate of potential risks from the site. Moreover, when evaluating risk assessment results, it is important to put the risks into perspective. For example, the background rate of cancer in the US is approximately 2,500 for a population of 10,000 people (Landis, et al., 1998). The results of the risk assessment must be

carefully interpreted considering the uncertainty and conservatism associated with the analysis, especially where site management decisions are made.

TABLE 6-1
TOTAL POTENTIAL CARCINOGENIC RISK
INDOOR WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Site G Groundwater Inhalation Risk | Site H Groundwater Inhalation Risk | Site I Groundwater Inhalation Risk | Site L Groundwater Inhalation Risk |
|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | NC | 5.26E-09 | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC |
| Benzene | 6.82E-07 | 4.24E-07 | 1.37E-07 | 8.20E-09 |
| Chlorobenzene | NC | NC | NC | NC |
| Chloroform | NC | 4.49E-07 | NC | 7.94E-08 |
| Ethylbenzene | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC |
| Tetrachloroethene | 1.69E-08 | NC | NC | NC |
| Toluene | NC | NC | NC | NC |
| Trichloroethene | 4.24E-08 | 1.08E-08 | 3.78E-08 | NC |
| Vinyl chloride | 8.06E-08 | NC | 1.90E-06 | NC |
| **Total** | 8.22E-07 | 8.89E-07 | 2.08E-06 | 8.76E-08 |

Notes:
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-2
TOTAL POTENTIAL HAZARD INDEX
INDOOR WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Site G Groundwater Inhalation HQ | Site H Groundwater Inhalation HQ | Site J Groundwater Inhalation HQ | Site L Groundwater Inhalation HQ |
|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | 2.30E-03 | NC | NC | NC |
| Benzene | 1.46E-01 | 9.06E-02 | 2.93E-02 | 1.75E-03 |
| Chlorobenzene | 2.96E-02 | 3.09E-02 | 5.94E-02 | NC |
| Chloroform | NC | 2.75E-01 | NC | 4.86E-02 |
| Ethylbenzene | NC | 4.34E-04 | NC | NC |
| Naphthalene | 1.48E-02 | 1.69E-02 | NC | NC |
| Tetrachloroethene | 2.08E-04 | NC | NC | NC |
| Toluene | 5.16E-03 | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC |
| Vinyl chloride | 5.13E-04 | NC | 1.21E-02 | NC |
| **Total HI** | 1.98E-01 | 4.14E-01 | 1.01E-01 | 5.04E-02 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-3
TOTAL POTENTIAL CARCINOGENIC RISK
OUTDOOR WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | | Transect 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC | 8.99E-07 | 6.45E-09 | 9.06E-07 |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | 7.98E-08 | 2.32E-11 | 7.98E-08 | 1.07E-06 | 3.12E-10 | 1.07E-06 | 1.11E-06 | 3.21E-10 | 1.11E-06 | 6.45E-07 | 1.87E-10 | 6.45E-07 |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | 7.06E-08 | 2.05E-11 | 7.06E-08 | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total** | 7.98E-08 | 2.32E-11 | 7.98E-08 | 1.15E-06 | 3.32E-10 | 1.15E-06 | 1.11E-06 | 3.21E-10 | 1.11E-06 | 1.54E-06 | 6.64E-09 | 1.55E-06 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-3
TOTAL POTENTIAL CARCINOGENIC RISK
OUTDOOR WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | 1.73E-09 | 1.73E-09 | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 3.84E-06 | 4.13E-08 | NC | 3.88E-06 | NC | NC | NC | NC | 2.22E-06 | 1.59E-08 | NC | 2.24E-06 |
| Benzene | 3.66E-08 | NC | NC | 3.66E-08 | 3.66E-08 | NC | NC | 3.14E-08 | 3.14E-08 | NC | NC | 2.62E-10 | 2.62E-10 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | 6.75E-07 | 3.84E-10 | NC | 6.76E-07 | 2.15E-06 | 6.23E-10 | NC | 2.15E-06 |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 4.52E-08 | 4.52E-08 | NC | NC | NC | NC | NC | NC | 2.53E-09 | 2.53E-09 |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | 3.99E-07 | 1.16E-10 | NC | 3.99E-07 |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 1.02E-09 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | 1.47E-05 | 8.40E-09 | NC | 1.47E-05 | 1.35E-04 | 1.01E-07 | NC | 1.36E-04 | NC | NC | NC | NC |
| Total PCBs | NC | 3.57E-07 | 1.31E-10 | NC | 3.57E-07 | 2.85E-05 | 1.37E-08 | NC | 2.85E-05 | 2.51E-07 | 6.15E-11 | NC | 2.51E-07 |
| Trichloroethene | 3.47E-09 | NC | NC | 1.43E-09 | 1.43E-09 | NC | NC | 1.31E-08 | 1.31E-08 | NC | NC | NC | NC |
| Vinyl chloride | 1.20E-08 | NC | NC | NC | NC | NC | NC | 1.20E-06 | 1.20E-06 | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total** | 5.32E-08 | 1.89E-05 | 4.99E-08 | 8.50E-08 | 1.90E-05 | 1.65E-04 | 1.15E-07 | 1.25E-06 | 1.66E-04 | 5.02E-06 | 1.67E-08 | 2.79E-09 | 5.04E-06 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-4
TOTAL POTENTIAL HAZARD INDEX
OUTDOOR WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | | Transect 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC | 5.59E-03 | NC | 5.59E-03 |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | NC | NC | NC | NC | NC | NC | NC | NC | NC | 5.59E-03 | NC | 5.59E-03 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
HI - Hazard Index.
HQ - Hazard Quotient.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-4
TOTAL POTENTIAL HAZARD INDEX
OUTDOOR WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | 3.96E-05 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 2.39E-02 | NC | NC | 2.39E-02 | NC | NC | NC | NC | 1.38E-02 | NC | NC | 1.38E-02 |
| Benzene | 7.84E-03 | NC | NC | 7.84E-03 | 7.84E-03 | NC | NC | 6.72E-03 | 6.72E-03 | NC | NC | 5.60E-05 | 5.60E-05 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | 1.58E-03 | NC | NC | 2.67E-03 | 2.67E-03 | NC | NC | 1.35E-02 | 1.35E-02 | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 2.77E-02 | 2.77E-02 | NC | NC | NC | NC | NC | NC | 1.55E-03 | 1.55E-03 |
| Copper | NC | NC | NC | NC | NC | 1.31E-01 | NC | NC | 1.31E-01 | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | 3.99E-05 | 3.99E-05 | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | 7.66E-04 | NC | NC | 1.44E-03 | 1.44E-03 | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 1.25E-05 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | 2.84E-04 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | 2.50E-02 | NC | NC | 2.50E-02 | 1.99E+00 | NC | NC | 1.99E+00 | 1.76E-02 | NC | NC | 1.76E-02 |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | 7.66E-05 | NC | NC | NC | NC | NC | NC | 7.66E-03 | 7.66E-03 | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | 1.06E-02 | 4.89E-02 | NC | 3.97E-02 | 8.85E-02 | 2.12E+00 | NC | 2.79E-02 | 2.15E+00 | 3.14E-02 | NC | 1.61E-03 | 3.30E-02 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
HI - Hazard Index.
HQ - Hazard Quotient.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-5
TOTAL POTENTIAL CARCINOGENIC RISK
CONSTRUCTION WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | 4.02E-09 | 4.91E-11 | 4.06E-09 | NC | NC | NC |
| Benzo(a)pyrene | 1.77E-09 | 2.16E-11 | 1.79E-09 | 2.38E-08 | 2.91E-10 | 2.41E-08 | 2.45E-08 | 3.00E-10 | 2.48E-08 |
| Benzo(b)fluoranthene | NC | NC | NC | 2.25E-09 | 2.75E-11 | 2.27E-09 | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | 3.54E-09 | 4.33E-11 | 3.58E-09 | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total Risk** | 1.77E-09 | 2.16E-11 | 1.79E-09 | 3.36E-08 | 4.11E-10 | 3.40E-08 | 2.45E-08 | 3.00E-10 | 2.48E-08 |

Notes:
ing/derm - Ingestion/Dermal.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-5
TOTAL POTENTIAL CARCINOGENIC RISK
CONSTRUCTION WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 7 | | | Site G | | | Site H | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | 1.57E-10 | 1.27E-08 | 1.29E-08 |
| 1,4-Dichlorobenzene | NC | NC | NC | 8.06E-09 | NC | 8.06E-09 | NC | NC | 2.69E-08 | NC | 2.69E-08 |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | 2.59E-09 | NC | 2.59E-09 |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | 9.98E-09 | NC | 9.98E-09 | NC | NC | 3.45E-10 | NC | 3.45E-10 |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | 1.54E-08 | 6.03E-09 | 2.14E-08 | NC | NC | NC | 6.58E-08 | 2.58E-08 | 1.93E-08 | NC | 1.11E-07 |
| Benzene | NC | NC | NC | 1.64E-08 | 1.78E-07 | 1.94E-07 | NC | NC | 1.62E-08 | 1.75E-07 | 1.91E-07 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | 1.43E-08 | 1.75E-10 | 1.45E-08 | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | 7.06E-11 | NC | 7.06E-11 | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | 5.26E-11 | NC | 5.26E-11 |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | 1.68E-10 | 1.38E-07 | 1.39E-07 |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | 3.11E-09 | NC | 3.11E-09 |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | NC | 9.73E-07 | NC | 9.73E-07 | NC | NC | 2.42E-06 | NC | 2.42E-06 |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | 2.72E-09 | 1.83E-09 | 4.56E-09 | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | 8.89E-06 | NC | 8.89E-06 | 3.56E-07 | 5.23E-09 | 2.26E-07 | NC | 5.87E-07 |
| Total PCBs | NC | NC | NC | NC | NC | NC | 7.37E-09 | 8.16E-11 | NC | NC | 7.45E-09 |
| Trichloroethene | NC | NC | NC | 2.40E-10 | 3.51E-08 | 3.54E-08 | NC | NC | 5.93E-11 | 8.69E-09 | 8.75E-09 |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | 1.62E-09 | 4.46E-09 | 6.08E-09 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total Risk** | 2.97E-08 | 6.21E-09 | 3.59E-08 | 9.90E-06 | 2.19E-07 | 1.01E-05 | 4.30E-07 | 3.11E-08 | 2.71E-06 | 3.35E-07 | 3.51E-06 |

Notes:
ing/derm - Ingestion/Dermal.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-5
TOTAL POTENTIAL CARCINOGENIC RISK
CONSTRUCTION WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site I | | | | | Site L | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | 1.09E-07 | NC | 1.09E-07 | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | 5.62E-10 | NC | 5.62E-10 | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | 1.24E-09 | NC | 1.24E-09 | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | 3.80E-08 | 1.49E-08 | 2.00E-07 | NC | 2.53E-07 |
| Benzene | NC | NC | 4.68E-09 | 5.06E-08 | 5.53E-08 | NC | NC | 5.70E-10 | 4.10E-09 | 4.67E-09 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | 1.50E-08 | 1.83E-10 | NC | NC | 1.52E-08 | 4.76E-08 | 5.82E-10 | NC | NC | 4.82E-08 |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | 3.27E-10 | NC | 3.27E-10 | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | 9.80E-11 | NC | 9.80E-11 | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | 1.49E-10 | NC | 1.49E-10 | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | 9.00E-11 | 4.95E-08 | 4.96E-08 |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | 8.85E-09 | 1.08E-10 | NC | NC | 8.96E-09 |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | 4.37E-10 | NC | 4.37E-10 | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | 1.98E-09 | NC | 1.98E-09 | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | 1.22E-07 | NC | 1.22E-07 | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | 3.29E-06 | 4.83E-08 | 4.55E-06 | NC | 7.89E-06 | NC | NC | NC | NC | NC |
| Total PCBs | 5.88E-07 | 6.51E-09 | 2.86E-08 | NC | 6.23E-07 | 5.19E-09 | 5.74E-11 | NC | NC | 5.24E-09 |
| Trichloroethene | NC | NC | 1.08E-10 | 1.58E-08 | 1.59E-08 | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | 2.38E-08 | 6.59E-08 | 8.97E-08 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total Risk** | 3.89E-06 | 5.50E-08 | 4.84E-06 | 1.32E-07 | 8.92E-06 | 9.97E-08 | 1.56E-08 | 2.00E-07 | 5.36E-08 | 3.69E-07 |

Notes:
ing/derm - Ingestion/Dermal.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-6
TOTAL POTENTIAL HAZARD INDEX
CONSTRUCTION WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | NC | NC | NC | NC | NC | NC | NC | NC | NC |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient
ing/derm - Ingestion/Dermal.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-6
TOTAL POTENTIAL HAZARD INDEX
ONSTRUCTION WORKER - RME
AUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 7 | | | Site G | | | Site H | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | 9.15E-07 | NC | 9.15E-07 |
| 1,4-Dichlorobenzene | NC | NC | NC | 7.84E-04 | NC | 7.84E-04 | NC | NC | 2.61E-03 | NC | 2.61E-03 |
| 2,4,5-TP (Silvex) | NC | NC | NC | 8.13E-05 | NC | 8.13E-05 | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | 1.28E-02 | NC | 1.28E-02 | NC | NC | 1.32E-03 | NC | 1.32E-03 |
| 2-Chlorophenol | NC | NC | NC | 6.86E-04 | NC | 6.86E-04 | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | 2.40E-04 | NC | 2.40E-04 | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | 2.10E-02 | NC | 2.10E-02 | NC | NC | 2.20E-03 | NC | 2.20E-03 |
| 4-Methyl-2-pentanone | NC | NC | NC | 3.02E-05 | 8.55E-02 | 8.55E-02 | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | 2.94E-04 | NC | 2.94E-04 |
| Arsenic | 2.39E-03 | NC | 2.39E-03 | NC | NC | NC | 1.02E-02 | NC | 3.01E-03 | NC | 1.32E-02 |
| Benzene | NC | NC | NC | 2.56E-02 | 9.50E-01 | 9.76E-01 | NC | NC | 2.52E-02 | 9.35E-01 | 9.60E-01 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | 4.55E-03 | 3.37E-01 | 3.41E-01 | NC | NC | 5.14E-03 | 3.80E-01 | 3.85E-01 |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | 1.92E-04 | 2.12E+00 | 2.12E+00 |
| cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | 4.41E-04 | NC | 4.41E-04 | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | 5.92E-04 | 2.29E-03 | 2.89E-03 |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | 1.84E-03 | NC | 1.84E-03 |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | 6.50E-05 | NC | 6.50E-05 | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | 3.82E-03 | 9.93E-01 | 9.97E-01 | NC | NC | 3.83E-03 | 9.95E-01 | 9.99E-01 |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | 4.16E-04 | NC | 4.16E-04 |
| Pentachlorophenol | NC | NC | NC | 1.89E-02 | NC | 1.89E-02 | NC | NC | 4.70E-02 | NC | 4.70E-02 |
| Phenol | NC | NC | NC | 7.31E-05 | NC | 7.31E-05 | NC | NC | 1.60E-06 | NC | 1.60E-06 |
| Tetrachloroethene | NC | NC | NC | 3.67E-04 | 5.63E-04 | 9.29E-04 | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | 8.61E-04 | 3.08E-02 | 3.16E-02 | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | 1.29E-02 | NC | NC | NC | 1.29E-02 |
| Trichloroethene | NC | NC | NC | 2.54E-04 | NC | 2.54E-04 | NC | NC | 6.29E-05 | NC | 6.29E-05 |
| Vanadium | NC | NC | NC | 6.36E-05 | NC | 6.36E-05 | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | 5.24E-05 | 7.10E-04 | 7.62E-04 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | 2.39E-03 | NC | 2.39E-03 | 9.06E-02 | 2.40E+00 | 2.49E+00 | 2.31E-02 | NC | 9.37E-02 | 4.43E+00 | 4.55E+00 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient
ing/derm - Ingestion/Dermal.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-6
TOTAL POTENTIAL HAZARD INDEX
CONSTRUCTION WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site I | | | | | Site L | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | 1.06E-02 | NC | 1.06E-02 | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | 2.77E-04 | NC | 2.77E-04 |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | 3.40E-03 | NC | 3.40E-03 | NC | NC | 1.41E-04 | NC | 1.41E-04 |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | 5.92E-03 | NC | 3.10E-02 | NC | 3.70E-02 |
| Benzene | NC | NC | 7.28E-03 | 2.71E-01 | 2.78E-01 | NC | NC | 8.86E-04 | 2.19E-02 | 2.28E-02 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | 1.27E-03 | NC | 1.27E-03 | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | 7.91E-03 | 5.85E-01 | 5.93E-01 | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | 1.03E-04 | 7.58E-01 | 7.58E-01 |
| Cis/Trans-1,2-Dichloroethene | NC | NC | 4.28E-04 | NC | 4.28E-04 | NC | NC | NC | NC | NC |
| Copper | 5.57E-02 | NC | NC | NC | 5.57E-02 | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | 1.36E-05 | NC | 1.36E-05 | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | 1.17E-03 | NC | 1.17E-03 | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | 4.84E-04 | NC | 4.84E-04 | NC | NC | 6.70E-02 | NC | 6.70E-02 |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | 2.37E-03 | NC | 2.37E-03 | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | 1.03E+00 | NC | 5.01E-02 | NC | 1.08E+00 | 9.08E-03 | NC | NC | NC | 9.08E-03 |
| Trichloroethene | NC | NC | 1.14E-04 | NC | 1.14E-04 | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | 7.73E-04 | 1.05E-02 | 1.13E-02 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | 1.01E-04 | NC | 1.01E-04 | NC | NC | NC | NC | NC |
| **Total HI** | 1.08E+00 | NC | 8.60E-02 | 8.66E-01 | 2.04E+00 | 1.50E-02 | NC | 9.94E-02 | 7.80E-01 | 8.95E-01 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient
ing/derm - Ingestion/Dermal.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-7
TOTAL POTENTIAL CARCINOGENIC RISK
TRESPASSING TEEN - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | 2.90E-11 | 2.90E-11 | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 6.88E-07 | 6.95E-10 | NC | 6.88E-07 | NC | NC | NC | NC | 3.98E-07 | 2.68E-10 | NC | 3.98E-07 |
| Benzene | 6.16E-10 | NC | NC | 6.16E-10 | 6.16E-10 | NC | NC | 5.28E-10 | 5.28E-10 | NC | NC | 4.40E-12 | 4.40E-12 |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | 1.17E-07 | 6.46E-12 | NC | 1.17E-07 | 3.71E-07 | 1.05E-11 | NC | 3.71E-07 |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 7.59E-10 | 7.59E-10 | NC | NC | NC | NC | NC | NC | 4.25E-11 | 4.25E-11 |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | 6.89E-08 | 1.95E-12 | NC | 6.89E-08 |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 1.71E-11 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | 2.49E-06 | 1.41E-10 | NC | 2.49E-06 | 2.30E-05 | 1.70E-09 | NC | 2.30E-05 | NC | NC | NC | NC |
| Total PCBs | NC | 6.22E-08 | 2.20E-12 | NC | 6.22E-08 | 4.97E-06 | 2.30E-10 | NC | 4.97E-06 | 4.38E-08 | 1.03E-12 | NC | 4.38E-08 |
| Trichloroethene | 5.83E-11 | NC | NC | 2.40E-11 | 2.40E-11 | NC | NC | 2.19E-10 | 2.19E-10 | NC | NC | NC | NC |
| Vinyl chloride | 2.02E-10 | NC | NC | NC | NC | NC | NC | 2.02E-08 | 2.02E-08 | NC | NC | NC | NC |
| **Total Risk** | 8.94E-10 | 3.24E-06 | 8.38E-10 | 1.43E-09 | 3.24E-06 | 2.81E-05 | 1.94E-09 | 2.10E-08 | 2.81E-05 | 8.81E-07 | 2.82E-10 | 4.69E-11 | 8.81E-07 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
RME - Reasonable Maximum Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-8
TOTAL POTENTIAL HAZARD INDEX
TRESPASSING TEEN - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | 1.51E-06 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 9.72E-03 | NC | NC | 9.72E-03 | NC | NC | NC | NC | 5.62E-03 | NC | NC | 5.62E-03 |
| Benzene | 3.00E-04 | NC | NC | 3.00E-04 | 3.00E-04 | NC | NC | 2.57E-04 | 2.57E-04 | NC | NC | 2.14E-06 | 2.14E-06 |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | 6.05E-05 | NC | NC | 1.02E-04 | 1.02E-04 | NC | NC | 5.16E-04 | 5.16E-04 | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 1.06E-03 | 1.06E-03 | NC | NC | NC | NC | NC | NC | 5.92E-05 | 5.92E-05 |
| Copper | NC | NC | NC | NC | NC | 5.33E-02 | NC | NC | 5.33E-02 | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | 1.53E-06 | 1.53E-06 | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | 2.93E-05 | NC | NC | 5.52E-05 | 5.52E-05 | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 4.79E-07 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | 1.08E-05 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | 9.90E-03 | NC | NC | 9.90E-03 | 7.90E-01 | NC | NC | 7.90E-01 | 6.97E-03 | NC | NC | 6.97E-03 |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | 2.93E-06 | NC | NC | NC | NC | NC | NC | 2.93E-04 | 2.93E-04 | NC | NC | NC | NC |
| **Total** | 4.05E-04 | 1.96E-02 | NC | 1.52E-03 | 2.11E-02 | 8.43E-01 | NC | 1.07E-03 | 8.44E-01 | 1.26E-02 | NC | 6.14E-05 | 1.27E-02 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
Ing/Derm - Ingestion/Dermal Contact.
RME - Reasonable Maximum Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-9
TOTAL POTENTIAL CARCINOGENIC RISK
RECREATIONAL TEEN - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dead Creek and Borrow Pit Lake Sediment | | |
|---|---|---|---|
| | Wading | Swimming | Total Risk |
| Arsenic | 2.05E-07 | 1.03E-07 | 3.08E-07 |
| Total PCBs | 9.70E-08 | 4.85E-08 | 1.45E-07 |
| **Total Risk** | 3.02E-07 | 1.51E-07 | 4.53E-07 |

Notes:
RME - Reasonable Maximum Exposure.
(a) - Based on exposure scenario assumptions, Swimming potential risk is equal to 1/2 wading potential risk.

TABLE 6-10
TOTAL POTENTIAL HAZARD INDEX
RECREATIONAL TEEN - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dead Creek and Borrow Pit Lake Sediment | | |
|---|---|---|---|
| | Wading | Swimming | Total HQ |
| Arsenic | 2.90E-03 | 1.45E-03 | 4.35E-03 |
| Total PCBs | 1.54E-02 | 7.71E-03 | 2.31E-02 |
| **Total HI** | 1.83E-02 | 9.16E-03 | 2.75E-02 |

Notes:
HQ - Hazard Quotient.
HI - Hazard Index.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.
(a) - Based on exposure scenario assumptions, Swimming potential risk is equal to 1/2 wading potential risk.

TABLE 6-11
TOTAL POTENTIAL CARCINOGENIC RISK
RECREATIONAL FISHER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Dead Creek and Borrow Pit Lake | | |
|---|---|---|---|
| **Constituent** | **Sediment** | **Fish** | **Total Risk** |
| Arsenic | 3.42E-07 | 3.31E-05 | 3.34E-05 |
| Total PCBs | 2.41E-07 | NC | 2.41E-07 |
| **Total Risk** | 5.83E-07 | 3.31E-05 | 3.36E-05 |

Notes:
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-12
TOTAL POTENTIAL HAZARD INDEX
RECREATIONAL FISHER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dead Creek and Borrow Pit Lake | | |
|---|---|---|---|
| | Sediment | Fish | Total HQ |
| Arsenic | 1.78E-03 | 1.71E-01 | 1.73E-01 |
| Total PCBs | 1.40E-02 | NC | 1.40E-02 |
| **Total HI** | 1.58E-02 | 1.71E-01 | 1.87E-01 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-13
TOTAL POTENTIAL CARCINOGENIC RISK
RESIDENTIAL RECEPTORS - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site N | | | Transect 3 | | | Transect 4 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Total Risk** |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | 1.27E-06 | 4.66E-11 | 1.27E-06 |
| Benzo(a)pyrene | 9.74E-07 | 5.36E-11 | 9.74E-07 | 7.68E-07 | 2.82E-11 | 7.68E-07 | 1.03E-05 | 3.80E-10 | 1.03E-05 |
| Benzo(b)fluoranthene | NC | NC | NC | 1.18E-07 | 4.34E-12 | 1.18E-07 | 8.30E-07 | 3.05E-11 | 8.30E-07 |
| Dibenzo(a,h)anthracene | 3.25E-07 | 1.79E-11 | 3.25E-07 | 2.95E-07 | 1.08E-11 | 2.95E-07 | 6.79E-07 | 2.49E-11 | 6.79E-07 |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | 2.82E-07 | 1.04E-11 | 2.82E-07 |
| **Total:** | 1.30E-06 | 7.15E-11 | 1.30E-06 | 1.18E-06 | 4.34E-11 | 1.18E-06 | 1.34E-05 | 4.92E-10 | 1.34E-05 |

Notes:
NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-13
TOTAL POTENTIAL CARCINOGENIC RISK
RESIDENTIAL RECEPTORS - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 5 | | | Transect 6 | | | Transect 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Produce** | **Total Risk** |
| Arsenic | NC | NC | NC | NC | NC | NC | 8.09E-06 | 7.86E-09 | 5.33E-05 | 6.14E-05 |
| Benzo(a)anthracene | NC | NC | NC | 1.24E-06 | 4.56E-11 | 1.24E-06 | 5.61E-07 | 2.06E-11 | NC | 5.61E-07 |
| Benzo(a)pyrene | 1.00E-06 | 3.69E-11 | 1.00E-06 | 1.06E-05 | 3.90E-10 | 1.06E-05 | 6.20E-06 | 2.28E-10 | NC | 6.20E-06 |
| Benzo(b)fluoranthene | NC | NC | NC | 1.30E-06 | 4.77E-11 | 1.30E-06 | 6.49E-07 | 2.39E-11 | NC | 6.50E-07 |
| Dibenzo(a,h)anthracene | 5.61E-07 | 2.06E-11 | 5.61E-07 | 9.74E-07 | 3.58E-11 | 9.74E-07 | 5.90E-07 | 2.17E-11 | NC | 5.90E-07 |
| Dieldrin | 1.95E-06 | 5.63E-11 | 1.95E-06 | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | 1.74E-07 | 6.40E-12 | 1.74E-07 | 1.86E-07 | 6.83E-12 | NC | 1.86E-07 |
| **Total:** | 3.52E-06 | 1.14E-10 | 3.52E-06 | 1.43E-05 | 5.26E-10 | 1.43E-05 | 1.63E-05 | 8.16E-09 | 5.33E-05 | 6.96E-05 |

Notes:
NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-14
TOTAL POTENTIAL HAZARD INDEX
RESIDENTIAL RECEPTORS - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site N | | | Transect 3 | | | Transect 4 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Total HQ** |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI:** | NC | NC | NC | NC | NC | NC | NC | NC | NC |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-14
TOTAL POTENTIAL HAZARD INDEX
RESIDENTIAL RECEPTORS - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 5 | | | Transect 6 | | | Transect 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Produce** | **Total HQ** |
| Arsenic | NC | NC | NC | NC | NC | NC | 1.46E-01 | NC | 5.13E-02 | 1.97E-01 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | 1.96E-02 | NC | 1.96E-02 | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI:** | 1.96E-02 | NC | 1.96E-02 | NC | NC | NC | 1.46E-01 | NC | 5.13E-02 | 1.97E-01 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.
RME - Reasonable Maximum Exposure.

TABLE 6-15
TOTAL POTENTIAL CARCINOGENIC RISK
INDOOR WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Site G Groundwater Inhalation Risk | Site H Groundwater Inhalation Risk | Site I Groundwater Inhalation Risk | Site L Groundwater Inhalation Risk |
|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | NC | 3.56E-10 | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC |
| Benzene | 2.68E-08 | 2.68E-08 | 8.02E-09 | 2.54E-10 |
| Chlorobenzene | NC | NC | NC | NC |
| Chloroform | NC | 1.96E-08 | NC | 2.70E-09 |
| Ethylbenzene | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC |
| Tetrachloroethene | 3.51E-10 | 2.24E-10 | NC | NC |
| Toluene | NC | NC | NC | NC |
| Trichloroethene | 7.61E-10 | NC | 1.06E-09 | NC |
| Vinyl chloride | 2.93E-09 | NC | 5.04E-08 | NC |
| **Total** | 3.09E-08 | 4.70E-08 | 5.95E-08 | 2.95E-09 |

Notes:
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-16
TOTAL POTENTIAL HAZARD INDEX
INDOOR WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Site G Groundwater Inhalation HQ | Site H Groundwater Inhalation HQ | Site I Groundwater Inhalation HQ | Site L Groundwater Inhalation HQ |
|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | 1.44E-04 | NC | NC | NC |
| Benzene | 2.05E-02 | 2.05E-02 | 6.12E-03 | 1.94E-04 |
| Chlorobenzene | 1.96E-03 | 5.32E-03 | 6.58E-03 | NC |
| Chloroform | NC | 4.30E-02 | NC | 5.91E-03 |
| Ethylbenzene | NC | 6.62E-05 | NC | NC |
| Naphthalene | 9.77E-04 | 2.30E-03 | NC | NC |
| Tetrachloroethene | 1.54E-05 | 9.82E-06 | NC | NC |
| Toluene | 3.21E-04 | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC |
| Vinyl chloride | 6.66E-05 | NC | 1.15E-03 | NC |
| **Total HI** | 2.40E-02 | 7.11E-02 | 1.38E-02 | 6.10E-03 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-17
TOTAL POTENTIAL CARCINOGENIC RISK
OUTDOOR WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | | Transect 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC | 1.01E-07 | 7.53E-10 | 1.02E-07 |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | 7.46E-09 | 2.13E-12 | 7.47E-09 | 3.21E-08 | 9.19E-12 | 3.22E-08 | 2.75E-08 | 7.85E-12 | 2.75E-08 | 2.04E-08 | 5.83E-12 | 2.04E-08 |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | 7.08E-09 | 2.03E-12 | 7.08E-09 | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total** | 7.46E-09 | 2.13E-12 | 7.47E-09 | 3.92E-08 | 1.12E-11 | 3.92E-08 | 2.75E-08 | 7.85E-12 | 2.75E-08 | 1.21E-07 | 7.59E-10 | 1.22E-07 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-17
TOTAL POTENTIAL CARCINOGENIC RISK
OUTDOOR WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | 6.64E-11 | 6.64E-11 | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 2.31E-07 | 2.58E-09 | NC | 2.33E-07 | NC | NC | NC | NC | 3.37E-07 | 2.51E-09 | NC | 3.39E-07 |
| Benzene | 5.50E-10 | NC | NC | 1.24E-09 | 1.24E-09 | NC | NC | 3.62E-10 | 3.62E-10 | NC | NC | 1.37E-11 | 1.37E-11 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | 3.43E-08 | 1.92E-11 | NC | 3.43E-08 | 1.25E-07 | 3.58E-11 | NC | 1.25E-07 |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 8.22E-10 | 8.22E-10 | NC | NC | NC | NC | NC | NC | 1.36E-10 | 1.36E-10 |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | 2.48E-08 | 7.09E-12 | NC | 2.48E-08 |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 2.02E-11 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | 1.09E-06 | 6.02E-10 | NC | 1.09E-06 | 6.83E-06 | 4.94E-09 | NC | 6.84E-06 | NC | NC | NC | NC |
| Total PCBs | NC | 2.71E-08 | 9.95E-12 | NC | 2.71E-08 | 1.28E-06 | 6.17E-10 | NC | 1.28E-06 | 2.01E-08 | 4.93E-12 | NC | 2.01E-08 |
| Trichloroethene | 5.71E-11 | NC | NC | NC | NC | NC | NC | 6.78E-11 | 6.78E-11 | NC | NC | NC | NC |
| Vinyl chloride | 4.21E-10 | NC | NC | NC | NC | NC | NC | 6.50E-09 | 6.50E-09 | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total** | 1.05E-09 | 1.35E-06 | 3.19E-09 | 2.13E-09 | 1.35E-06 | 8.15E-06 | 5.57E-09 | 6.93E-09 | 8.16E-06 | 5.07E-07 | 2.56E-09 | 1.50E-10 | 5.10E-07 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-18
TOTAL POTENTIAL HAZARD INDEX
OUTDOOR WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | | Transect 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC | 2.25E-03 | NC | 2.25E-03 |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | NC | NC | NC | NC | NC | NC | NC | NC | NC | 2.25E-03 | NC | 2.25E-03 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
HI - Hazard Index.
HQ - Hazard Quotient.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-18
TOTAL POTENTIAL HAZARD INDEX
OUTDOOR WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | 2.45E-06 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 5.12E-03 | NC | NC | 5.12E-03 | NC | NC | NC | NC | 7.48E-03 | NC | NC | 7.48E-03 |
| Benzene | 4.20E-04 | NC | NC | 9.45E-04 | 9.45E-04 | NC | NC | 2.76E-04 | 2.76E-04 | NC | NC | 1.05E-05 | 1.05E-05 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | 1.01E-04 | NC | NC | 2.50E-04 | 2.50E-04 | NC | NC | 3.02E-04 | 3.02E-04 | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 1.80E-03 | 1.80E-03 | NC | NC | NC | NC | NC | NC | 2.97E-04 | 2.97E-04 |
| Copper | NC | NC | NC | NC | NC | 4.03E-02 | NC | NC | 4.03E-02 | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | 3.54E-06 | 3.54E-06 | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | 4.86E-05 | NC | NC | 1.04E-04 | 1.04E-04 | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 8.87E-07 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | 1.67E-05 | NC | NC | 6.26E-07 | 6.26E-07 | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | 6.77E-03 | NC | NC | 6.77E-03 | 3.21E-01 | NC | NC | 3.21E-01 | 5.02E-03 | NC | NC | 5.02E-03 |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | 9.58E-06 | NC | NC | NC | NC | NC | NC | 1.48E-04 | 1.48E-04 | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | 5.99E-04 | 1.19E-02 | NC | 3.10E-03 | 1.50E-02 | 3.61E-01 | NC | 7.26E-04 | 3.62E-01 | 1.25E-02 | NC | 3.08E-04 | 1.28E-02 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
HI - Hazard Index.
HQ - Hazard Quotient.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-19
TOTAL POTENTIAL CARCINOGENIC RISK
CONSTRUCTION WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | 3.27E-10 | 3.19E-12 | 3.30E-10 | NC | NC | NC |
| Benzo(a)pyrene | 3.49E-10 | 3.42E-12 | 3.53E-10 | 1.55E-09 | 1.52E-11 | 1.57E-09 | 1.29E-09 | 1.26E-11 | 1.30E-09 |
| Benzo(b)fluoranthene | NC | NC | NC | 2.73E-10 | 2.67E-12 | 2.76E-10 | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | 6.10E-10 | 5.97E-12 | 6.16E-10 | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total Risk** | 3.49E-10 | 3.42E-12 | 3.53E-10 | 2.76E-09 | 2.70E-11 | 2.79E-09 | 1.29E-09 | 1.26E-11 | 1.30E-09 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-19
TOTAL POTENTIAL CARCINOGENIC RISK
CONSTRUCTION WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 7 | | | Site G | | | Site H | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | 7.84E-11 | 3.81E-09 | 3.89E-09 |
| 1,4-Dichlorobenzene | NC | NC | NC | 4.03E-09 | NC | 4.03E-09 | NC | NC | 1.34E-08 | NC | 1.34E-08 |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | 1.30E-09 | NC | 1.30E-09 |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | 4.99E-09 | NC | 4.99E-09 | NC | NC | 1.73E-10 | NC | 1.73E-10 |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | 3.32E-09 | 1.21E-09 | 4.53E-09 | NC | NC | NC | 7.59E-09 | 2.75E-09 | 9.67E-09 | NC | 2.00E-08 |
| Benzene | NC | NC | NC | 8.22E-09 | 5.33E-08 | 6.15E-08 | NC | NC | 8.09E-09 | 5.25E-08 | 6.06E-08 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | 9.54E-10 | 9.33E-12 | 9.63E-10 | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | 3.53E-11 | NC | 3.53E-11 | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | 2.63E-11 | NC | 2.63E |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | N |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | 8.39E-11 | 4.15E-08 | 4.16E-08 |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | 1.56E-09 | NC | 1.56E-09 |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | NC | 2.46E-07 | NC | 2.46E-07 | NC | NC | 9.73E-07 | NC | 9.73E-07 |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | 1.36E-09 | 5.50E-10 | 1.91E-09 | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | 4.45E-06 | NC | 4.45E-06 | 5.70E-08 | 6.44E-10 | 1.13E-07 | NC | 1.70E-07 |
| Total PCBs | NC | NC | NC | NC | NC | NC | 1.16E-09 | 1.06E-11 | NC | NC | 1.17E-09 |
| Trichloroethene | NC | NC | NC | 1.20E-10 | 1.05E-08 | 1.07E-08 | NC | NC | 2.96E-11 | 2.61E-09 | 2.64E-09 |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | 8.08E-10 | 1.34E-09 | 2.15E-09 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total Risk** | 4.28E-09 | 1.22E-09 | 5.49E-09 | 4.71E-06 | 6.57E-08 | 4.78E-06 | 6.57E-08 | 3.41E-09 | 1.12E-06 | 1.00E-07 | 1.29E-06 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-19
TOTAL POTENTIAL CARCINOGENIC RISK
CONSTRUCTION WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site I | | | | | Site L | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | Risk | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | 4.45E-08 | NC | 4.45E-08 | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | 2.81E-10 | NC | 2.81E-10 | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | 6.11E-10 | NC | 6.11E-10 | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | 1.11E-08 | 4.02E-09 | 9.98E-08 | NC | 1.15E-07 |
| Benzene | NC | NC | 2.10E-09 | 1.36E-08 | 1.57E-08 | NC | NC | 2.85E-10 | 1.23E-09 | 1.52E-09 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | 1.60E-09 | 1.57E-11 | NC | NC | 1.62E-09 | 5.87E-09 | 5.74E-11 | NC | NC | 5.92E-09 |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | 1.64E-10 | NC | 1.64E-10 | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | 4.90E-11 | NC | 4.90E-11 | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | 7.45E-11 | NC | 7.45E-11 | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | 4.50E-11 | 1.48E-08 | 1.49E-08 |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | 1.16E-09 | 1.14E-11 | NC | NC | 1.17E-09 |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | 2.19E-10 | NC | 2.19E-10 | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | 9.91E-10 | NC | 9.91E-10 | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | 4.01E-08 | NC | 4.01E-08 | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | 3.57E-07 | 4.03E-09 | 2.28E-06 | NC | 2.64E-06 | NC | NC | NC | NC | NC |
| Total PCBs | 5.49E-08 | 5.04E-10 | 1.43E-08 | NC | 6.98E-08 | 8.60E-10 | 7.89E-12 | NC | NC | 8.68E-10 |
| Trichloroethene | NC | NC | 3.11E-11 | 2.74E-09 | 2.77E-09 | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | 9.21E-09 | 1.53E-08 | 2.45E-08 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total Risk** | 4.14E-07 | 4.55E-09 | 2.39E-06 | 3.16E-08 | 2.84E-06 | 1.90E-08 | 4.10E-09 | 1.00E-07 | 1.61E-08 | 1.39E-07 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-20
TOTAL POTENTIAL HAZARD INDEX
CONSTRUCTION WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 3 | | | Transect 4 | | | Transect 6 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Surface Soil | | Total | Surface Soil | | Total |
| Constituent | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | NC | NC | NC | NC | NC | NC | NC | NC | NC |

Notes:
HQ - Hazard Quotient
HI - Hazard Index.
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-20
TOTAL POTENTIAL HAZARD INDEX
CONSTRUCTION WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 7 | | | Site G | | | Site H | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Total | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | 4.57E-07 | NC | 4.57E-07 |
| 1,4-Dichlorobenzene | NC | NC | NC | 3.92E-04 | NC | 3.92E-04 | NC | NC | 1.31E-03 | NC | 1.31E-03 |
| 2,4,5-TP (Silvex) | NC | NC | NC | 4.06E-05 | NC | 4.06E-05 | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | 6.40E-03 | NC | 6.40E-03 | NC | NC | 6.58E-04 | NC | 6.58E-04 |
| 2-Chlorophenol | NC | NC | NC | 3.43E-04 | NC | 3.43E-04 | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | 1.20E-04 | NC | 1.20E-04 | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | NC | 1.05E-02 | NC | 1.05E-02 | NC | NC | 1.10E-03 | NC | 1.10E-03 |
| 4-Methyl-2-pentanone | NC | NC | NC | 1.51E-05 | 2.56E-02 | 2.57E-02 | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | 1.47E-04 | NC | 1.47E-04 |
| Arsenic | 5.17E-04 | NC | 5.17E-04 | NC | NC | NC | 1.18E-03 | NC | 1.50E-03 | NC | 2.68E-03 |
| Benzene | NC | NC | NC | 1.28E-02 | 2.85E-01 | 2.98E-01 | NC | NC | 1.26E-02 | 2.81E-01 | 2.93E-01 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | NC | 2.28E-03 | 1.01E-01 | 1.03E-01 | NC | NC | 2.57E-03 | 1.14E-01 | 1.17E-01 |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | NC | 9.62E-05 | 6.36E-01 | 6.36E-01 |
| Cis/Trans-1,2-Dichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | 2.21E-04 | NC | 2.21E-04 | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | 2.96E-04 | 6.88E-04 | 9.84E-04 |
| Heptachlor | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | NC | NC | NC | NC | NC | NC | 9.21E-04 | NC | 9.21E-04 |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | 3.25E-05 | NC | 3.25E-05 | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | 1.91E-03 | 2.98E-01 | 3.00E-01 | NC | NC | 1.92E-03 | 2.98E-01 | 3.00E-01 |
| Nickel | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | 2.08E-04 | NC | 2.08E-04 |
| Pentachlorophenol | NC | NC | NC | 4.78E-03 | NC | 4.78E-03 | NC | NC | 1.89E-02 | NC | 1.89E-02 |
| Phenol | NC | NC | NC | 3.65E-05 | NC | 3.65E-05 | NC | NC | 8.00E-07 | NC | 8.00E-07 |
| Tetrachloroethene | NC | NC | NC | 1.83E-04 | 1.69E-04 | 3.52E-04 | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | 4.30E-04 | 9.23E-03 | 9.66E-03 | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | NC | NC | NC | NC | NC | 2.03E-03 | NC | NC | NC | 2.03E-03 |
| Trichloroethene | NC | NC | NC | 1.27E-04 | NC | 1.27E-04 | NC | NC | 3.14E-05 | NC | 3.14E-05 |
| Vanadium | NC | NC | NC | 3.18E-05 | NC | 3.18E-05 | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | NC | 2.62E-05 | 2.13E-04 | 2.39E-04 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI** | 5.17E-04 | NC | 5.17E-04 | 4.06E-02 | 7.19E-01 | 7.60E-01 | 3.21E-03 | NC | 4.23E-02 | 1.33E+00 | 1.38E+00 |

Notes:
HQ - Hazard Quotient
HI - Hazard Index.
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-20
TOTAL POTENTIAL HAZARD INDEX
CONSTRUCTION WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site I | | | | | Site L | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Surface Soil | | Groundwater | | Total | Surface Soil | | Groundwater | | Total |
| Constituent | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | HQ | Ing/Derm. | Inhalation | Ing/Derm. | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 1,4-Dichlorobenzene | NC | NC | 4.33E-03 | NC | 4.33E-03 | NC | NC | NC | NC | NC |
| 2,4,5-TP (Silvex) | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4,6-Trichlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2,4-Dichlorophenol | NC | NC | NC | NC | NC | NC | NC | 1.39E-04 | NC | 1.39E-04 |
| 2-Chlorophenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 2-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 3-Methylphenol/4-Methylphenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4,4-DDE | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Chloroaniline | NC | NC | 1.45E-03 | NC | 1.45E-03 | NC | NC | 7.03E-05 | NC | 7.03E-05 |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Nitroaniline | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| alpha-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Antimony | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | NC | NC | NC | NC | 1.72E-03 | NC | 1.55E-02 | NC | 1.72E-02 |
| Benzene | NC | NC | 3.27E-03 | 7.28E-02 | 7.61E-02 | NC | NC | 4.43E-04 | 6.58E-03 | 7.03E-03 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(k)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| beta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Cadmium | NC | NC | 3.28E-04 | NC | 3.28E-04 | NC | NC | NC | NC | NC |
| Carbazole | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | NC | NC | 2.78E-03 | 1.23E-01 | 1.26E-01 | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | NC | NC | NC | NC | 5.16E-05 | 2.27E-01 | 2.28E-01 |
| Cis/Trans-1,2-Dichloroethene | NC | NC | 1.41E-04 | NC | 1.41E-04 | NC | NC | NC | NC | NC |
| Copper | 9.20E-03 | NC | NC | NC | 9.20E-03 | NC | NC | NC | NC | NC |
| delta-BHC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Heptachlor | NC | NC | 6.81E-06 | NC | 6.81E-06 | NC | NC | NC | NC | NC |
| Heptachlor epoxide | NC | NC | 5.86E-04 | NC | 5.86E-04 | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Lead | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Molybdenum | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Nickel | NC | NC | 1.36E-04 | NC | 1.36E-04 | NC | NC | 3.35E-02 | NC | 3.35E-02 |
| Nitrobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Pentachlorophenol | NC | NC | 7.80E-04 | NC | 7.80E-04 | NC | NC | NC | NC | NC |
| Phenol | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | 9.62E-02 | NC | 2.51E-02 | NC | 1.21E-01 | 1.51E-03 | NC | NC | NC | 1.51E-03 |
| Trichloroethene | NC | NC | 3.30E-05 | NC | 3.30E-05 | NC | NC | NC | NC | NC |
| Vanadium | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | NC | NC | 2.99E-04 | 2.43E-03 | 2.73E-03 | NC | NC | NC | NC | NC |
| Zinc | NC | NC | 2.80E-05 | NC | 2.80E-05 | NC | NC | NC | NC | NC |
| **Total HI** | 1.05E-01 | NC | 3.92E-02 | 1.99E-01 | 3.43E-01 | 3.23E-03 | NC | 4.97E-02 | 2.34E-01 | 2.87E-01 |

Notes:
HQ - Hazard Quotient
HI - Hazard Index.
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-21
TOTAL POTENTIAL CARCINOGENIC RISK
TRESPASSING TEEN - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk | Ing/Derm. | Inhalation | Inhalation | Risk |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | 2.66E-12 | 2.66E-12 | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 6.14E-08 | 1.03E-10 | NC | 6.15E-08 | NC | NC | NC | NC | 8.97E-08 | 1.01E-10 | NC | 8.98E-08 |
| Benzene | 2.20E-11 | NC | NC | 4.95E-11 | 4.95E-11 | NC | NC | 1.45E-11 | 1.45E-11 | NC | NC | 5.50E-13 | 5.50E-13 |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | 8.73E-09 | 7.69E-13 | NC | 8.73E-09 | 3.19E-08 | 1.43E-12 | NC | 3.19E-08 |
| Chlorobenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 3.29E-11 | 3.29E-11 | NC | NC | NC | NC | NC | NC | 5.44E-12 | 5.44E-12 |
| Copper | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | 6.32E-09 | 2.84E-13 | NC | 6.32E-09 |
| Ethylbenzene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 8.10E-13 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | 2.73E-07 | 2.41E-11 | NC | 2.73E-07 | 1.71E-06 | 1.98E-10 | NC | 1.71E-06 | NC | NC | NC | NC |
| Total PCBs | NC | 6.99E-09 | 3.98E-13 | NC | 6.99E-09 | 3.31E-07 | 2.47E-11 | NC | 3.31E-07 | 5.19E-09 | 1.97E-13 | NC | 5.19E-09 |
| Trichloroethene | 2.29E-12 | NC | NC | NC | NC | NC | NC | 2.72E-12 | 2.72E-12 | NC | NC | NC | NC |
| Vinyl chloride | 1.69E-11 | NC | NC | NC | NC | NC | NC | 2.60E-10 | 2.60E-10 | NC | NC | NC | NC |
| **Total Risk** | 4.20E-11 | 3.41E-07 | 1.28E-10 | 8.51E-11 | 3.42E-07 | 2.05E-06 | 2.23E-10 | 2.78E-10 | 2.05E-06 | 1.33E-07 | 1.02E-10 | 5.99E-12 | 1.33E-07 |

Notes:
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-22
TOTAL POTENTIAL HAZARD INDEX
TRESPASSING TEEN - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site G | Site H | | | | Site I | | | | Site L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Groundwater | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total | Surface Soil | | Groundwater | Total |
| Constituent | Inhalation HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ | Ing/Derm. | Inhalation | Inhalation | HQ |
| 1,1,2,2-Tetrachloroethane | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| 4-Methyl-2-pentanone | 6.23E-08 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Arsenic | NC | 8.68E-04 | NC | NC | 8.68E-04 | NC | NC | NC | NC | 1.27E-03 | NC | NC | 1.27E-03 |
| Benzene | 1.07E-05 | NC | NC | 2.41E-05 | 2.41E-05 | NC | NC | 7.04E-06 | 7.04E-06 | NC | NC | 2.67E-07 | 2.67E-07 |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Chlorobenzene | 2.57E-06 | NC | NC | 6.37E-06 | 6.37E-06 | NC | NC | 7.70E-06 | 7.70E-06 | NC | NC | NC | NC |
| Chloroform | NC | NC | NC | 4.58E-05 | 4.58E-05 | NC | NC | NC | NC | NC | NC | 7.58E-06 | 7.58E-06 |
| Copper | NC | NC | NC | NC | NC | 6.84E-03 | NC | NC | 6.84E-03 | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Ethylbenzene | NC | NC | NC | 9.01E-08 | 9.01E-08 | NC | NC | NC | NC | NC | NC | NC | NC |
| Naphthalene | 1.24E-06 | NC | NC | 2.65E-06 | 2.65E-06 | NC | NC | NC | NC | NC | NC | NC | NC |
| Tetrachloroethene | 2.26E-08 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Toluene | 4.25E-07 | NC | NC | 1.60E-08 | 1.60E-08 | NC | NC | NC | NC | NC | NC | NC | NC |
| Total 2,3,7,8-TCDD TEQ | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Total PCBs | NC | 1.11E-03 | NC | NC | 1.11E-03 | 5.27E-02 | NC | NC | 5.27E-02 | 8.25E-04 | NC | NC | 8.25E-04 |
| Trichloroethene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Vinyl chloride | 2.44E-07 | NC | NC | NC | NC | NC | NC | 3.77E-06 | 3.77E-06 | NC | NC | NC | NC |
| **Total** | 1.53E-05 | 1.98E-03 | NC | 7.90E-05 | 2.06E-03 | 5.95E-02 | NC | 1.85E-05 | 5.96E-02 | 2.09E-03 | NC | 7.85E-06 | 2.10E-03 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
Ing/Derm - Ingestion/Dermal Contact.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-23
TOTAL POTENTIAL CARCINOGENIC RISK
RECREATIONAL TEEN - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dead Creek and Borrow Pit Lake Sediment | | |
|---|---|---|---|
| | Wading | Swimming (a) | Total Risk |
| Arsenic | 4.50E-08 | 2.25E-08 | 6.75E-08 |
| Total PCBs | 1.17E-08 | 5.87E-09 | 1.76E-08 |
| **Total Risk** | 5.68E-08 | 2.84E-08 | 8.51E-08 |

Notes:
MLE - Most Likely Exposure.
(a) - Based on exposure scenario assumptions, swimming potential risk is equal to 1/2 wading potential risk.

TABLE 6-24
TOTAL POTENTIAL HAZARD INDEX
RECREATIONAL TEEN - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Dead Creek and Borrow Pit Lake Sediment | | |
|---|---|---|---|
| **Constituent** | **Wading** | **Swimming (a)** | **Total HQ** |
| Arsenic | 6.37E-04 | 3.18E-04 | 9.55E-04 |
| Total PCBs | 1.87E-03 | 9.34E-04 | 2.80E-03 |
| **Total HI** | 2.50E-03 | 1.25E-03 | 3.76E-03 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
(a) - Based on exposure scenario assumptions, swimming potential risk is equal to 1/2 wading potential risk.

TABLE 6-25
TOTAL POTENTIAL CARCINOGENIC RISK
RECREATIONAL FISHER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dead Creek and Borrow Pit Lake | | |
|---|---|---|---|
| | Sediment | Fish | Total Risk |
| Arsenic | 6.54E-09 | 1.24E-06 | 1.25E-06 |
| Total PCBs | 2.69E-09 | NC | 2.69E-09 |
| **Total Risk** | 9.22E-09 | 1.24E-06 | 1.25E-06 |

Notes:
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.
MLE - Most Likely Exposure.

TABLE 6-26
TOTAL POTENTIAL HAZARD INDEX
RECREATIONAL FISHER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Constituent | Dead Creek and Borrow Pit Lake | | |
|---|---|---|---|
| | Sediment | Fish | Total HQ |
| Arsenic | 1.13E-04 | 2.14E-02 | 2.15E-02 |
| Total PCBs | 5.23E-04 | NC | 5.23E-04 |
| **Total HI** | 6.36E-04 | 2.14E-02 | 2.21E-02 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area/medium.

TABLE 6-27
TOTAL POTENTIAL CARCINOGENIC RISK
RESIDENTIAL RECEPTORS - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site N | | | Transect 3 | | | Transect 4 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Total Risk** |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | 2.50E-08 | 4.68E-13 | 2.50E-08 |
| Benzo(a)pyrene | 6.68E-08 | 1.88E-12 | 6.68E-08 | 4.89E-08 | 9.17E-13 | 4.89E-08 | 2.11E-07 | 3.95E-12 | 2.11E-07 |
| Benzo(b)fluoranthene | NC | NC | NC | 5.71E-09 | 1.07E-13 | 5.71E-09 | 2.14E-08 | 4.01E-13 | 2.14E-08 |
| Dibenzo(a,h)anthracene | 2.59E-08 | 7.27E-13 | 2.59E-08 | 2.50E-08 | 4.68E-13 | 2.50E-08 | 4.64E-08 | 8.70E-13 | 4.64E-08 |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | 1.29E-08 | 2.41E-13 | 1.29E-08 |
| **Total:** | 9.27E-08 | 2.60E-12 | 9.27E-08 | 7.96E-08 | 1.49E-12 | 7.96E-08 | 3.16E-07 | 5.93E-12 | 3.16E-07 |

Notes:
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.

TABLE 6-27
TOTAL POTENTIAL CARCINOGENIC RISK
RESIDENTIAL RECEPTORS - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 5 | | | Transect 6 | | | Transect 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Total Risk** | **Surface Soil** | **Inhalation** | **Produce** | **Total Risk** |
| Arsenic | NC | NC | NC | NC | NC | NC | 5.83E-07 | 3.23E-10 | 2.87E-06 | 3.45E-06 |
| Benzo(a)anthracene | NC | NC | NC | 2.16E-08 | 4.05E-13 | 2.16E-08 | 1.22E-08 | 2.29E-13 | NC | 1.22E-08 |
| Benzo(a)pyrene | 4.93E-08 | 9.23E-13 | 4.93E-08 | 1.80E-07 | 3.37E-12 | 1.80E-07 | 1.34E-07 | 2.50E-12 | NC | 1.34E-07 |
| Benzo(b)fluoranthene | NC | NC | NC | 2.26E-08 | 4.24E-13 | 2.26E-08 | 1.45E-08 | 2.72E-13 | NC | 1.45E-08 |
| Dibenzo(a,h)anthracene | 3.52E-08 | 6.60E-13 | 3.52E-08 | 4.21E-08 | 7.90E-13 | 4.21E-08 | 3.68E-08 | 6.89E-13 | NC | 3.68E-08 |
| Dieldrin | 3.38E-08 | 5.49E-13 | 3.38E-08 | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | 7.86E-09 | 1.47E-13 | 7.86E-09 | 8.57E-09 | 1.61E-13 | NC | 8.57E-09 |
| **Total:** | 1.18E-07 | 2.13E-12 | 1.18E-07 | 2.74E-07 | 5.14E-12 | 2.74E-07 | 7.89E-07 | 3.27E-10 | 2.87E-06 | 3.65E-06 |

Notes:
MLE - Most Likely Exposure.
NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.

TABLE 6-28
TOTAL POTENTIAL HAZARD INDEX
RESIDENTIAL RECEPTORS - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site N | | | Transect 3 | | | Transect 4 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Total HQ** |
| Arsenic | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI:** | NC | NC | NC | NC | NC | NC | NC | NC | NC |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
MLE - Most Likely Exposure.

NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.

TABLE 6-28
TOTAL POTENTIAL HAZARD INDEX
RESIDENTIAL RECEPTORS - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Transect 5 | | | Transect 6 | | | Transect 7 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Constituent** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Total HQ** | **Surface Soil** | **Inhalation** | **Produce** | **Total HQ** |
| Arsenic | NC | NC | NC | NC | NC | NC | 3.26E-02 | NC | 9.12E-03 | 4.17E-02 |
| Benzo(a)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(a)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Benzo(b)fluoranthene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dibenzo(a,h)anthracene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Dieldrin | 1.04E-03 | NC | 1.04E-03 | NC | NC | NC | NC | NC | NC | NC |
| Indeno(1,2,3-cd)pyrene | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| **Total HI:** | 1.04E-03 | NC | 1.04E-03 | NC | NC | NC | 3.26E-02 | NC | 9.12E-03 | 4.17E-02 |

Notes:
HI - Hazard Index.
HQ - Hazard Quotient.
MLE - Most Likely Exposure.

NC - Not Calculated, no dose-response value, or not a constituent of potential concern in this area/medium.

# 7.0 SHORT-TERM RISK ASSESSMENT

As discussed in the HHRA workplan (Appendix A), a short term risk assessment has been conducted for the site. Short-term exposure generally poses less of a health risk than longer-term (chronic) exposure to the same environmental concentration of a constituent. Therefore, generally only those constituents that result in risk levels greater than the risk targets in the baseline risk assessment are evaluated for potential short-term health effects. Since short-term health evaluations are not a standard component of most hazardous waste site health evaluations, limited guidance exists for performing these types of evaluations.

The purpose of the short-term risk assessment is to determine if concentrations of constituents at the site are present at high enough concentrations to pose an acute risk to current receptors. A short-term risk may exist where constituent concentrations are greater than 100 times the appropriate screening criteria (direct-contact scenarios only).

## 7.1 Methodology for Selection of Constituents of Potential Concern for Short-Term Exposure

Short-term COPCs (STCOPCs) for the short-term risk assessment were selected through the use of a toxicity screen for an acute scenario, as discussed in the HHRA workplan (Appendix A).

### 7.1.1 Toxicity Screen

The same screening criteria identified in Section 3.1.1.1 were employed for the STCOPC selection. As discussed in the HHRA workplan (Appendix A), the screening criteria were multiplied by 100 and compared to the average concentration. Appendix C presents the screening values used for the residential soil – direct contact screen, the industrial soil – direct contact screen, the groundwater and surface water screen, the air screen, and the fish tissue screen.

#### 7.1.1.1 Screening Methodology

Constituents in an area/medium with average concentrations less than or equal to the screening criteria multiplied by 100 were not included as STCOPCs. Where no STCOPCs are identified for an area/medium, that area/medium is not evaluated in the short-term HHRA.

## 7.2 Hazard Identification

This section presents the results of the STCOPC selection by medium and area.

### 7.2.1 Soils

Data for soils were compared to both residential and industrial direct contact screening values.

#### 7.2.1.1 Residential Scenario Direct Contact Screen

Average constituent concentrations in surface soil in all seven transects and for Site N were compared to residential soil screening values for direct contact multiplied by 100. The comparison is presented in the last column of the screening tables presented in Appendix E.

Transects. No residential scenario STCOPCs were identified in surface soil for the transects.

Sites. No residential scenario STCOPCs were identified in surface soil for Site N.

#### 7.2.1.2 Industrial Scenario Direct Contact Screen

Average constituent concentrations in surface soil and subsurface soil in all transects and surface soil in all sites were compared to industrial screening values for direct contact multiplied by 100. The comparison is presented in the last column of the screening tables presented in Appendix F.

Transects. No industrial scenario STCOPCs were identified in surface soil or subsurface soil for the transects.

Sites. No industrial scenario STCOPCs were identified in surface soil for the fill areas.

#### 7.2.1.3 Soil STCOPC Summary

No direct contact STCOPCs for either a residential or industrial scenario were identified for either the transects or the sites. Therefore, surface and subsurface soils in these areas will not be further evaluated in the short-term risk assessment.

### 7.2.2 Groundwater

The selection of STCOPCs for groundwater was conducted on a location-by-location basis. The screening tables are presented in Appendix H, which lists each well included in the analysis. Screening intervals and/or sample depths are also included where known. The Illinois Class II Groundwater Criteria multiplied by 100 and a comparison of that value to the average concentration in the well are presented in the last two columns of each table.

As noted above and in the HHRA Workplan, a drinking water scenario would only be included in the risk assessment if it was determined that groundwater was being used as a sole source of drinking water for any of the residences in the study area that are downgradient of the fill areas. Private wells in the study area are either not used or are used for outdoor household activities. Moreover, the Villages of Sauget and Cahokia have ordinances in effect that prevent the use of groundwater as a potable water supply source (see Appendix S). Therefore, a drinking water scenario is not included in the short-term risk assessment. STCOPCs were identified to evaluate potential incidental exposures to groundwater (i.e., non-drinking water scenarios), including incidental contact by a construction worker that may excavate to a depth where groundwater would be exposed in the excavation, or potential volatilization of VOCs through the soil column to indoor or outdoor air. As noted above, the groundwater concentrations are compared to TACO Tier 1 Class II Groundwater Remediation Objectives (presented in Appendix C).

A 30-foot bgs excavation depth is assumed as some sewer lines in the area are at that depth. Moreover, volatilization from groundwater through the soil column to indoor and/or outdoor air is generally assumed to occur up to depths of 15 feet bgs (MADEP, 1995). Therefore, wells and or groundwater samples with screening intervals or sample collection depths between 0 and 30 feet bgs were included in the evaluation.

A total of 34 groundwater sampling locations were included in the evaluation. Of these, 19 sampling locations are existing wells from previous investigations (those beginning with EE and EEG designations), 11 are new push sampling locations installed in support of the SSP (those beginning with AA and SGW designations), and four sampling locations are existing residential area non-potable use wells (those beginning with DW designations).

The results of the STCOPC selection for groundwater are presented in Table 7-1. Of the 34 sampling locations, STCOPCs were identified in only six locations from Sites G, H, I, and L. No STCOPCs were identified in the residential (non-potable) wells. Five locations have only one or two STCOPCs identified, and one well (EEG-107, Site G) has seven STCOPCs identified. There appears to be no clear pattern of STCOPCs between locations. A total of nine STCOPCs were identified in the six locations combined. Of these, three are VOCs.

The nine STCOPCs were also evaluated in the chronic risk assessment as chronic COPCs. The groundwater scenarios included in the chronic risk assessment include the following:

- Incidental ingestion and dermal contact (future construction worker)
- Inhalation of VOCs – excavation air (future construction worker)
- Inhalation of VOCs – indoor air (current indoor industrial worker)
- Inhalation of VOCs – outdoor air (current outdoor industrial worker, trespassing teenager)

Concentrations of VOCs in groundwater were used to calculate indoor air, excavation air, and outdoor air concentrations for the above scenarios in Appendices K (indoor air), L (excavation air), and M (outdoor air). These calculated concentrations are compared to 100 times the USEPA Region 9 air PRGs (USEPA, 1999) in Table 7-2. As indicated on the table, air concentrations of all constituents are less than 100 times the USEPA Region 9 air PRGs (which are protective of residential exposure) with the exception of benzene and chloroform in excavation air. Therefore, concentrations of these constituents are compared to short-term air screening levels, as discussed in the HHRA workplan (Appendix A) in Table 7-3. The short-term screening levels were obtained from the following sources:

- Threshold Limit Value (TLVs) and Biological Exposure Indices (BEIs). The American Conference of Governmental Industrial Hygienists (ACGIH, 2000).
- National Institute for Occupational Health and Safety (NIOSH) Pocket Guide to Chemical Hazards. http://www.cdc.gov/niosh/npg/pgdstart.html (NIOSH, 2000).
- Texas Natural Resource Conservation Commission (TNRCC) Effects Screening Levels (ESLs) July 19, 2000 (TNRCC, 2000).

The calculated excavation air concentrations of both benzene and chloroform are below the TLVs and NIOSH short-term air standards (Table 7-3). The concentration of benzene exceeds the short-term TNRCC ESL. Although the excavation air concentration of benzene exceeds the TNRCC short-term standard, this does not necessarily indicate that a short-term risk is present. The TNRCC ESLs are very conservative and the exceedance of the benzene short-term ESL is slight. In addition, the excavation air scenario is a potential future scenario; there are no current excavation trenches at the site.

The six non-VOC STCOPCs were evaluated in the chronic risk assessment in a future construction worker scenario. As indicated on Tables 6-5 and 6-6, none of these six constituents have a potential cancer risk or an HQ that exceeds the target levels. Therefore, it is concluded that neither a chronic nor an acute risk exists for these constituents.

Therefore, it is concluded that concentrations in groundwater are not posing a current short-term risk to receptors at the site.

### 7.2.3 Sediment

Average constituent concentrations in sediment in the combined CS-F/Borrow Pit Lake area were compared to 100 times the residential soil screening values for direct contact. This screen is presented in the last column of the sediment screening table presented in Appendix E.

No STCOPCs were identified in sediment, and sediment is therefore not evaluated further in the short-term risk assessment.

### 7.2.4 Surface Water

Average constituent concentrations in surface water in the combined CS-F/Borrow Pit Lake area were compared to 100 times the screening values for groundwater. The screening table is presented in Appendix I; the comparison of the average concentration to 100 times the screening value is presented in the last column. Based on this screen, no STCOPCs were identified in surface water. Therefore, surface water is not evaluated further in the short-term risk assessment.

### 7.2.5 Fish Fillet

The selection of COPCs for fish fillet samples was conducted on a sample-by-sample basis in Section 3. The screening table is presented in Appendix I. As shown in the table, only one COPC, arsenic, was identified in fish tissue. Arsenic was detected in only one of the three fish tissue samples analyzed for arsenic at a concentration of 0.45 mg/kg. The RBC for fish tissue is 0.002 mg/kg; 100 times this value is 0.2 mg/kg. The arsenic concentration of 0.45 mg/kg is greater than 100 times the RBC. Therefore, arsenic in fish fillet is identified as a STCOPC for the short-term risk assessment.

Arsenic in fish fillet was evaluated in the chronic risk assessment for a recreational fisher. In the RME scenario, it was assumed that a recreational fisher ingests 8 grams of fish per day, every day, for 30 years. The results of the chronic risk assessment for potential carcinogenic effects indicate that the potential risk for the recreational fisher (RME scenario) due to arsenic in fish fillet is $3.3 \times 10^{-5}$ (Table 6-11). This is within the USEPA target risk range of $10^{-6}$ to $10^{-4}$. The results for chronic noncarcinogenic risk assessment indicate that the HQ for ingestion of arsenic in fish fillet is 0.17 (Table 6-12). This is below the USEPA target HQ of 1. It should be noted that the fish tissue samples collected here were analyzed for total arsenic. Arsenic can exist in organic and inorganic forms; the organic forms are less, and in some cases much less, toxic than the inorganic forms (ATSDR, 1998). It is well known that arsenic in aquatic organisms is predominantly present in organic forms; recent quantitative analysis of inorganic and organic forms of arsenic in food stuffs indicates that inorganic arsenic represented less than 1% of total arsenic in freshwater finfish, tuna, saltwater finfish and shrimp (Schoof, et al., 1999). The screening values (USEPA Region 3 RBCs) and the USEPA toxicity values used to evaluate arsenic in fish tissue assume all arsenic is in the inorganic form. Therefore, it is likely that the chronic risk estimates for arsenic in fish tissue greatly overestimate actual risk. In addition, the identification of arsenic as a STCOPC is also not appropriate due to these considerations.

Therefore, based on the results of the risk assessment, it is concluded that a chronic risk is not present for arsenic in fish fillet. Therefore, it is also concluded that a short-term (acute) risk does not exist for arsenic in fish fillet.

### 7.2.6 Air

Ambient air sampling was conducted at Sites G, H, I and L to determine the tendency of site constituents to enter the atmosphere and local wind patterns. At Site G, air samples were collected at two upwind and two downwind locations. At Sites H, I, and L, air samples were collected at one upwind and two downwind locations. Figure 3-7 identifies the ambient air sampling locations.

Air samples were analyzed for VOCs, SVOCs, PCBs, dioxins, and metals. Appendix J (Table J-6) presents the comparison of average air concentrations in air to 100 times the PRGs for ambient air (USEPA, 1999).

Methylene chloride is the only constituent identified as an STCOPC in air. It should be noted that methylene chloride is a common laboratory contaminant, however, review of the field blank data did not clearly indicate a problem with sample collection or analysis. Methylene chloride was identified as a COPC in all four sites. However, the numerical results are sporadic (see Appendix J). For example, in each downwind sample pair, methylene chloride was detected at a high concentration in one sample, and not detected or detected at a much lower concentration in the second downwind sample. As samples were collected from all areas on the same day, such spikes would not be expected. Moreover, methylene chloride was not identified as a COPC in sites soils or groundwater. Therefore, although it is not indicated by the sample blank evaluations, laboratory contamination appears to be the most likely source of methylene chloride in these samples.

As noted in the HHRA Workplan, and because these data represent a single 24-hour snapshot of air quality, they are not used for further risk calculations, and methylene chloride is not considered to be present.

### 7.2.7 Summary of STCOPC

Based on the analysis of short-term risk presented above, it is concluded that no short-term (acute) risks are posed at the site.

TABLE 7-1
SUMMARY OF CONSTITUENTS OF POTENTIAL CONCERN
GROUNDWATER - SHORT TERM EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Site | G | H | | I | | L |
|---|---|---|---|---|---|---|
| **Constituent * Location** | **EEG-107** | **EE-01** | **EE-02** | **AA-I-S1** | **EE-12** | **EEG-109** |
| 1,1,2,2-Tetrachloroethane * | -- | X | -- | -- | -- | -- |
| 2,4-Dichlorophenol | X | -- | -- | -- | -- | -- |
| 4-Chloroaniline | X | -- | -- | X | -- | -- |
| Benzene * | X | -- | -- | -- | -- | -- |
| Chloroform * | -- | -- | X | -- | -- | X |
| delta-BHC | X | -- | -- | -- | -- | -- |
| Pentachlorophenol | X | X | X | -- | -- | -- |
| Phenol | X | -- | -- | -- | -- | -- |
| Total 2,3,7,8-TCDD TEQ | X | -- | -- | -- | X | -- |
| **Total:** | **7** | **2** | **2** | **1** | **1** | **1** |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on this screen.
* Indicates volatile organic compound (VOC).

TABLE 7-2
COMPARISON OF CALCULATED AIR CONCENTRATIONS FOR VOCs TO PRGs
GROUNDWATER - SHORT TERM EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Site | G | | | H | | | | I | | L | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air | Indoor | Outdoor | Excavation (b) | Indoor | Outdoor | Excavation (b) | | | | Indoor | Outdoor | Excavation (b) | | 100 Times |
| Constituent * Location | (a) | (a) | EEG-107 | (a) | (a) | EE-01 | EE-02 | AA-I-S1 | EE-12 | (a) | (a) | EEG-109 | Air PRG (c) | Air PRG (c) |
| **VOCs** | | | | | | | | | | | | | | |
| 1,1,2,2-Tetrachloroethane * | | | -- | 2.24E-07 | 5.50E-08 | 2.80E-04 | -- | -- | -- | | | -- | 3.30E-05 | 3.30E-03 |
| Benzene * | 4.45E-04 | 1.20E-05 | **1.00E-01** | | | -- | -- | -- | -- | | | -- | 2.50E-04 | 2.50E-02 |
| Chloroform * | | | -- | 4.72E-05 | 2.60E-06 | -- | **1.16E-02** | -- | -- | 6.49E-06 | 4.30E-06 | 2.08E-03 | 8.40E-05 | 8.40E-03 |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on the short-term groundwater screen.
PRG - Preliminary Remediation Goal.
VOC -Volatile Organic Compound.
(a) - Calculated based on average groundwater concenentration in this area. Units = mg/m^3.
(b) - Excavation air concentrations calculated based on average concentration in each well. Units = mg/m^3.
(c) - See Appendix C Table C-5 for references. Concentrations greater than 100 times the PRG are shaded.

TABLE 7-3
COMPARISON OF CALCULATED VOC AIR CONCENTRATIONS TO SHORT TERM ACTION LEVELS
GROUNDWATER - SHORT TERM EXPOSURE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Site | G - Excavation Air | H - Excavation Air | TLVs (a) | NIOSH (b) | | TNRCC ESL (c) |
|---|---|---|---|---|---|---|
| Location | EEG-107 | EE-02 | STEL | TWA-STEL | PEL-STEL | Short-term |
| Constituent | (mg/m$^3$) | (mg/m$^3$) | (mg/m$^3$) | (mg/m$^3$) | (mg/m$^3$) | (mg/m$^3$) |
| | | | | | | |
| Benzene | 0.1 (e) | -- | 7.987 | 3.19 | 15.95 | 0.075 |
| Chloroform | -- | 0.0116 | NA | 9.78 (d) | NA | 0.098 |

Notes:
-- This constituent was not identifed as a constituent of potential concern based on the short-term groundwater screen.
Shading indicates that the concentration is above the Long-Term TNRCC ESL.
BEI - Biological Exposure Indices.
ESL - Effects Screening Level.
NIOSH - National Institute for Occupational Health and Safety.
PEL - Permissible Exposure Limit.
STEL - Short-Term Exposure Limit. The concentration to which it is believed that workers can be exposed continuously for a short period without adverse effect. It is defined as a 15-minute TWA exposure which should not be exceeded at any time during the workday, unless otherwise stated.
TLV - Threshold Limit Value.
TNRCC - Texas Natural Resource Conservation Commission.
TWA - Time Weighted Average. Concentration for a 10-hour day and 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect.
VOC - Volatile Organic Compound.
(a) - TLVs and BEIs. The American Conference of Governmental Industrial Hygienists (ACGIH, 2000).
(b) - NIOSH Pocket Guide to Chemical Hazards. http://www.cdc.gov/niosh/npg/pgdstart.html
(c) - TNRCC Effects Screening Levels. July 19, 2000. Short-term indicates a 1 hour averaging period.
(d) - 60-minute STEL.
(e) - Concentration exceeds Short Term (1-hour average) TNRCC ESL.

# 8.0 SUMMARY AND CONCLUSIONS

This report has presented the baseline human health risk assessment (HHRA) and the stream-lined short-term risk assessment for Sauget Area 1, located in Sauget and Cahokia, Illinois. It is Volume II of the RI/SC for Sauget Area 1 (in preparation). The environmental evaluations of Sauget Area 1 are being conducted as an EE/CA for the Sauget Area 1 sites and soil, sediment, surface water and air, and for the RI/FS for Sauget Area 1 groundwater. The HHRA was conducted to satisfy the SOW for the EE/CA and RI/FS (specifically Task 4 Section 2.5 and Task 5 Section 2 of the SOW) provided as an attachment to the AOC entered into by the USEPA and Solutia, as well as to be compliant with the NCP (USEPA, 1990).

The HHRA and the short-term risk assessment were conducted in accordance with the USEPA-approved HHRA Workplan dated June 25, 1999 (including the August 6, 1999 revised pages), which was submitted as Volume 1B of the SSP for Sauget Area 1 (Solutia, 1999). The HHRA Workplan is provided as Appendix A to this report.

The HHRA and the short-term risk assessment were conducted using data from environmental samples collected from the study area (shown in Figure 1-1 and described in more detail in Section 2) in accordance with the USEPA-approved SSP. The SSP for Sauget Area 1 was designed to investigate three major areas of the Sauget Area 1 study area (the media sampled in each are identified in parenthesis):

- The Sites G, H, I, L, M, and N (waste, surface soil, groundwater, sediment, surface water, ambient air);
- Dead Creek and its environs including creek segments CS-B, CS-C, CS-D, CS-E, and CS-F, which includes the Borrow Pit Lake (sediment, surface water and fish tissue); and
- The residential/commercial/undeveloped areas adjacent to Dead Creek, evaluated as Transects 1, 2, 3, 4, 5, 6, and 7 (surface soil, subsurface soil, and groundwater).

Background or reference samples were collected for surface soil, subsurface soil, groundwater, surface water, sediment, fish tissue, and ambient air. The SSP identified the suites of analytes for each medium. The analytes included in the risk assessment are: VOCs, SVOCs, metals, mercury, cyanide, PCBs, pesticides, herbicides, and dioxins. Validated laboratory analytical data are compiled in the Data Validation Report (Solutia, 2000a), and field data are compiled in the Field Sampling Report (Solutia, 2000b).

On May 31, 2000, the USEPA issued a UAO to Monsanto Company and Solutia Inc. (Docket No. V-W-99-C-554) pursuant to section 106(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended, 42 U.S.C. Section 9606(a). The Order requires, among other

things, a sediment removal action at Sauget Area 1 Creek Segments B and Fill Area M and Creek Segments C, D and E and the portion of Creek Segment F between Creek Segment E and Route 3, which are located in Sauget and Cahokia, Illinois. Therefore, these areas were not further evaluated in the risk assessment.

The baseline HHRA has been conducted in accordance with the four-step paradigm for human health risk assessments developed by USEPA (USEPA, 1989a); these steps are:

- Data Evaluation and Hazard Identification
- Toxicity Assessment
- Exposure Assessment
- Risk Characterization

The risk assessment results are summarized by step below.

## 8.1 Data Evaluation and Hazard Identification

The purpose of the data evaluation and hazard identification process is two-fold: 1) to evaluate the nature and extent of release of constituents present at the site; and 2) to select a subset of these constituents identified as COPCs for quantitative evaluation in the risk assessment. This step of the risk assessment involves compiling and summarizing the data for the risk assessment, and selecting COPCs based on a series of screening steps. Several factors are typically considered in selecting COPCs for a site, including natural background, frequency of detection, and toxicity, including essential nutrient status.

Per the HHRA Workplan, IEPA TACO Tier I criteria (IEPA, 1998) were used for the identification of COPCs for soil and groundwater for quantitative evaluation in the risk assessment. Where IEPA TACO Tier I criteria were not available, USEPA Region 9 PRGs (1999) were used. Residential values were used to identify COPCs for transect soils and sediments, and industrial values were used to evaluate transect and site soils. The TACO program also provides screening criteria for the groundwater ingestion component of the soil to groundwater pathway that were used here. These latter values conservatively address leaching of constituents from soils to underlying groundwater.

IEPA TACO Tier I values are not available for surface water, fish tissue, or air. Hence, surface water data were compared to the groundwater criteria. Fish tissue data were compared to the USEPA Region 3 RBCs for fish (USEPA, 2000b). Air concentrations were compared to USEPA Region 9 PRGs (USEPA, 1999) for ambient air.

Background samples were collected in the vicinity of the site to provide information on naturally-occurring levels of constituents typical for the local area. The purpose of comparing site conditions to local background is to determine if site concentrations of constituents are representative of background concentrations, which, therefore, should not be included in risk calculations. Background comparisons were conducted for each medium using site-specific background data.

The procedure for determining whether a constituent concentration is consistent with background follows that developed by USEPA Region 4 (USEPA, 2000a) and presented in the HHRA Workplan (Appendix A). Maximum detected concentrations of constituents in environmental media at the site were compared to two times the arithmetic mean site-specific background concentration. Therefore, if maximum concentrations of constituents in an area are found to be less than two times the average background concentrations, then those constituents are eliminated from quantitative evaluation in the risk assessment.

In the screening process, constituents in an area/medium with maximum concentrations less than or equal to the screening criteria were not included as COPCs. Where no COPCs are identified for an area/medium, that area/medium was not evaluated quantitatively in the HHRA.

No COPCs were identified in surface water. Therefore, surface water was not further evaluated in the risk assessment. No direct contact COPCs for either a residential or industrial scenario were identified for Transect 1, Transect 2, or Site G. Therefore, surface and subsurface soils in these areas were not further evaluated in the risk assessment.

The majority of the COPCs identified in surface and subsurface soils in the transects and in Site N (five of seven) are PAHs (Tables 3-1 and 3-2). Of the remaining two COPCs, dieldrin was identified as a COPC in Transect 5 surface soil for the residential scenario, and arsenic was identified as a COPC in Transect 7 surface soil for both the residential and industrial scenarios.

PAHs are common combustion products and are found in grilled foods, charcoal, and in motor oils and asphalt paving (ATSDR, 1995). A paper entitled "Background Levels of Polycyclic Aromatic Hydrocarbons (PAH) and Selected Metals in New England Urban Soils" (Bradley et al., 1994) investigated the occurrence of PAHs in soils in three New England towns: Boston, MA; Providence, RI; and Springfield, MA. Samples were collected in non-industrial areas. PAH concentrations were consistently higher than residential screening criteria. Higher PAH concentrations were found near roadways and near telephone poles. Comparison of the PAH concentrations reported in the paper with those concentrations detected in Transect 3, 4, 5, 6, and 7 surface soils indicates that the transect concentrations are similar to those presented in the paper, i.e., are consistent with urban background.

Arsenic was identified as a COPC in surface soils in Transect 7. Of the nine surface soil samples collected in this transect, eight had concentrations ranging from 6.2 to 8.1 mg/kg, below the site-

specific background concentration of 19 mg/kg. However, one sample in Transect 7 (UAS-T7-S1-0-0.5FT) had an arsenic concentration of 34 mg/kg. Because this maximum detected value is greater than the background concentration, arsenic was identified as a COPC in Transect 7. Although the majority of the COPCs identified in the transect soils are likely consistent with background concentrations, they have all been quantitatively evaluated in the risk assessment.

The COPCs identified in the industrial scenario for surface soils in the fill areas are PAHs, arsenic, and copper, PCBs and TCDD-TEQs. These are all quantitatively evaluated in the risk assessment.

The selection of COPCs for groundwater was conducted on a location-by-location basis. Samples with screening intervals or sample collection depths between 0 and 30 feet bgs were included in the evaluation. Because groundwater in the area is not used a source of drinking water (see Appendix S), exposure to COPCs in groundwater could occur due to either volatilization of COPCs into indoor or outdoor air, or contact with COPCs in groundwater exposed in an excavation trench. A 30-foot bgs excavation depth is assumed as some sewer lines in the area are located at that depth. Moreover, volatilization from groundwater through the soil column to indoor and/or outdoor air is generally assumed to occur up to depths of up to 15 feet bgs (MADEP, 1995). Based on these considerations, a total of 34 groundwater sampling locations were included in the evaluation. Of these, 19 locations are existing wells from previous investigations (those beginning with EE and EEG designations), 11 are push sampling locations installed in support of the SSP (those beginning with AA and SGW designations), and four locations are existing residential area non-potable use wells (those beginning with DW designations).

The results of the COPC selection for groundwater are presented in Table 3-5. Of the 34 groundwater sampling locations, COPCs were identified in only 14. Five locations have only one or two COPCs identified. Seven locations have between six and 11 COPCs identified, and two locations have 17 and 19 COPCs identified; these are in Sites G and H, respectively. There appears to be no clear pattern of COPCs between locations. A total of 42 COPCs were identified in the 14 groundwater sampling locations combined. Of these, 12 are VOCs. Of the four residential area non-potable use wells, a single COPC, lead, was identified in only one well (DW-MCDO). This is the only COPC identified in the approximately 10 locations located south of Site L, and lead was not identified as a COPC in any other well included in the evaluation.

Two COPCs, arsenic and PCBs, were identified in sediment, as shown in Table 3-6. One COPC was identified in fish tissue – arsenic, as shown on Table 3-6. Arsenic was detected in only one of the three fish tissue samples analyzed for arsenic. No COPCs were identified in surface water. Therefore, surface water is not evaluated further in the risk assessment.

COPCs identified in Site TCLP samples, Site leachate samples and in Site historical subsurface soils are presented in Appendix T.

## 8.2 Dose-Response Assessment

The purpose of the dose-response assessment is to identify the types of adverse health effects a constituent may potentially cause, and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response) (USEPA, 1989a). Adverse effects are classified by USEPA as potentially carcinogenic or noncarcinogenic (i.e., potential effects other than cancer). Dose-response relationships are defined by USEPA for oral exposure and for exposure by inhalation. Oral toxicity values are also used to assess dermal exposures, with appropriate adjustments, because USEPA has not yet developed values for this route of exposure. Combining the results of the toxicity assessment with information on the magnitude of potential human exposure provides an estimate of potential risk.

Sources of the published toxicity values in this risk assessment include USEPA's Integrated Risk Information System (IRIS) (USEPA, 2000c), the Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b), and the USEPA National Center for Environmental Assessment (NCEA) in Cincinnati, Ohio.

Risks were calculated for 2,3,7,8-TCDD and the dioxin and furan congeners using the cancer slope factor for 2,3,7,8-TCDD listed in HEAST and using the TEFs provided by WHO (Van den Berg et al., 1998), presented in Table 4-6. The TEFs are fractions that equate the potential toxicity of each congener to that of 2,3,7,8-TCDD.

## 8.3 Exposure Assessment

The purpose of the exposure assessment is to predict the magnitude and frequency of potential human exposure to each of the COPC retained for quantitative evaluation in the HHRA. The first step in the exposure assessment process is the characterization of the setting of the site and surrounding area. Current and potential future site uses and potential receptors (i.e., people who may contact the impacted environmental media of interest) are then identified. Potential exposure scenarios identifying appropriate environmental media and exposure pathways for current and potential future site uses and receptors are then developed. Those potential exposure pathways for which COPCs are identified and are judged to be complete are evaluated quantitatively in the risk assessment.

### 8.3.1 Conceptual Site Model

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a CSM for human health was developed. The purpose of the CSM is to identify source areas, potential migration pathways of constituents from source areas to environmental media where exposure can occur, and to identify potential human receptors.

The CSM for the Sauget Area 1 risk assessment is presented in Figure 5-1. The CSM identifies potential sources, constituent migration pathways from one medium to another, and potential exposure pathways (e.g., soil, groundwater), potential exposure routes (e.g., ingestion, inhalation), and potential receptors (e.g., worker, resident). Historical evidence presented in the SSP demonstrates that the major source of COPCs in surface water and sediments in Dead Creek was industrial and municipal discharges directly to the creek. There are no current discharges to the creek other than stormwater.

Surface and subsurface soil samples were collected and analyzed from transects in the residential/commercial/undeveloped areas. The SSP sampling program for this area was developed to address the potential for sediments in Dead Creek to serve as a source of constituents to soils in the surrounding flood plain via overbank flooding. Transects were located on alternating sides of Dead Creek from the sites south to Route 3 (Figure 3-1), with the intention of determining if there was a north to south concentration gradient of constituents. Sampling locations on the transects extended out east or west of the creek, with the intention of determining if there was a concentration gradient of constituents extending out from the creek.

A review of the data indicate that Dead Creek is not serving as a source of constituents to soils in the surrounding flood plain. The COPCs identified in transect soils in Section 3.0 are likely representative of background conditions in the area, as discussed above. Moreover, no COPCs were identified in soils in Transects 1 and 2, which are the transects located closest to the sites. Therefore, it can also be concluded that the sites are not serving a source of constituents to the residential, commercial and undeveloped soils in the study area.

### 8.3.2 Exposure Point Concentrations

Exposure points are located where potential receptors may contact COPCs at or from the site. The concentration of COPCs in the environmental medium that receptors may contact must be estimated in order to determine the magnitude of potential exposure. Both measured and modeled EPCs have been used in this risk assessment.

Measured EPCs. The EPC for a human health risk assessment is defined as the 95% upper confidence limit (95% UCL) on the arithmetic mean concentration, or the maximum concentration, whichever is lower (U.S. EPA, 1992a), for the RME scenario and the arithmetic mean concentration for the MLE scenario. Summary statistics have been calculated for each COPC in each medium, as presented in Appendix B. Calculation of the 95% UCL is dependent upon the distribution of the data set. The 95% UCL calculations were conducted as described by USEPA (1992a).

Modeled EPCs. Some pathways required modeling to derive the EPCs. These pathways include volatile constituents in groundwater migrating upwards and infiltrating into indoor air, outdoor air and

excavation air, generation of fugitive dusts from undisturbed soils as well as during construction activities, and prediction of garden produce concentrations. The models used are described in Section 5.0 and the appendices.

The exposure point concentrations for each COPC in each medium are presented in Section 5 tables for both the RME and MLE scenarios.

### 8.3.3 Receptor Evaluation

Table 5-1 presents the detailed receptor/pathway/area matrix that summarizes the receptors evaluated in each area, by medium and exposure route. These scenarios were developed based on the data, the CSM, and the COPCs identified in each medium. RME scenarios and MLE scenarios based on appropriate USEPA guidance were both evaluated in the quantitative risk assessment. In all, 64 receptor scenarios were evaluated in the Sauget Area 1 risk assessment. In addition to these evaluations, an additional construction worker evaluation was conducted using data from TCLP and leachate samples and historical subsurface soil data. This evaluation is presented separately in Appendix T.

To estimate the potential risk to human health that may be posed by the presence of COPCs in environmental media in the study area, it is first necessary to estimate the potential exposure dose of each COPC for each receptor. The exposure dose is estimated for each constituent via each exposure pathway by which the receptor is assumed to be exposed. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day). The exposure doses are combined with the toxicity values to estimate potential risks and hazards for each receptor. The exposure dose and risk calculation spreadsheets are presented in Appendix P.

## 8.4 Risk Characterization Methodology

The potential risk to human health associated with potential exposure to COPCs in environmental media at the site is evaluated in this step of the risk assessment process. Risk characterization is the process in which the dose-response information (Section 4.0) is integrated with quantitative estimates of human exposure derived in the Exposure Assessment (Section 5.0). The result is a quantitative estimate of the likelihood that humans will experience any adverse health effects given the exposure assumptions made. Two general types of health risk are characterized for each potential exposure pathway considered: potential carcinogenic risk and potential noncarcinogenic risk. Carcinogenic risk is evaluated by averaging exposure over a normal human lifetime, which, based on USEPA guidance (1989a), is assumed to be 70 years. Noncarcinogenic risk is evaluated by averaging exposure over the total exposure period.

Characterization of the potential impact of potential carcinogenic and noncarcinogenic constituents is approached in very different ways. The difference in approaches arises from the conservative assumption that substances with possible carcinogenic action proceed by a no-threshold mechanism, whereas other toxic actions may have a threshold, a dose below which few individuals would be expected to respond. Thus, under the no-threshold assumption, it is necessary to calculate a risk, but for constituents with a threshold, it is possible to simply characterize an exposure as above or below the threshold. In risk assessment, that threshold is termed an RfD.

### 8.4.1 Carcinogenic Risk Characterization

The purpose of carcinogenic risk characterization is to estimate the upper-bound likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of exposure to a constituent in environmental media at the site. This likelihood is a function of the dose of a constituent (described in the Exposure Assessment, Section 5.0) and the CSF (described in the Toxicity Assessment, Section 4.0) for that constituent. The ELCR is the likelihood over and above the background cancer rate, which currently in the U.S. is between 1 in 3 and 1 in 4 (Landis et al., 1998), that an individual will contract cancer in his or her lifetime. The risk value is expressed as a probability (e.g., $10^{-6}$, or one in one million). The ELCR is calculated using the following equation:

$$\mathbf{ELCR = LADD\ (mg/kg\text{-}day) \times CSF\ (mg/kg\text{-}day)^{-1}}$$

The potential carcinogenic risk for each exposure pathway is calculated for each receptor. In current regulatory risk assessment, it is assumed that cancer risks are additive or cumulative. Pathway and area-specific risks were summed to estimate the total site potential cancer risk for each receptor. A summary of the total site cancer risks for each receptor group were presented in Section 6.0 and compared to the USEPA's target risk range of $10^{-4}$ to $10^{-6}$. Any COPC that causes an exceedance of the $10^{-4}$ risk level for a particular receptor was designated a COC. Both RME and MLE results were considered in the identification of COCs. Remedial goals (RGs) were then calculated for each COC.

The target risk levels used for the identification of COCs are based on USEPA guidance and Illinois TACO guidance. Specifically, USEPA provides the following guidance (USEPA, 1991a):

> "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than $10^{-4}$, and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." and,
>
> "The upper boundary of the risk range is not a discrete line at $1 \times 10^{-4}$, although EPA generally uses $1 \times 10^{-4}$ in making risk management decisions. A specific risk estimate around $10^{-4}$ may be considered acceptable if justified based on site-specific conditions."

IEPA provides the following summary for the evaluation of cumulative risk for carcinogens (IEPA, 1998, Fact Sheet 13: Mixture Rule):

> "The cumulative risk of carcinogenic contaminants attacking the same target must not exceed 1 in 10,000 [$10^{-4}$]. Therefore, the risk from all on-site similar acting carcinogens must be added together. If this cumulative risk level is greater than 1 in 10,000, corrective action must be taken to reach an acceptable risk level."

### 8.4.2 Non-Carcinogenic Risk Characterization

The potential for exposure to a constituent to result in adverse noncarcinogenic health effects is estimated for each receptor by comparing the Chronic Average Daily Dose (CADD) for each COPC with the RfD for that COPC. The resulting ratio, which is unitless, is known as the Hazard Quotient (HQ) for that constituent. The HQ is calculated using the following equation:

$$\mathbf{HQ} = \frac{\mathbf{CADD\ (mg/kg\text{-}day)}}{\mathbf{RfD\ (mg/kg\text{-}day)}}$$

The target HQ is defined as an HQ of less than or equal to one (USEPA, 1989a). When the HQ is less than or equal to 1, the RfD has not been exceeded, and no adverse noncarcinogenic effects are expected. If the HQ is greater than 1, there may be a potential for adverse noncarcinogenic health effects to occur; however, the magnitude of the HQ cannot be directly equated to a probability or effect level. HQs for a given pathway are summed to provide a hazard Index (HI). Pathway HIs are summed to provide a total receptor HI. When the HI is less than 1, the target has not been exceeded, and no adverse noncarcinogenic effects are expected. This initial HI summation assumes that all the COPCs are additive in their toxicity, and is considered only a screening step as additive toxicity may not be correct. If the HI is greater than 1, further evaluation is necessary to determine if the COPCs are additive in toxicity. This evaluation is termed a toxic endpoint analysis, and is discussed in Appendix R. Any COPC that causes an exceedance of a toxic-endpoint specific HI of one was designated a COC.

### 8.4.3 Calculation of Remedial Goals

For potentially carcinogenic risk results, COCs are identified as those COPCs that cause an exceedance of the target risk level of $10^{-4}$. For noncarcinogenic hazard results, COCs are identified as those COPCs that cause an exceedance of the toxic-endpoint specific HI of one. RGs have been calculated for those COPCs identified as COCs.

Where RGs are calculated, the following formula is used:

$$RG = \frac{\text{EPC x Target (Risk or HQ)}}{\text{Calculated (Risk or HQ)}}$$

The EPC is the exposure point concentration used in the risk calculations. Where only one constituent is the risk driver, the target risk level per constituent to be used in the RG calculation is $1x10^{-4}$ minus the total risk for all other constituents for that receptor. Similarly, the target HQ per constituent is 1 minus the HQ for all other constituents with similar toxic endpoints.

When there is more than one constituent identified as a COC for a given scenario, the target risk level (or HQ for noncarcinogens) is again $1 \times 10^{-4}$ (or 1 for noncarcinogens) minus the total risk (or HI for noncarcinogens) for all other constituents for that receptor. However, this target risk (or HQ for noncarcinogens) is then apportioned between the identified COCs. This apportioning can be done in any manner, though most commonly it is done equally between all of the COCs.

## 8.5 Potential Carcinogenic Risk Results

Potential carcinogenic risks are summarized for all receptors and pathways for the transects in Table 8-1, and for the Sites in Table 8-3. Table 8-6 presents the recreational receptors risks.

### 8.5.1 Transects

As shown in Table 8-1, all potential risks calculated for both the RME and MLE receptor scenarios for the transects are within or below the USEPA target risk range of $10^{-4}$ to $10^{-6}$.

### 8.5.2 Sites

As shown in Table 8-3, all potential risks calculated for both the RME and MLE receptor scenarios in the sites are within or below the USEPA target risk range of $10^{-4}$ to $10^{-6}$, with the exception of the RME outdoor industrial worker receptor in Site I. The calculated risk for this receptor is $1.66x10^{-4}$, which is only slightly above $10^{-4}$. The risk calculated for 2,3,7,8-TCDD-TEQ for this receptor is $1.38x10^{-4}$ due to potential incidental ingestion and dermal contact with soils (see Table 6-3). Therefore, 2,3,7,8-TCDD-TEQ is identified as a COC for Site I soils.

### 8.5.3 Dead Creek/Borrow Pit Lake

As shown in Table 8-6, both RME and MLE risks are within or below the target risk range of $10^{-4}$ to $10^{-6}$ for the recreational teen and the recreational fisher receptors.

### 8.5.4 Summary of Potentially Carcinogenic Risk Results

As noted above, potential carcinogenic risk results are evaluated based on the $10^{-6}$ to $10^{-4}$ risk range. The following scenarios resulted in risks below the target risk range (i.e., risks less than $10^{-6}$):

Transect 3 – RME Outdoor Industrial Worker
Transect 3 – MLE Outdoor Industrial Worker
Transect 3 – RME Construction Worker
Transect 3 – MLE Construction Worker
Transect 3 – MLE Resident

Transect 4 – MLE Outdoor Industrial Worker
Transect 4 – RME Construction Worker
Transect 4 – MLE Construction Worker
Transect 4 – MLE Resident

Transect 5 – MLE Resident

Transect 6 – MLE Outdoor Industrial Worker
Transect 6 – RME Construction Worker
Transect 6 – MLE Construction Worker
Transect 6 – MLE Resident

Transect 7 – MLE Outdoor Industrial Worker
Transect 7 – RME Construction Worker
Transect 7 – MLE Construction Worker

Site G – RME Indoor Industrial Worker
Site G – MLE Indoor Industrial Worker
Site G – RME Outdoor Industrial Worker
Site G – MLE Outdoor Industrial Worker
Site G – RME Trespassing Teen
Site G – MLE Trespassing Teen

Site H – RME Indoor Industrial Worker
Site H – MLE Indoor Industrial Worker
Site H – MLE Trespassing Teen

Site I – MLE Indoor Industrial Worker

Site L – RME Indoor Industrial Worker

Site L – MLE Indoor Industrial Worker
Site L – MLE Outdoor Industrial Worker
Site L – RME Construction Worker
Site L – MLE Construction Worker
Site L – MLE Construction Worker - Suppelemental
Site L – RME Trespassing Teen
Site L – MLE Trespassing Teen

Site N – MLE Resident

Dead Creek/Borrow Pit Lake – RME Recreational Teen
Dead Creek/Borrow Pit Lake – MLE Recreational Teen

The following scenarios [and risk-driving constituents – environmental medium] resulted in risks between $10^{-6}$ and $10^{-5}$, which are within the target risk range:

Transect 3 – RME Resident [benzo(a)pyrene – soil]

Transect 4 – RME Outdoor Industrial Worker [benzo(a)pyrene – soil]

Transect 5 – RME Resident [benzo(a)pyrene and dieldrin – soil]

Transect 6 – RME Outdoor Industrial Worker [benzo(a)pyrene – soil]

Transect 7 – RME Outdoor Industrial Worker [benzo(a)pyrene and arsenic – soil]
Transect 7 – MLE Resident [arsenic – produce]

Site G – MLE Construction Worker [2,3,7,8-TCDD-TEQ – soil]
Site G – MLE Supplemental Construction Worker [PCBs – subsurface soil, Pentachlorophenol – leachate]

Site H – MLE Outdoor Industrial Worker [2,3,7,8-TCDD-TEQ – soil]
Site H – RME Construction Worker [pentachlorophenol – groundwater]
Site H – MLE Construction Worker [pentachlorophenol – groundwater]
Site H – MLE Supplemental Construction Worker [PCBs - subsurface soil]
Site H – RME Trespassing Teen [2,3,7,8-TCDD-TEQ – soil]

Site I – RME Indoor Industrial Worker [vinyl chloride – groundwater]
Site I – MLE Outdoor Industrial Worker [2,3,7,8-TCDD-TEQ and PCBs – soil]
Site I – RME Construction Worker [2,3,7,8-TCDD-TEQ – soil and groundwater]
Site I – MLE Construction Worker [2,3,7,8-TCDD-TEQ – groundwater]

Site I –MLE Supplemental Construction Worker [PCBs, 2,3,7,8-TCDD-TEQ, Pentachlorophenol - leachate]
Site I – MLE Trespassing Teen [2,3,7,8-TCDD-TEQ – soil]

Site L – RME Outdoor Industrial Worker [benzo(a)pyrene – soil]
Site L –RME Supplemental Construction Worker [PCBs - subsurface soil]

Site N - RME Resident [benzo(a)pyrene - soil]

Dead Creek/Borrow Pit Lake – MLE Recreational Fisher [arsenic – fish]

The following scenarios resulted in risks between $10^{-5}$ and $10^{-4}$, which are within the target risk range:

Transect 4 – RME Resident [benzo(a)pyrene – soil]

Transect 6 – RME Resident [benzo(a)pyrene – soil]

Transect 7 – RME Resident [arsenic – produce]

Site G – RME Construction Worker [pentachlorophenol and 2,3,7,8-TCDD-TEQ – groundwater]

Site G – RME Supplemental Construction Worker [Pentachlorophenol - subsurface soil and leachate, PCBs – subsurface soil]

Site H – RME Outdoor Industrial Worker [2,3,7,8-TCDD-TEQ – soil]

Site H — RME Supplemental Construction Worker [PCBs, 1,4-Dichlorobenzene, Benzo(a)pyrene - subsurface soil]

Site I – RME Trespassing Teen [2,3,7,8-TCDD-TEQ – soil]

Site I – RME Supplemental Construction Worker [Pentachlorophenol, Chloroform, PCBs, 1,1-Dichloroethene, 2,3,7,8-TCDD-TEQ, leachate; Hexachlorobenzene, PCBs, Toxaphene - subsurface soil]

Dead Creek/Borrow Pit Lake – RME Recreational Fisher [arsenic – fish]

The following scenario resulted in a risk above $10^{-4}$, which is above the target risk range:

Site I RME – Outdoor Industrial Worker [2,3,7,8-TCDD-TEQ – soil]

Based on the exceedance of the $10^{-4}$ risk level for the RME Outdoor Industrial Worker in Site I, 2,3,7,8-TCDD-TEQ is identified as a COC in Site I soils.

## 8.6 Potential Noncarcinogenic Hazard Results

Potential noncarcinogenic hazards are summarized for all receptors and pathways for the transects in Table 8-2, and for the Sites in Table 8-4. Table 8-7 presents the recreational receptors risks.

### 8.6.1 Transects

As shown in Table 8-2, all potential HIs calculated for both the RME and MLE receptor scenarios for the transects are below the target HI of 1.

### 8.6.2 Sites

As shown in Table 8-4, all potential HIs calculated for both the RME and MLE receptor scenarios for the sites are below the target HI of 1, with the exception of the following:

- The RME construction worker in Site G;
- The RME construction worker in Site H;
- The MLE construction worker in Site H;
- The RME outdoor industrial worker in Site I; and
- The RME construction worker in Site I.

Because these HIs were calculated by summing all HIs for all pathways, a toxic endpoint analysis was conducted for each receptor, as discussed in Section 8.6.4.

### 8.6.3 Dead Creek/Borrow Pit Lake

As shown in Table 8-7, both RME and MLE risks are below the target HI of 1 for the recreational teen and the recreational fisher receptors.

### 8.6.4 Toxic Endpoint Analysis

The RME construction worker in Site G. A toxic endpoint analysis was conducted for this receptor, as presented in Appendix R and summarized in Table 8-5. As shown, none of the toxic endpoint specific HIs exceed the target of 1, therefore, no COCs are identified for this receptor in this area.

The RME construction worker in Site H. A toxic endpoint analysis was conducted for this receptor, as presented in Appendix R and summarized in Table 8-5. As shown, all of the toxic endpoint HIs are below 1 with the exception of "nasal effects." This is due to potential inhalation exposures to

chloroform and naphthalene (see Table R-3) volatilized from exposed groundwater in an excavation trench (Table 6-6). Therefore, chloroform and naphthalene are identified as COCs for groundwater in Site H.

The MLE construction worker in Site H. A toxic endpoint analysis was conducted for this receptor, as presented in Appendix R and summarized in Table 8-5. As shown, none of the toxic endpoint specific HIs exceed the target of 1, therefore, no COCs are identified for this receptor in this area.

The RME outdoor industrial worker receptor in Site I. PCBs are the main contributor to the HI of 2.15 for this scenario. The total HQ for PCBs is 1.99, due to potential ingestion and dermal contact with surface soil. A review of Table R-1, which presents toxic endpoints by constituent, indicates that the toxic endpoints for PCBs are immune, skin and eye effects. None of the other COPCs in Site I exhibit these effects, thus, a quantitative toxic endpoint analysis was not conducted, and PCBs are identified as a COC for soil for the outdoor industrial worker scenario in Site I.

The RME construction worker in Site I. PCBs are the main contributor to the HI of 2.04 for this scenario. The total HQ for PCBs is 1.08, with the majority (1.03) due to potential ingestion and dermal contact with surface soil. As noted above, review of Table R-1, which presents toxic endpoints by constituent, indicates that the toxic endpoints for PCBs are immune, skin and eye effects. None of the other COPCs in Site I exhibit these effects; thus, a toxic endpoint analysis was not conducted, and PCBs are identified as a COC for soil for the construction worker scenario in Site I.

### 8.6.5 Summary of Noncarcinogenic Hazards

Based on the toxic endpoint analyses, the following constituents are identified as COCs:

- Chloroform and naphthalene in groundwater in Site H for the construction worker scenario.
- PCBs in surface soil in Site I for the outdoor industrial worker and construction worker scenarios.

## 8.7 Remedial Goals

### 8.7.1 2,3,7,8-TCDD-TEQ in Site I

2,3,7,8-TCDD-TEQ was identified as a COC in Site I soils for the outdoor industrial worker, due to an exceedance of the target risk level of $10^{-4}$. The following RG is calculated using the equation in Section 8.4.3. The EPC for 2,3,7,8-TCDD-TEQ in Site I is 0.012 mg/kg. The risk associated with all other COPCs in Site I for the outdoor worker receptor is 3E-05. Therefore, for a total receptor target risk level of 1E-04, the target risk level for 2,3,7,8-TCDD-TEQ alone is 7E-05. Thus the RG for 2,3,7,8-TCDD-TEQ is 0.0062 mg/kg.

Of the four soil samples collected in Site I, only one sample exceeds this target concentration; this is WASTE-I-B2-0-0.5FT (see Figure 8-1). Therefore, a remedial action may be warranted at this location, however, it should be noted that the target risk range was not exceeded for the MLE scenario for this receptor.

### 8.7.2 Chloroform and Naphthalene in Site H

Chloroform and naphthalene were identified as COCs in Site H groundwater for the RME construction worker receptor due to an exceedance of the target toxic endpoint HI of 1 (for nasal effects). An RG is calculated using the equation in Section 8.4.5.

First, the EPCs must be identified. Hazards and risks associated with potential exposure to groundwater were calculated on a per groundwater sampling location basis, prorated based on the number of groundwater sampling locations in the evaluation, such that the hazard/risk per location could be summed for a total hazard/risk for the site. VOCs were detected in two of the three groundwater sampling locations in Site H (EE-01 and EE-02). Therefore, these two locations were evaluated in the excavation trench scenario for the construction worker. Naphthalene was detected in both VOC-containing locations. The concentration in well EE-01 is 2.3 mg/L and the concentration in well EE-02 is 0.195 mg/L; the effective risk concentration is the average of these two, which is 1.25 mg/L. Chloroform was detected in one of these two VOC-containing locations; therefore, although the EPC for chloroform in EE-02 is 0.425 mg/L, the effective risk concentration is 0.213 mg/L. [Note that this is a conservative approach, as not all groundwater sampling locations in Site H were used in this averaging.] These "effective risk concentrations" were used to calculate the RGs.

As shown in Appendix R, chloroform and naphthalene are the only two COPCs in Site H that have "nasal effects" identified as a toxic endpoint. The target HI for nasal effects is 1. Therefore, for the calculation of RGs, a target HQ of 0.5 for each COC (chloroform and naphthalene) is used here, although any HQ combination that results in a total HI of one would be appropriate for use in developing these RGs. The RG for chloroform is 0.0483 mg/L based on a target HI of 0.5, and the RG for naphthalene is 0.624 mg/L based on a target HI of 0.5.

### 8.7.3 PCBs in Site I - Outdoor Industrial Worker Scenario

PCBs were identified as a COC for Site I soils for the outdoor industrial worker scenario due to an exceedance of the target HI of 1. An RG is calculated using the equation in Section 8.4.3. The EPC for PCBs in Site I soils is 121.3 mg/kg. Assuming a target HQ of 1 for this scenario, the RG for PCBs in soil is 61 mg/kg. The only soil sample in Site I that exceeds this target concentration is WASTE-I-B2-0-0.5FT (Figure 8-1), which is the same sample indicating an exceedance based on the potential carcinogenic risk analysis. Therefore, a remedial action may be warranted at this location, however, it should be noted that the target HI was not exceeded for the MLE scenario for this receptor. It is also

noted that the highest of the remaining PCB concentrations is an order of magnitude lower than the RG, at 3.4 mg/kg.

### 8.7.4 PCBs in Site I - Construction Worker Scenario

PCBs were identified as a COC for Site I soils for the construction worker scenario due to an exceedance of the target HI of 1. An RG is calculated using the equation in Section 8.4.3. The EPC for PCBs in Site I soils is 121.3 mg/kg. Assuming no action is taken for the low level of PCBs detected in groundwater that contributes an HQ of 0.05 to this scenario (Table 6-6), the target HQ for PCBs in soil is 0.95, and the RG for PCBs in soil is 112 mg/kg. The only soil sample in Site I that exceeds this target concentration is WASTE-I-B2-0-0.5FT (Figure 8-1), which is the same sample indicating an exceedance identified above for the outdoor industrial worker, based on both the potential carcinogenic risk and noncarcinogenic hazard analyses. Therefore, a remedial action may be warranted at this location, however, it should be noted that the target HI was not exceeded for the MLE scenario for this receptor. It is also noted that the highest of the remaining PCB concentrations is almost two orders of magnitude lower than this RG, at 3.4 mg/kg.

## 8.8 Short-Term Risk Assessment

The short-term risk assessment is presented in Section 7.0. The same screening criteria identified in Section 3.1.1.1 were employed for the short-term COPC (STCOPC) selection. As discussed in the HHRA workplan (Appendix A), the screening criteria were multiplied by 100 and compared to the average site concentration for each constituent detected.

No direct contact STCOPCs for either a residential soil or an industrial soil scenario were identified for either the transects or the sites. No STCOPCs were identified in sediment or surface water. Therefore, these media were not evaluated further in the short-term risk assessment.

In groundwater, of the 34 groundwater sampling locations evaluated in the risk assessment, STCOPCs were identified in only 6 locations from Sites G, H, I, and L. No STCOPCs were identified in the residential (non-potable) wells. Five locations have only one or two STCOPCs identified, and one well (EEG-107, Site G) has 7 STCOPCs identified. There appears to be no clear pattern of STCOPCs between wells. A total of 9 STCOPCs were identified in the 6 groundwater sampling locations combined. Of these, 3 are VOCs.

Concentrations of VOCs in groundwater were used to calculate indoor air, excavation air, and outdoor air concentrations for the above scenarios in Appendices K (indoor air), L (excavation air), and M (outdoor air). These calculated concentrations are compared to 100 times the USEPA Region 9 air PRGs in Table 7-2. As indicated on the table, air concentrations of all constituents are less than 100 times the air PRG with the exception of benzene and chloroform in excavation air. Therefore,

concentrations of these constituents are compared to short-term air action levels, as presented in Table 7-3. The short-term action levels were obtained from the ACGIH, NIOSH, and the TNRCC.

The calculated excavation air concentrations of both benzene in Site G and chloroform in Site H are below the TLVs and NIOSH standards (Table 7-3). The concentration of benzene and chloroform exceed the short-term TNRCC ESLs. Although the excavation air concentrations do exceed the TNRCC standards, this does not indicate that a short term risk presently exists. The excavation air scenario is a potential future scenario, in which the air concentrations are modeled rather than measured, and there are no current excavations at the site.

The six non-VOC STCOPCs were evaluated in the chronic risk assessment in a future construction worker scenario. It was assumed that a future construction worker may contact groundwater during excavation for 10 days per year for one year. As indicated on Tables 6-5 and 6-6, none of these six constituents exhibits a potential cancer risk or an HQ that exceeds the target levels. Therefore, neither a chronic nor an acute risk exists for these constituents.

Therefore, it is concluded that concentrations in groundwater are not posing a current short-term risk to receptors at the site. However, future construction activities in Sites G and H should be conducted with air monitoring in the excavation trenches, and the workers using appropriate personal protective equipment.

Arsenic in fish fillet is identified as a STCOPC for the short-term risk assessment. However, as the chronic risk for the fish ingestion pathway does not exceed target risk levels, it is also concluded that a short-term (acute) risk does not exist for exposure to arsenic in fish fillet. Moreover, the form of arsenic present in fish tissue (organic versus inorganic) is likely not to pose acute or chronic health risks (see discussion in Section 7.2.5).

## 8.9 Summary of Supplemental Construction Worker Risk Assessment

Pursuant to comments received from USEPA on the December 29, 2000 Human Health Risk Assessment for Sauget Area 1 (the HHRA), an additional evaluation has been conducted for the construction worker and is presented in Appendix T and summarized in Tables 8-8 and 8-9. This evaluation was conducted to evaluate potential risks to the construction worker associated with constituents in subsurface soil and in leachate in Sites G, H, I and L, and followed the same methods as the HHRA.

The potential risk for the construction worker for both the RME and MLE scenarios for all Sites is below or within the USEPA risk range of $10^{-4}$ to $10^{-6}$.

The potential HIs for the construction worker (RME) are above the target HI of 1 in each Site. The HI for the construction worker for the MLE scenario is above 1 for all Sites with the exception of Site L.

This construction worker evaluation (for subsurface soil and leachate) was conducted as a supplement to the original construction worker scenario presented in the main body of the report (surface soil and groundwater). Potential carcinogenic risks for this supplemental scenario are within the target risk range for all Sites. To evaluate potential additivity of risks for the two evaluations, risks calculated for the original and the supplemental risk assessments were summed. The results indicate that the combined risks for each Site are still within the target risk range. With the exception of the MLE scenario for Site L, as the HIs for the supplemental risk assessment are all above 1, the combined HIs are also above 1. The combined HI for the MLE scenario for Site L is slightly above 1 (at 1.1).

These results support the original conclusion in the risk assessment that construction/excavation activities should not occur in Sites G, H, I and now L without use of proper personal protective equipment and monitoring for air emissions from standing water.

## 8.10 Summary of Class I Groundwater Evaluation

Appendix U and Section 6.5.1.1 presents the comparison of groundwater data to TACO Class I groundwater criteria. Comparing the results to the Class II results, additional Class I COPCs were identified in most locations for which Class II COPCs occurred. Class I COPCs were also identified in additional locations: in Site G, between 1 and 3 COPCs were identified in five additional locations; in Site H, one COPC was identified in one additional location; in Site I, two COPCs were identified in one additional location; and in Site L, one and two COPCs were identified in two additional sampling locations, respectively. In residential areas, lead was identified as a COPC in two residential non-potable use wells and one shallow groundwater sample location. Therefore, the Class I screening results were not substantially different from the Class II screening results.

Lead was identified as (the only) COPC in two of the non-potable use residential wells (DW-MCDO and DW-WRIG). No COPCs were identified in the other two non-potable use wells. A drinking water evaluation of lead was conducted and is presented in Appendix V. The results indicate that well DW-WRIG could be used as a source of drinking water; however, use of well DW-MCDO as a source of drinking water would not be appropriate.

## 8.11 Summary

Based on the results of this baseline risk assessment and short-term risk assessment for Sauget Area 1, it is recommended that remedial action be considered for 2,3,7,8-TCDD-TEQs and PCBs for a single location in Site I. In addition, it is recommended that excavation work in Sites G, H, I, and L, based on both long-term and short-term potential health risks, be monitored for air emissions and that appropriate personal protective equipment be used during such work.

TABLE 8-1
SUMMARY OF POTENTIAL RISKS FOR ALL RECEPTORS - TRANSECTS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Residential Transects | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | | 4 | | 5 | | 6 | | 7 | |
| **Medium (Pathways)** | **RME** | **MLE** | **RME** | **MLE** | **RME** | **MLE** | **RME** | **MLE** | **RME** | **MLE** |
| ***Indoor Industrial Worker (IW)*** | | | | | | | | | | |
| Groundwater to Indoor Air (inh) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| ***Outdoor Industrial Worker (OW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | 7.98E-08 | 7.46E-09 | 1.15E-06 | 3.92E-08 | -- | -- | 1.11E-06 | 2.75E-08 | 1.54E-06 | 1.21E-07 |
| Surface Soil to Outdoor Air (inh) | 2.32E-11 | 2.13E-12 | 3.32E-10 | 1.12E-11 | -- | -- | 3.21E-10 | 7.85E-12 | 6.64E-09 | 7.59E-10 |
| Groundwater to Outdoor Air (inh) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Potential Risk:** | **7.98E-08** | **7.47E-09** | **1.15E-06** | **3.92E-08** | **--** | **--** | **1.11E-06** | **2.75E-08** | **1.55E-06** | **1.22E-07** |
| ***Construction Worker (CW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | 1.77E-09 | 3.49E-10 | 3.36E-08 | 2.76E-09 | -- | -- | 2.45E-08 | 1.29E-09 | 2.97E-08 | 4.28E-09 |
| Surface Soil to Outdoor Air (inh) | 2.16E-11 | 3.42E-12 | 4.11E-10 | 2.70E-11 | -- | -- | 3.00E-10 | 1.26E-11 | 6.21E-09 | 1.22E-09 |
| Groundwater (ing/derm) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Groundwater to Outdoor Air (inh) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Potential Risk:** | **1.79E-09** | **3.53E-10** | **3.40E-08** | **2.79E-09** | **--** | **--** | **2.48E-08** | **1.30E-09** | **3.59E-08** | **5.49E-09** |
| ***Resident (RES)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | 1.18E-06 | 7.96E-08 | 1.34E-05 | 3.16E-07 | 3.52E-06 | 1.18E-07 | 1.43E-05 | 2.74E-07 | 1.63E-05 | 7.89E-07 |
| Surface Soil to Outdoor Air (inh) | 4.34E-11 | 1.49E-12 | 4.92E-10 | 5.93E-12 | 1.14E-10 | 2.13E-12 | 5.26E-10 | 5.14E-12 | 8.16E-09 | 3.27E-10 |
| Produce (ing) | -- | -- | -- | -- | -- | -- | -- | -- | 5.33E-05 | 2.87E-06 |
| **Total Potential Risk:** | **1.18E-06** | **7.96E-08** | **1.34E-05** | **3.16E-07** | **3.52E-06** | **1.18E-07** | **1.43E-05** | **2.74E-07** | **6.96E-05** | **3.65E-06** |

Notes:
-- No constituents of potential concern were identified for this pathway.
derm - dermal contact.
ing - ingestion.
inh - inhalation.
MLE - Most Likely Exposure.
NA - Not Applicable. Pathway not identified as a pathway of potential concern.
RME - Reasonable Maximum Exposure.

TABLE 8-2
SUMMARY OF POTENTIAL HAZARD INDICES FOR ALL RECEPTORS - TRANSECTS
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Medium (Pathways) | Residential Transects | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | | 4 | | 5 | | 6 | | 7 | |
| | RME | MLE | RME | MLE | RME | MLE | RME | MLE | RME | MLE |
| ***Indoor Industrial Worker (IW)*** | | | | | | | | | | |
| Groundwater to Indoor Air (inh) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| ***Outdoor Industrial Worker (OW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | NC | NC | NC | NC | -- | -- | NC | NC | 5.59E-03 | 2.25E-03 |
| Surface Soil to Outdoor Air (inh) | NC | NC | NC | NC | -- | -- | NC | NC | NC | NC |
| Groundwater to Outdoor Air (inh) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Potential Hazard Index:** | **NC** | **NC** | **NC** | **NC** | **--** | **--** | **NC** | **NC** | **5.59E-03** | **2.25E-03** |
| ***Construction Worker (CW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | NC | NC | NC | NC | -- | -- | NC | NC | 2.39E-03 | 5.17E-04 |
| Surface Soil to Outdoor Air (inh) | NC | NC | NC | NC | -- | -- | NC | NC | NC | NC |
| Groundwater (ing/derm) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Groundwater to Outdoor Air (inh) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Total Potential Hazard Index:** | **NC** | **NC** | **NC** | **NC** | **--** | **--** | **NC** | **NC** | **2.39E-03** | **5.17E-04** |
| ***Resident (RES)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | NC | NC | NC | NC | 1.96E-02 | 1.04E-03 | NC | NC | 1.46E-01 | 3.26E-02 |
| Surface Soil to Outdoor Air (inh) | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Produce (ing) | -- | -- | -- | -- | -- | -- | -- | -- | 5.13E-02 | 9.12E-03 |
| **Total Potential Hazard Index:** | **NC** | **NC** | **NC** | **NC** | **1.96E-02** | **1.04E-03** | **NC** | **NC** | **1.97E-01** | **4.17E-02** |

Notes:
-- No constituents of potential concern were identified for this pathway.
derm - dermal contact.
ing - ingestion.
inh - inhalation.
MLE - Most Likely Exposure.
NA - Not Applicable. Pathway not identified as a pathway of potential concern.
NC - Not Calculated. No appropriate dose-response values for constituents for this pathway.
RME - Reasonable Maximum Exposure.

TABLE 8-3
SUMMARY OF POTENTIAL RISKS FOR ALL RECEPTORS - SITES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Medium (Pathways) | Sites | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | G | | H | | I | | L | | N | |
| | RME | MLE | RME | MLE | RME | MLE | RME | MLE | RME | MLE |
| ***Indoor Industrial Worker (IW)*** | | | | | | | | | | |
| Groundwater to Indoor Air (inh) | **8.22E-07** | **3.09E-08** | **8.89E-07** | **4.70E-08** | **2.08E-06** | **5.95E-08** | **8.76E-08** | **2.95E-09** | -- | -- |
| ***Outdoor Industrial Worker (OW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | -- | -- | 1.89E-05 | 1.35E-06 | 1.65E-04 | 8.15E-06 | 5.02E-06 | 5.07E-07 | -- | -- |
| Surface Soil to Outdoor Air (inh) | -- | -- | 4.99E-08 | 3.19E-09 | 1.15E-07 | 5.57E-09 | 1.67E-08 | 2.56E-09 | -- | -- |
| Groundwater to Outdoor Air (inh) | 5.32E-08 | 1.05E-09 | 8.50E-08 | 2.13E-09 | 1.25E-06 | 6.93E-09 | 2.79E-09 | 1.50E-10 | -- | -- |
| **Total Potential Risk:** | **5.32E-08** | **1.05E-09** | **1.90E-05** | **1.35E-06** | **1.66E-04** | **8.16E-06** | **5.04E-06** | **5.10E-07** | -- | -- |
| ***Construction Worker (CW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | -- | -- | 4.30E-07 | 6.57E-08 | 3.89E-06 | 4.14E-07 | 9.97E-08 | 1.90E-08 | -- | -- |
| Surface Soil to Outdoor Air (inh) | -- | -- | 3.11E-08 | 3.41E-09 | 5.50E-08 | 4.55E-09 | 1.56E-08 | 4.10E-09 | -- | -- |
| Groundwater (ing/derm) | 9.90E-06 | 4.71E-06 | 2.71E-06 | 1.12E-06 | 4.84E-06 | 2.39E-06 | 2.00E-07 | 1.00E-07 | -- | -- |
| Groundwater to Outdoor Air (inh) | 2.19E-07 | 6.57E-08 | 3.35E-07 | 1.00E-07 | 1.32E-07 | 3.16E-08 | 5.36E-08 | 1.61E-08 | -- | -- |
| **Total Potential Risk:** | **1.01E-05** | **4.78E-06** | **3.51E-06** | **1.29E-06** | **8.92E-06** | **2.84E-06** | **3.69E-07** | **1.39E-07** | -- | -- |
| ***Trespassing Teenager (TT)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | -- | -- | 3.24E-06 | 3.41E-07 | 2.81E-05 | 2.05E-06 | 8.81E-07 | 1.33E-07 | -- | -- |
| Surface Soil to Outdoor Air (inh) | -- | -- | 8.38E-10 | 1.28E-10 | 1.94E-09 | 2.23E-10 | 2.82E-10 | 1.02E-10 | -- | -- |
| Groundwater to Outdoor Air (inh) | 8.94E-10 | 4.20E-11 | 1.43E-09 | 8.51E-11 | 2.10E-08 | 2.78E-10 | 4.69E-11 | 5.99E-12 | -- | -- |
| **Total Potential Risk:** | **8.94E-10** | **4.20E-11** | **3.24E-06** | **3.42E-07** | **2.81E-05** | **2.05E-06** | **8.81E-07** | **1.33E-07** | -- | -- |
| ***Resident (RES)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | NA | NA | NA | NA | NA | NA | NA | NA | 1.30E-06 | 9.27E-08 |
| Surface Soil to Outdoor Air (inh) | NA | NA | NA | NA | NA | NA | NA | NA | 7.15E-11 | 2.60E-12 |
| Produce (ing) | NA | NA | NA | NA | NA | NA | NA | NA | -- | -- |
| **Total Potential Risk:** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **1.30E-06** | **9.27E-08** |

Notes:
-- No constituents of potential concern were identified for this pathway.
derm - dermal contact.
ing - ingestion.
inh - inhalation.
MLE - Most Likely Exposure.
NA - Not Applicable. Pathway not identified as a pathway of potential concern.
RME - Reasonable Maximum Exposure.

TABLE 8-4
SUMMARY OF POTENTIAL HAZARD INDICES FOR ALL RECEPTORS - SITES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Medium (Pathways) | Sites | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | G | | H | | I | | L | | N | |
| | RME | MLE | RME | MLE | RME | MLE | RME | MLE | RME | MLE |
| ***Indoor Industrial Worker (IW)*** | | | | | | | | | | |
| Groundwater to Indoor Air (inh) | **0.20** | **0.02** | **0.41** | **0.07** | **0.10** | **0.01** | **0.05** | **0.01** | -- | -- |
| ***Outdoor Industrial Worker (OW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | -- | -- | 0.05 | 0.01 | 2.12 | 0.36 | 0.03 | 0.01 | -- | -- |
| Surface Soil to Outdoor Air (inh) | -- | -- | NC | NC | NC | NC | NC | NC | -- | -- |
| Groundwater to Outdoor Air (inh) | 0.01 | 0.001 | 0.04 | 0.003 | 0.03 | 0.001 | 0.002 | 0.0003 | -- | -- |
| **Total Potential Hazard Index:** | **0.01** | **0.001** | **0.09** | **0.01** | **2.15** | **0.36** | **0.03** | **0.01** | -- | -- |
| ***Construction Worker (CW)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | -- | -- | 0.02 | 0.003 | 1.08 | 0.11 | 0.01 | 0.003 | -- | -- |
| Surface Soil to Outdoor Air (inh) | -- | -- | NC | NC | NC | NC | NC | NC | -- | -- |
| Groundwater (ing/derm) | 0.09 | 0.04 | 0.09 | 0.04 | 0.09 | 0.04 | 0.10 | 0.05 | -- | -- |
| Groundwater to Outdoor Air (inh) | 2.40 (a) | 0.72 | 4.43 | 1.33 (a) | 0.87 | 0.20 | 0.78 | 0.23 | -- | -- |
| **Total Potential Hazard Index:** | **2.49 (a)** | **0.76** | **4.55** | **1.38 (a)** | **2.04** | **0.34** | **0.89** | **0.29** | -- | -- |
| ***Trespassing Teenager (TT)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | -- | -- | 0.02 | 0.002 | 0.84 | 0.06 | 0.01 | 0.002 | -- | -- |
| Surface Soil to Outdoor Air (inh) | -- | -- | NC | NC | NC | NC | NC | NC | -- | -- |
| Groundwater to Outdoor Air (inh) | 0.0004 | 0.00002 | 0.002 | 0.0001 | 0.001 | 0.00002 | 0.00006 | 0.00001 | -- | -- |
| **Total Potential Hazard Index:** | **0.0004** | **0.00002** | **0.02** | **0.002** | **0.84** | **0.06** | **0.01** | **0.002** | -- | -- |
| ***Resident (RES)*** | | | | | | | | | | |
| Surface Soil (ing/derm) | NA | NA | NA | NA | NA | NA | NA | NA | NC | NC |
| Surface Soil to Outdoor Air (inh) | NA | NA | NA | NA | NA | NA | NA | NA | NC | NC |
| Produce (ing) | NA | NA | NA | NA | NA | NA | NA | NA | -- | -- |
| **Total Potential Hazard Index:** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NC** | **NC** |

Notes:
-- No constituents of potential concern were identified for this pathway.
derm - dermal contact.
ing - ingestion.
inh - inhalation.
MLE - Most Likely Exposure.
NA - Not Applicable. Pathway not identified as a pathway of potential concern.
NC - Not Calculated. No appropriate dose-response values for constituents for this pathway.
RME - Reasonable Maximum Exposure.
(a) No HI exceedence based on a toxic endpoint analysis (See Table 8-5 and Appendix R).

TABLE 8-5
SUMMARY OF TARGET ENDPOINT ANALYSIS - CONSTRUCTION WORKER
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Medium (Pathways) / Target Endpoint | Sites | | |
|---|---|---|---|
| | G | H | |
| | RME | RME | MLE |
| ***Construction Worker (CW)*** | | | |
| Surface Soil (ing/derm) | | | |
| Eye | -- | 0.01 | 0.002 |
| Immunological | -- | 0.01 | 0.002 |
| Skin | -- | 0.02 | 0.003 |
| Vascular | -- | 0.01 | 0.001 |
| Groundwater (ing/derm) | | | |
| Blood | 0.03 | 0.03 | 0.01 |
| Decreased Body Weight | 0.004 | 0.004 | 0.002 |
| Decreased Longevity | -- | 0.0003 | 0.0001 |
| Developmental | 0.0001 | 0.000002 | 0.000001 |
| Immunological | 0.01 | 0.001 | 0.001 |
| Kidney | 0.02 | 0.05 | 0.02 |
| Liver | 0.03 | 0.06 | 0.02 |
| Neurological | 0.0002 | -- | -- |
| Reproductive | 0.0007 | -- | -- |
| Skin | -- | 0.003 | 0.002 |
| Spleen | 0.02 | 0.002 | 0.001 |
| Vascular | -- | 0.003 | 0.002 |
| Groundwater to Outdoor Air (inh) | | | |
| Blood | 0.95 | 0.94 | 0.28 |
| Developmental | -- | 0.002 | 0.001 |
| Kidney | 0.42 | 0.38 | 0.11 |
| Liver | 0.42 | 0.38 | 0.11 |
| Nasal | 0.99 | 3.12 | 0.93 |
| Neurological | 0.03 | -- | -- |
| **Total Potential Hazard Index:** | | | |
| Blood | 0.98 | 0.96 | 0.29 |
| Decreased Body Weight | 0.004 | 0.004 | 0.002 |
| Decreased Longevity | -- | 0.0003 | 0.0001 |
| Developmental | 0.0001 | 0.002 | 0.001 |
| Eye | -- | 0.01 | 0.002 |
| Immunological | 0.01 | 0.01 | 0.003 |
| Kidney | 0.44 | 0.43 | 0.13 |
| Liver | 0.45 | 0.44 | 0.14 |
| Nasal | 0.99 | **3.12** | 0.93 |
| Neurological | 0.03 | -- | -- |
| Reproductive | 0.0007 | -- | -- |
| Skin | -- | 0.03 | 0.005 |
| Spleen | 0.02 | 0.002 | 0.001 |
| Vascular | -- | 0.01 | 0.003 |

Notes:
derm - Dermal.
ing - Ingestion.
inh - Inhalation.
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.

TABLE 8-6
SUMMARY OF POTENTIAL RISKS FOR ALL RECEPTORS - DEAD CREEK AND BORROW PIT LAKE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Medium (Pathways) | Dead Creek/Borrow Pit Lake | |
|---|---|---|
| | RME | MLE |
| ***Recreational Teen (RT)*** | | |
| Sediment - Wading (ing/derm) | 3.02E-07 | 5.68E-08 |
| Sediment - Swimming (ing/derm) | 1.51E-07 | 2.84E-08 |
| **Total Potential Risk:** | **4.53E-07** | **8.51E-08** |
| ***Recreational Fisher (RF)*** | | |
| Sediment (ing/derm) | 5.83E-07 | 9.22E-09 |
| Fish Tissue (ing) | 3.31E-05 | 1.24E-06 |
| **Total Potential Risk:** | **3.36E-05** | **1.25E-06** |

Notes:
-- No constituents of potential concern were identified for this pathway.
derm - dermal contact.
ing - ingestion.
inh - inhalation.
MLE - Most Likely Exposure.
NA - Not Applicable. Pathway not identified as a pathway of potential concern.
RME - Reasonable Maximum Exposure.

TABLE 8-7
SUMMARY OF POTENTIAL HAZARD INDICES FOR ALL RECEPTORS - DEAD CREEK AND BORROW PIT LAKE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| Medium (Pathways) | Dead Creek/Borrow Pit Lake | |
|---|---|---|
| | RME | MLE |
| ***Recreational Teen (RT)*** | | |
| Sediment - Wading (ing/derm) | 0.02 | 0.003 |
| Sediment - Swimming (ing/derm) | 0.01 | 0.001 |
| **Total Potential Risk:** | **0.03** | **0.004** |
| ***Recreational Fisher (RF)*** | | |
| Sediment (ing/derm) | 0.02 | 0.001 |
| Fish Tissue (ing) | 0.17 | 0.02 |
| **Total Potential Risk:** | **0.19** | **0.02** |

Notes:
-- No constituents of potential concern were identified for this pathway.
derm - dermal contact.
ing - ingestion.
inh - inhalation.
MLE - Most Likely Exposure.
NA - Not Applicable. Pathway not identified as a pathway of potential concern.
RME - Reasonable Maximum Exposure.

TABLE 8-8
TOTAL POTENTIAL RISKS - ORIGINAL AND SUPPLEMENTAL
CONSTRUCTION WORKER - RME
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

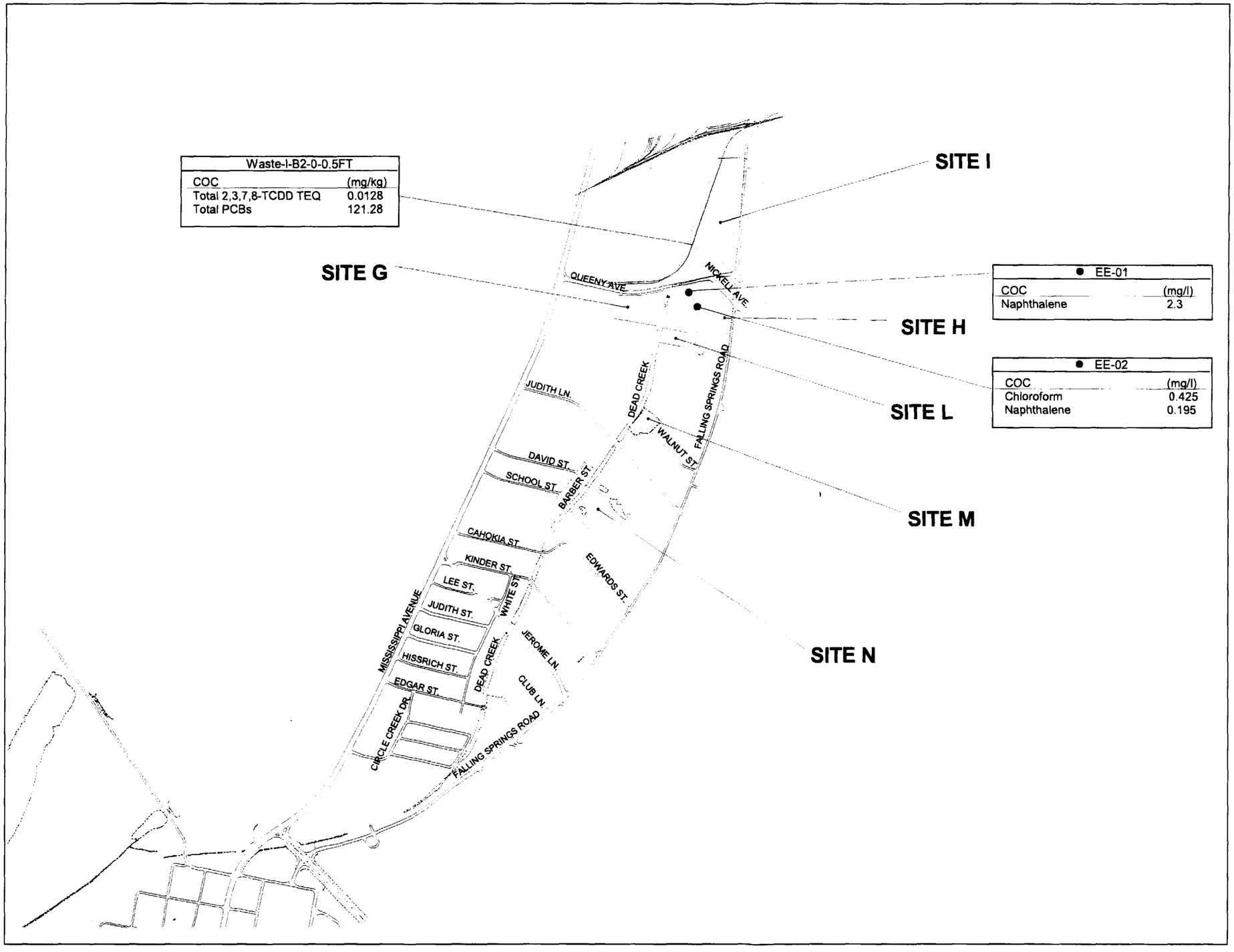
| | Site | | | |
|---|---|---|---|---|
| | G | H | I | L |
| Total Potential Carcinogenic Risk - Original HHRA | 1.01E-05 | 3.51E-06 | 8.92E-06 | 3.69E-07 |
| Total Potential Carcinogenic Risk - Supplemental HHRA | 3.53E-05 | 9.37E-05 | 2.66E-05 | 3.00E-06 |
| **Total Potential Carcinogenic Risk - Combined** | **4.54E-05** | **9.72E-05** | **3.56E-05** | **3.37E-06** |
| Total Hazard Index - Original HHRA | 2.49E+00 | 4.55E+00 | 2.04E+00 | 8.95E-01 |
| Total Hazard Index - Supplemental HHRA | 4.77E+01 | 1.62E+02 | 4.61E+01 | 4.32E+00 |
| **Total Hazard Index - Combined HHRA** | **5.02E+01** | **1.67E+02** | **4.81E+01** | **5.21E+00** |

Notes:
HHRA - Human Heath Risk Assessment.
HI - Hazard Index.
RME - Reasonable Maximum Exposure.

TABLE 8-9
TOTAL POTENTIAL RISKS - ORIGINAL AND SUPPLEMENTAL
CONSTRUCTION WORKER - MLE
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

| | Site | | | |
|---|---|---|---|---|
| | G | H | I | L |
| Total Potential Carcinogenic Risk - Original HHRA | 4.78E-06 | 1.29E-06 | 2.84E-06 | 1.39E-07 |
| Total Potential Carcinogenic Risk - Supplemental HHRA | 7.74E-06 | 5.68E-06 | 9.18E-06 | 5.95E-07 |
| **Total Potential Carcinogenic Risk - Combined** | **1.25E-05** | **6.97E-06** | **1.20E-05** | **7.34E-07** |
| Total Hazard Index - Original HHRA | 7.60E-01 | 1.38E+00 | 3.43E-01 | 2.87E-01 |
| Total Hazard Index - Supplemental HHRA | 4.98E+00 | 9.01E+00 | 7.42E+00 | 8.08E-01 |
| **Total Hazard Index - Combined HHRA** | **5.74E+00** | **1.04E+01** | **7.76E+00** | **1.10E+00** |

Notes:
HHRA - Human Heath Risk Assessment.
HI - Hazard Index.
MLE - Most Likely Exposure.




N

LEGEND

Site

Water Body

Roads

Soil Sample Locations

Groundwater Sample Locations

CS-A Dead Creek Segment Designations

**FIGURE 8-1**

Sample By Sample Concentrations of Constituents of Concern (COC)

**Sauget Area 1**
**EE/CA and RI/FS**
**Volume II**
**Human Health Risk Assessment**

Solutia, Inc.
Remediation Technology Group
St. Louis, Missouri

3000 0 30

ENSR INTERNATIONAL

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December 29, 2000
Revision 0

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# APPENDIX A

# HHRA WORKPLAN

# APPENDIX A
# HHRA WORKPLAN

This appendix presents a copy of the USEPA-approved Human Health Risk Assessment (HHRA) Workplan for Sauget Area 1, Sauget and Cohokia, Illinois, dated June 25, 1999, including the change pages issued August 6, 1999.

Workplan Appendix C provides the USEPA Region 9 Preliminary Remediation Goals (PRGs). The PRGs current at the time of the submittal of the workplan were dated June 3, 1998. The original appendix has been replaced here with the PRGs current at the time of the conduct of the hazard identification screen for the HHRA, those dated October 1, 1999. [Note that as of this writing, the PRGs have been updated by Region 9, dated November 22, 2000. Of the constituents for which PRGs were used for the screening process, only the value for lead changed significantly. The most current value for lead has been incorporated into the screening process.]

Workplan Appendix D provides the USEPA Region 3 Risk-Based Concentrations (RBCs). The RBCs current at the time of the submittal of the workplan were dated October 1998. The original appendix has been replaced here with the most recent RBCs current at the time of the conduct of the hazard identification screen, those dated October 2000.

# Solutia, Inc.
# St. Louis, Missouri

# Sauget Area 1 EE/CA and RI/FS Support Sampling Plan Volume 1B

# Human Health Risk Assessment Workplan, Sauget Area 1, Sauget and Cahokia, Illinois

**ENSR Corporation**
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# CONTENTS

**LIST OF ACRONYMS**

**1.0 INTRODUCTION** ..... **1-1**

**2.0 SITE CHARACTERIZATION** ..... **2-1**

**3.0 HAZARD IDENTIFICATION** ..... **3-1**

3.1 Data Compilation ..... 3-1
3.1.1 Areas and Media ..... 3-1
3.1.2 Analytes ..... 3-2
3.1.3 Sample Collection by Area and Medium ..... 3-2
3.1.3.1 Groundwater ..... 3-3
3.1.3.2 Fill Area Wastes ..... 3-3
3.1.3.3 Soil ..... 3-3
3.1.3.4 Surface Water ..... 3-4
3.1.3.5 Sediment ..... 3-4
3.1.3.6 Fish Tissue ..... 3-4
3.1.3.7 Air ..... 3-4

3.2 Selection of Constituents of Potential Concern ..... 3-4
3.2.1 Evaluation of Frequency of Detection and Essential Nutrient Status ..... 3-5
3.2.2 Comparison to Background ..... 3-5
3.2.3 Toxicity Screen ..... 3-6

**4.0 DOSE-RESPONSE ASSESSMENT** ..... **4-1**

4.1 PCB Dose-Response ..... 4-1

4.2 Dioxin Dose-Response ..... 4-2

**5.0 EXPOSURE ASSESSMENT** ..... **5-1**

5.1 Identification of Potential Exposure Scenarios ..... 5-1

5.2 Sample Collection Strategy ..... 5-3

5.3 Receptor Identification ..... 5-3
5.3.1 Indoor Industrial Worker ..... 5-4

CONTENTS (Cont'd)

5.3.2 Outdoor Industrial Worker ..... 5-4
5.3.3 Trespassing Teenager ..... 5-4
5.3.4 Construction/Utility Worker ..... 5-4
5.3.5 Resident ..... 5-4
5.3.6 Recreational Teenager ..... 5-5
5.3.7 Recreational Fisher ..... 5-5

5.4 Exposure Parameters ..... 5-5
5.4.1 Soil Ingestion Rate – Adult Construction Worker ..... 5-5
5.4.2 Frequency of Exposure to COPC in Soil ..... 5-7

5.5 Quantification of Potential Exposures ..... 5-8
5.5.1 Estimating Potential Exposure from Ingestion of and Dermal Contact with Soil or Sediment ..... 5-9
5.5.2 Estimating Potential Exposure via Inhalation ..... 5-10
5.5.3 Estimating Potential Exposure from Groundwater/Surface Water ..... 5-11
5.5.4 Estimating Potential Exposure From Food Consumption ..... 5-12

5.6 Calculation of Exposure Point Concentrations ..... 5-12

**6.0 RISK CHARACTERIZATION ..... 6-1**

6.1 Carcinogenic Risk Characterization ..... 6-1

6.2 Noncarcinogenic Risk Characterization ..... 6-2

6.3 Risk Assessment Refinement ..... 6-2

6.4 Cumulative Risk ..... 6-3

6.5 Uncertainty Analysis ..... 6-3

**7.0 SUMMARY AND CONCLUSIONS ..... 7-1**

**8.0 REFERENCES ..... 8-1**

## CONTENTS (Cont'd)

**APPENDICES:**

A DATA QUALITY LEVELS FOR HUMAN HEALTH RISK ASSESSMENT
B TACO TIER I CRITERIA
C USEPA REGION 9 PRELIMINARY REMEDIATION GOALS
D USEPA REGION 3 RISK-BASED CONCENTRATIONS
E FEDERAL AMBIENT WATER QUALITY CRITERIA

## LIST OF TABLES

Table 4-1 TEFs for Dioxin and Furan Congeners ..... 4-3
Table 5-1 Receptor - Area Matrix ..... 5-15
Table 5-2 Sampling in Support of the Human Health Risk Assessment ..... 5-16
Table 5-3 Summary of Potential Exposure Assumptions – Indoor Industrial Worker ..... 5-20
Table 5-4 Summary of Potential Exposure Assumptions – Outdoor Industrial Worker ..... 5-21
Table 5-5 Summary of Potential Exposure Assumptions – Trespassing Teenager ..... 5-22
Table 5-6 Summary of Potential Exposure Assumptions – Construction Worker ..... 5-23
Table 5-7 Summary of Potential Exposure Assumptions – Resident ..... 5-24
Table 5-8 Summary of Potential Exposure Assumptions - Recreational Teenager ..... 5-25
Table 5-9 Summary of Potential Exposure Assumptions - Recreational Fisher ..... 5-26
Table 5-10 Soil Adherence Factors - Outdoor Industrial Worker ..... 5-27
Table 5-11 Soil Adherence Factors – Construction Worker ..... 5-27
Table 5-12 Soil Adherence Factors – Resident Adult ..... 5-28
Table 5-13 Soil Adherence Factors – Resident Child ..... 5-28
Table 5-14 Soil Adherence Factors - Trespassing Teenager ..... 5-29

## LIST OF FIGURES

Figure 2-1 Conceptual Site Model for Human Health Risk ..... 2-3

## LIST OF ACRONYMS

| | |
|---|---|
| AAF | Absorption Adjustment Factors |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| AOC | Administrative Order by Consent |
| ASTM | American Society for Testing and Materials |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| AWQC | Ambient Water Quality Criteria |
| bgs | below ground surface |
| CADD | Chronic Average Daily Dose |
| CAS | Chemical Abstracts Service |
| COC | Constituents of Concern |
| COPC | Constituents of Potential Concern |
| CS | Creek Segment |
| CSF | Cancer Slope Factor |
| CSM | Conceptual Site Model |
| DQL | Data Quality Levels |
| EE/CA | Engineering Evaluation and Cost Analysis |
| EFH | Exposure Factors Handbook |
| ELCR | Excess Lifetime Cancer Risk |
| HEAST | Health Effects Assessment Summary Tables |
| HHRA | Human Health Risk Assessment |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| IEPA | Illinois Environmental Protection Agency |
| IRIS | Integrated Risk Information System |
| LADD | Lifetime Average Daily Dose |
| MLE | Most Likely Exposure |
| MRL | Minimum Risk Level |
| NCEA | National Center for Environmental Assessment |
| NCP | National Contingency Plan |
| NIOSH | National Institute of Occupational Safety and Health |
| NOAA | National Oceanographic and Atmospheric Administration |
| OSHA | Occupational Safety and Health Administration |
| PCB | Polychlorinated Biphenyls |
| PQL | Practical Quantitation Limit |
| PRG | Preliminary Remediation Goal |
| QAPP | Quality Assurance Project Plan |
| RAGS | Risk Assessment Guidance for Superfund |
| RBC | Risk-Based Concentration |

## LIST OF ACRONYMS

| | |
|---|---|
| RfC | Reference Concentration |
| RfD | Reference Dose |
| RG | Remedial Goal |
| RI/FS | Remedial Investigation and Feasibility Study |
| RME | Reasonable Maximum Exposure |
| SOW | Scope of Work |
| SSL | Soil Screening Level |
| SSP | Support Sampling Plan |
| SVOC | Semi-Volatile Organic Compounds |
| TACO | Tiered Approach to Corrective Action Objectives |
| TCDD | Tetrachlorodibenzo-p-dioxin |
| TEF | Toxic Equivalence Factor |
| TEQ | Toxic Equivalence Concentration |
| TPH | Total Petroleum Hydrocarbons |
| UCL | Upper Confidence Limit |
| USEPA | U.S. Environmental Protection Agency |
| VOC | Volatile Organic Compounds |
| WHO | World Health Organization |

# 1.0 INTRODUCTION

This document presents a workplan for conducting a streamlined evaluation of short-term exposures, as well as for performing a baseline human health risk assessment (HHRA) for Sauget Area 1 located in Sauget and Cahokia, IL. This workplan has been developed to support the Engineering Evaluation and Cost Analysis (EE/CA) for the Sauget Area 1 source areas and potentially impacted portions of Area 1, and for the Remedial Investigation and Feasibility Study (RI/FS) for Sauget Area 1 groundwater. In addition, this workplan has been developed to satisfy the Scope of Work (SOW) for the EE/CA and RI/FS, provided as an attachment to the Administrative Order by Consent (AOC) entered into by the U.S. Environmental Protection Agency (USEPA) and Solutia Inc. (Solutia), as well as to be compliant with the National Contingency Plan (NCP).

Streamlined Short-Term Risk Assessment

In some situations, short-term exposures (e.g., subchronic daily intakes) may be important. An evaluation of short-term exposures is not normally included as part of the baseline risk assessment. However, since an EE/CA is being performed, an evaluation of the potential for unacceptable health risks after short-term exposures will be conducted. If an identified release is predicted to pose unacceptable health risks after short-term exposure, accelerated response actions to address any potential imminent and substantial endangerment to human health or the environment (i.e., principal threats) may be warranted. According to USEPA (1989a) guidance, the following factors should be considered when deciding whether to evaluate short-term exposures for the purposes of addressing the need for time-critical removal actions:

- The toxicological characteristics of the chemicals of potential concern;
- The occurrence of high chemical concentrations or the potential for a large release;
- Persistence of the chemicals in the environment; and
- The characteristics of the population that influence the duration of exposure.

The above factors will be evaluated and discussed in the EE/CA report. Additionally, if the average concentration of any constituent detected during the investigations exceeds the screening level for that constituent by greater than 100-fold (MADEP, 1995), a short-term exposure scenario evaluation will be performed for that constituent. Since this type of short-term health evaluation is not a standard component of most hazardous waste site health evaluations, limited guidance exists for performing these types of evaluations. Short-term exposures generally pose less of a health risk than longer-term exposures to the same concentration of a chemical. In recognition of this fact, USEPA generally establishes subchronic toxicity criteria at ten fold higher concentrations than chronic toxicity criteria. When available, USEPA-approved acute and subchronic toxicity criteria will be used to evaluate short-term exposures. Both reasonable maximum exposure (RME) and most likely exposure (MLE)

scenarios will be included in the evaluation, utilizing upper bound and average media concentrations, respectively.

In the absence of USEPA criteria, short-term air exposures will be evaluated based on guidance provided by USEPA (1993c). As outlined by USEPA (1993c), the primary reference source for obtaining short-term air action levels will be the most recent version of the Texas Air Control Board Effects Screening Level List. Secondary sources of information will include, but will not be limited to, short-term exposure limits derived by the American Conference of Governmental Industrial Hygienists (ACGIH), the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA).

For soils, acute and intermediate duration minimal risk levels (MRLs) available from ATSDR will be used. If MRLs for soil are not available for a chemical evaluated for potential short-term health effects, acute and/or intermediate exposure duration health criteria will be derived by qualified toxicologists, for review by USEPA Region V and/or IEPA. A condition of imminent endangerment will be considered to exist if target risks exceed $10^{-4}$ or a hazard index for chemicals with similar target endpoints exceeds 1. Due to the need for time-critical removal actions when an imminent endangerment is identified, USEPA and IEPA will be notified within 30 days if any potential short-term health hazards are identified during the course of the investigations.

Baseline Risk Assessment

The HHRA will follow Task 4, Section 2.5, and Task 5, Section 2 of the SOW. In addition, the HHRA will also comply with USEPA guidance for conducting a risk assessment including, but not limited to, the following:

- Risk Assessment Guidance for Superfund (RAGS): Volume 1 - Human Health Evaluation Manual (Parts A and D) (USEPA, 1989a and 1998a).
- USEPA Soil Screening Guidance: Technical Background Document (USEPA, 1996a).
- Human Health Evaluation Manual Supplemental Guidance; Standard Default Exposure Factors. (USEPA, 1991a).
- Exposure Factors Handbook (USEPA, 1997a).
- Land Use in CERCLA Remedy Selection Process (USEPA, 1995).

The baseline risk assessment will evaluate potential health effects after chronic daily exposures and will be conducted using the four step paradigm as identified by the USEPA (USEPA, 1989a). The steps are:

- Data Evaluation and Hazard Identification
- Toxicity Assessment
- Exposure Assessment
- Risk Characterization

This workplan is organized into the following sections:

- Site Characterization – Section 2.0 of this workplan discusses the site and its environs, and presents a conceptual site model describing source areas, potential migration pathways, and potentially impacted media.

- Hazard Identification – Section 3.0 of this workplan presents a discussion of how site data will be summarized, and a description of the process for the selection of constituents of potential concern (COPC) to be evaluated quantitatively in the risk assessment.

- Dose-Response Assessment – Section 4.0 of this workplan presents a discussion of the dose-response assessment process. The dose-response assessment evaluates the relationship between the magnitude of exposure (dose) and the potential for occurrence of specific health effects (response) for each COPC. Both potential carcinogenic and noncarcinogenic effects will be considered. The most current USEPA verified dose-response values will be used when available.

- Exposure Assessment - Section 5.0 of this workplan presents a discussion of the exposure assessment process. The purpose of the exposure assessment is to provide a quantitative estimate of the magnitude and frequency of potential exposure to COPC by a receptor. Potentially exposed individuals, and the pathways through which those individuals may be exposed to COPC are identified based on the physical characteristics of the site, as well as the current and reasonably foreseeable future uses of the site and surrounding area. The extent of a receptor's exposure is estimated by constructing exposure scenarios that describe the potential pathways of exposure to COPC and the activities and behaviors of individuals that might lead to contact with COPC in the environment.

- Risk Characterization – Section 6.0 of this workplan presents a discussion of the risk characterization process and uncertainties associated with the risk assessment process. Risk characterization combines the results of the exposure assessment and the toxicity assessment to derive site-specific estimates of potentially carcinogenic and noncarcinogenic risks resulting from both current and reasonably foreseeable potential human exposures to COPC. The results of the risk characterization will be used to identify constituents of concern (COC), which are the subset of those COPC whose risks result in an exceedance of the target risk range of $10^{-6}$ to $10^{-4}$ for potential carcinogens and a target Hazard Index of 1 for

noncarcinogens (that act on the same target organ), as defined in the AOC SOW and by the Illinois Environmental Protection Agency (IEPA) (1998).

Within any of the steps of the risk assessment process described above, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. The assumptions that introduce the greatest amount of uncertainty in this risk evaluation will be discussed in Section 6.0 of the HHRA report.

- Summary and Conclusions – Section 7.0 of this workplan will discuss how the results of the HHRA will be summarized in the final report.

Each of these steps is discussed in the sections that follow. References are provided in Section 8.0 of this workplan. The sections of the HHRA report submitted as part of the EE/CA and RI/FS will be organized following this same format.

# 2.0 SITE CHARACTERIZATION

This workplan addresses the areas of Sauget Area 1 as identified in the AOC. Specifically, the EE/CA for Sauget Area 1 will address the following areas:

- Fill areas (Sites G, H, I, L, M, and N), and
- Potentially impacted areas:
  - Dead Creek Segments (CS): CS-B, CS-C, CS-D, CS-E, and CS-F
  - Commercial, residential and/or undeveloped properties adjacent to these creek segments

The RI/FS for Sauget Area 1 will address groundwater in the following areas:

- Fill areas and areas downgradient of the source areas
- Groundwater in the area of, and private wells identified along, Walnut Street and Judith Lane in Cahokia, IL

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a conceptual site model (CSM) for human health has been developed. The purpose of the CSM is to identify fill areas, potential migration pathways of constituents from fill areas to media where exposure can occur, and to identify potential human receptors. Potential exposure pathways and potential receptors are discussed in Section 5.0.

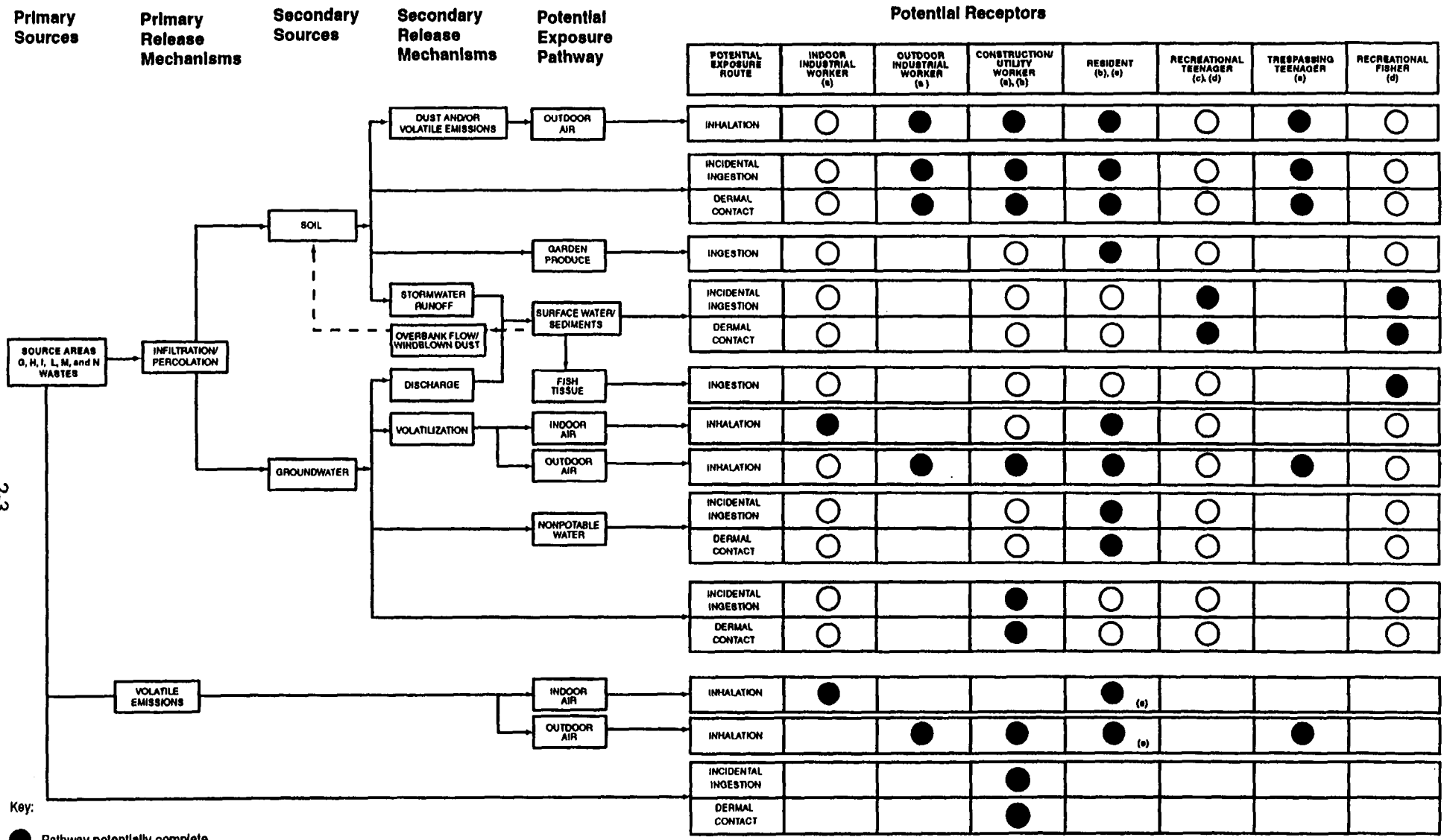
Conceptual Site Model

At Sauget Area 1, the fill areas are identified as Sites G, H, I, L, M, and N. Constituents in the fill areas may leach to underlying groundwater. Volatile organic compounds (VOCs) in groundwater may volatilize into outdoor air and may infiltrate into air in overlying buildings. Constituents in groundwater may discharge to Dead Creek and subsequently be transported downstream to the lower reaches of Dead Creek and into the Borrow Pit Lake. Fish in the Borrow Pit Lake may have accumulated constituents present in surface water and/or sediments. In addition, it is possible that Dead Creek flooding events and/or windblown dust may have resulted in the distribution of constituents to soils on the properties adjacent to the creek. Figure 2-1 presents a CSM for Sauget Area 1. The CSM identifies sources, environmental release mechanisms, potential exposure pathways, potential exposure routes, and potential human receptors. Those potentially complete exposure pathways to be considered for further evaluation in the risk assessment are identified. Receptors and pathways are discussed in more detail in Section 5.0.

The Support Sampling Plan (SSP) sampling program has been developed to address these potential migration pathways. Sampling to be conducted in support of the HHRA include the following. Fill area surface soil and wastes will be sampled and characterized. Groundwater in the source areas,

downgradient of the source areas, and southwest of the source areas will be sampled and characterized. Shallow groundwater and domestic wells in the vicinity of Walnut Street and Judith Lane will also be characterized. Surface and subsurface soils in the undeveloped and residential areas of the residential/commercial/undeveloped properties adjacent to Dead Creek will be sampled. Surface water and sediments in Dead Creek and the Borrow Pit Lake will be sampled. In addition, fish tissue samples from the Borrow Pit Lake will be analyzed.

The CSM is meant to be a "living" model that can be updated and modified as additional data become available. The exposure scenarios proposed for quantitative evaluation in the risk assessment (see Section 5.0) have been identified based on this current CSM. However, the CSM will be reviewed and modified as necessary once the analytical data from the SSP program have become available. Any substantial changes in the CSM and, subsequently, the pathways for quantitative evaluation, will be discussed with USEPA prior to conduct of the risk assessment.




Key:

● Pathway potentially complete, further evaluation recommended

○ Pathway evaluated and found incomplete or insignificant, no further evaluation recommended

(a) Source areas
(b) Residential, commerical, undeveloped areas
(c) Dead Creek segments CS-B through CS-E
(d) Borrow Pit Lake; SC-F
(e) Since Area N will be evaluated for potential residential receptors

**FIGURE 2-1**
Conceptual Site Model for Human Health Risk Assessment
Sauget Area 1 EE/CA and RI/FS, Sauget and Cahokia, Illinois
Solutia, Inc.

M990207

# 3.0 HAZARD IDENTIFICATION

The purpose of the hazard identification process is two-fold: 1) to evaluate the nature and extent of release of constituents present at the site; and 2) to select a subset of constituents of potential concern (COPC) for quantitative evaluation in the risk assessment. This step of the risk assessment will involve compiling and summarizing SSP data for the risk assessment, and selecting COPC based on a series of screening criteria.

## 3.1 Data Compilation

For Sauget Area 1, existing data are available from previously conducted investigations. New data will be available from the field activities specified in the SSP. The HHRA will include a section that compiles all of the valid data collected from the site in support of the SSP.

### 3.1.1 Areas and Media

The SSP for Sauget Area 1 is designed to investigate the source areas, Dead Creek and its environs, and the residential/commercial/undeveloped areas adjacent to Dead Creek. Of the data to be collected for the SSP, analytical data for use in the HHRA will be available for the following media:

- Source area shallow groundwater;
- Source area downgradient alluvial groundwater;
- Shallow groundwater southwest of source areas;
- Shallow groundwater in the vicinity of Walnut Street and Judith Lane;
- Groundwater from private wells in the vicinity of Walnut Street and Judith Lane;
- Source area surface soil;
- Source area subsurface waste;
- Residential area surface soil (0-0.5 feet below ground surface (bgs));
- Residential area subsurface soil (0.5-6 feet bgs);
- Dead Creek sediment;
- Borrow Pit Lake sediment;
- Dead Creek surface water;
- Borrow Pit Lake surface water;
- Fish tissue from Borrow Pit Lake (if populations are present); and
- 24-hour air samples at Sites G, H, I, and L.

Analytical data for use in the HHRA from background or reference locations will be available for the following media:

- Surface soil;

- Subsurface soil;
- Groundwater;
- Surface water;
- Sediment;
- Fish tissue; and
- Upwind air.

### 3.1.2 Analytes

The SSP identifies the suites of analytes for each medium. For ease of discussion here, the analytes to be included in the risk evaluation are identified as follows:

- Full suite of analytes – VOCs, semi-volatile organic compounds (SVOCs), metals, mercury, cyanide, polychlorinated biphenyls (PCBs), pesticides, and herbicides;
- Dioxins – dioxins and furans; and
- Industry-specific analytes – PCBs, total petroleum hydrocarbons (TPH), copper, zinc, fluorides, phosphorous and ortho-phosphate. [Note - only PCBs, copper, zinc, fluorides, and phosphorous will be quantitatively evaluated in the HHRA. Fluorides, phosphorous, and ortho-phosphate will be analyzed for only in surface water.]

All analytical data collected in support of the SSP will be compiled and tabulated in a database for statistical analysis. Summary statistics tables will be developed for each medium in each area, and will present for each constituent the minimum and maximum detected values, the arithmetic mean, the 95th percentile upper confidence limit (UCL) on the arithmetic mean (USEPA, 1992a), and the frequency of detection. Constituents analyzed for but never detected in a particular medium will not be included in the summary statistics for that medium. For constituents detected at least once in a particular medium, samples reported as "non-detect" by the laboratory will be assigned a value of one-half the sample quantitation limit in calculating summary statistics (USEPA, 1989a; IEPA, 1998). Duplicate sample results will be averaged and treated as a single sample result when compiling summary statistics.

### 3.1.3 Sample Collection by Area and Medium

Data sets for each medium are described below. Sample collection strategy based on human health risk assessment needs is discussed in conjunction with the potential exposure scenarios in Section 5.2.

#### 3.1.3.1 Groundwater

Fill Areas - Data for shallow groundwater samples from wells located in the fill areas, the downgradient alluvial aquifers, and shallow groundwater southwest of the fill areas, as identified in the SSP, will be evaluated in the risk assessment. These data will include the full suite of analytes and dioxins.

Residential Area - Analytical data for shallow groundwater in the Walnut Street/Judith Lane residential area, as well as for four domestic wells in this area will be evaluated in the risk assessment. These data will include the full suite of analytes and dioxins.

#### 3.1.3.2 Fill Area Wastes

Sediment samples will be collected from Site M and analyzed for the full suite of analytes and dioxins. Subsurface waste samples will be collected from Sites G, H, I, L, and N and analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment. As described in Section 5.2, the VOC sample will be a discrete sample taken along the depth of the waste at the location having the highest PID/FID (Photo/flame Ionization Detector) reading. The remaining analyses will be conducted on a sample composited from material collected throughout the depth of the waste (note - non-waste materials will not be included in this composite). Composting is being conducted to ensure that the sample collected is representative of all the wastes, not just a single stratum within the wastes. Composite samples are not generally regarded as the best descriptor with which to calculate the upper bound concentrations for a data set (USEPA, 1989a). In this case, because the sample is collected from waste materials only, the detected analytes are more likely to be representative of the heterogeneity of the wastes than those from a single sample collected at a discrete location within the wastes.

#### 3.1.3.3 Soil

Fill area - Surface soil (0-0.5 feet bgs) samples will be collected, colocated with the fill area waste sampling locations. These samples will be analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment.

Residential/Commercial/Undeveloped Area - Surface (0-0.5 feet bgs) and subsurface (0.5-6 feet bgs) soil samples will be collected from undeveloped areas along seven transects as identified in the SSP in the residential/commercial/undeveloped area adjacent to Dead Creek and analyzed for the full suite of analytes and dioxins. Based on the transect analytical results, surface and subsurface soil samples will be collected from three residences along each of Transects 1 through 6 and two residences along Transect 7 and analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment.

#### 3.1.3.4 Surface Water

Surface water samples will be collected from Dead Creek and Borrow Pit Lake, and analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment. Dead Creek and Borrow Pit Lake will be evaluated separately in the risk assessment. Depending on the distribution of analytical results, the sections of Dead Creek may be evaluated separately or in combination in the risk assessment.

#### 3.1.3.5 Sediment

Sediment samples will be collected from Dead Creek and Borrow Pit Lake. Data for the full suite of analytes and dioxins will be available for approximately 20 percent of these samples, and data for the industry-specific analytes will be available for approximately 80 percent of these samples. Depending on the distribution of analytical results, the sections of Dead Creek may be evaluated separately or in combination in the risk assessment.

#### 3.1.3.6 Fish Tissue

Fish tissue samples will be collected from Borrow Pit Lake and analyzed for the full suite of analytes (with the exception of VOCs) and dioxins. The determination of the applicability of the fish ingestion pathway for this waterbody is discussed in the Exposure Assessment (Section 5.3.5). If the fish ingestion pathway is included for quantitative evaluation in the HHRA, whole fish data will be used. Sample compositing will occur only where necessary to achieve a sufficient sample size for analysis. Predator, bottom feeding and forage fish will be collected as available. Expected types to be encountered include bass, crappie, catfish and/or bluegill.

#### 3.1.3.7 Air

Air samples will be collected in the vicinity of Sites G, H, I, and L and analyzed for VOCs, SVOCs, PCBs, dioxin, and metals. Because these are 24-hour air samples collected at a single time point, they will not be used in the calculation of risks in the HHRA. However, the data will be compared to chronic and, if appropriate, to subchronic or acute criteria as discussed in Section 1.0. Initial comparison will be made to USEPA Region 9 Preliminary Remediation Goals for air (USEPA, 1998c).

## 3.2 Selection of Constituents of Potential Concern

COPCs are a subset of the complete list of constituents detected in site media that are carried through the quantitative risk assessment process. Selection of COPCs focuses the analysis on the most likely risk "drivers." As stated in USEPA guidance (USEPA, 1993a):

"Most risk assessments are dominated by a few compounds and a few routes of exposure. Inclusion of all detected compounds at a site in the risk assessment has minimal influence on the total risk. Moreover, quantitative risk calculations using data from environmental media that may contain compounds present at concentrations too low to adversely affect public health have no effect on the overall risk estimate for the site. The use of a toxicity screen allows the risk assessment to focus on the compounds and media that may make significant contributions to overall risk."

Several factors are typically considered in selecting COPCs for a site, including natural background, frequency of detection, and toxicity, including essential nutrient status. Risk calculations will be conducted using the COPCs identified in this step.

Constituents of concern (COC) will be identified in Section 6.0 of the HHRA as those constituents whose risks result in an exceedance of the target risk range of $10^{-6}$ to $10^{-4}$ for potential carcinogens and a target Hazard Index of 1 for noncarcinogens (that act on the same target organ), as defined in the AOC SOW and by IEPA (1998). Remedial goals will be developed for COCs based on the exposure pathways evaluated in the risk assessment.

The steps to be used to identify COPC are presented below.

### 3.2.1 Evaluation of Frequency of Detection and Essential Nutrient Status

A frequency of detection screen will be conducted on each medium (e.g., sediment, surface soil, etc.). Constituents that are detected in fewer than 5% of samples, provided 20 samples are available, will not be included as COPCs. However, some of these constituents may be retained as COPC based on professional judgment, considering factors such as the presence of a hotspot. In addition to the frequency of detection screen, essential nutrients (i.e., calcium, iron, magnesium, sodium and potassium) will not be included as COPCs (USEPA, 1989a).

### 3.2.2 Comparison to Background

Background samples to be collected in the vicinity of the site present information on naturally-occurring levels of constituents typical for the local area. The purpose of comparing site conditions to local background is to determine if site concentrations of constituents are representative of background concentrations, which, therefore, should not be included in risk calculations. Background comparisons will be conducted for each medium using site-specific background data and background concentrations for rural and urban areas of Illinois published by IEPA (1998).

Groundwater, surface water and sediment samples collected in upgradient locations, if available, will provide site-specific background data for these media. Soil samples collected at appropriate off-site

locations, as described in the SSP, will provide site-specific background data for the soil media. See SSP Sections 6.8, 7.6, and 11.4 for a discussion of background locations.

The procedure for determining whether a constituent concentration is consistent with background will follow that developed by USEPA Region 4 (USEPA, 1996b). Maximum detected concentrations of constituents in environmental media at the site will be compared against two times the arithmetic mean site-specific background concentration. USEPA Region 4 states that although RAGS (USEPA, 1989a) allows the use of statistics in data evaluation, statistics may not be sufficiently conservative at this stage of the risk evaluation; and in most cases, there are not a sufficient number of samples for conducting a statistical analysis. Therefore, if maximum concentrations of inorganic constituents in an area are found to be less than two times the average background concentrations, then those constituents can be eliminated from quantitative evaluation in the risk assessment. Constituents whose concentrations are found to be above typical local background levels will be retained for evaluation in the next step of the hazard identification process (Toxicity Screen).

### 3.2.3 Toxicity Screen

A toxicity screen will be performed in accordance with USEPA Region 5 guidance (USEPA, 1998b) and IEPA regulations (IEPA, 1998). USEPA Region 5 guidance identifies the following three sources as appropriate screening levels for soil, in order of preference:

1) Most recent generic soil screening levels (SSLs) developed and presented in Appendix A of the Soil Screening Guidance (USEPA, 1996a). The SSLs are based on ingestion and inhalation (direct contact) and soil-to-groundwater exposure pathways for a residential scenario.

2) Site-specific SSLs derived using the methodology outlined in the above reference.

3) Most recent USEPA Region 9 Preliminary Remediation Goals (PRGs; USEPA, 1998c).

The IEPA Tiered Approach to Corrective Action (TACO) (IEPA, 1998) is very similar to that outlined in the SSL guidance (USEPA, 1996a) in that it provides Tier I criteria based on direct contact (ingestion and inhalation) and the soil-to-groundwater pathway. In fact, the TACO Tier I criteria have been developed based on the USEPA SSL guidance. However, the TACO Tier I criteria are more comprehensive because values are provided for a longer list of constituents, and Tier I criteria are available for both residential and industrial scenarios.

Therefore, IEPA TACO Tier I criteria will be used for the identification of COPC for soil and groundwater for quantitative evaluation in the risk assessment. Where IEPA TACO Tier I criteria (IEPA, 1998) are not available, USEPA Region 9 PRGs (1998c) will be used. Residential values will

be used to identify COPC for residential soils and sediments and all groundwater, and industrial values will be used to evaluate source area soils and waste.

Following IEPA guidance, the criteria for groundwater will be adjusted for cumulative effects for both potential carcinogens and noncarcinogens. Per the TACO program guidance, Tier I criteria for soils are not adjusted for cumulative effects (IEPA, 1998).

IEPA TACO Tier I values are not available for surface water, fish tissue, or air. Hence, surface water data will be compared with the lower of screening values identified for groundwater and the promulgated human health Ambient Water Quality Criteria (AWQCs) for fish ingestion (USEPA, 1998d). Fish tissue data will be compared to the USEPA Region 3 Risk-Based Concentrations (RBCs) for fish (USEPA, 1998e). Modeled air concentrations will be compared to USEPA Region 9 PRGs (USEPA, 1998c).

These criteria were used to develop data quality levels (DQLs) to be used to identify appropriate practical quantitation limits (PQLs) for laboratory methods for the analytical program. The DQLs and PQLs are discussed in greater detail in the Quality Assurance Project Plans (QAPPs) for the site (see Volumes 2B and 3B of the SSP). The DQLs for the HHRA are presented in Appendix A.

Per USEPA request, the current TACO Tier I values are presented in Appendix B, the current USEPA Region 9 PRGs are presented in Appendix C, the current USEPA Region 3 RBCs are presented in Appendix D, and the current AWQCs are presented in Appendix E. The PRGs and RBCs are periodically updated by USEPA. The most current criteria available will be used in the selection of COPC.

Constituents with maximum concentrations less than or equal to the screening criteria will not be included as COPC. If no COPC are identified for a medium, that medium will not be evaluated quantitatively in the HHRA.

Tables presenting the results of each screening step will be presented in the risk assessment report. The final list of COPC for inclusion in the risk assessment will also be presented in the risk assessment and included in all subsequent risk calculations.

# 4.0 DOSE-RESPONSE ASSESSMENT

The purpose of the dose-response assessment is to identify the types of adverse health effects a constituent may potentially cause, and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response).

Adverse effects are defined by USEPA as potentially carcinogenic or noncarcinogenic (i.e., potential effects other than cancer). Dose-response relationships are defined by USEPA. The dose-response values for potentially carcinogenic effects are termed Cancer Slope Factors (CSFs) or Unit Risk Factors, and dose-response values for noncarcinogenic effects are termed Reference Doses (RfDs) or Reference Concentrations (RfCs). These values are available from USEPA sources, such as USEPA's Integrated Risk Information System (IRIS), an on-line computer database (USEPA, 1999), and the Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b). Both sets of potential health effects will be evaluated in the risk assessment. The USEPA National Center for Environmental Assessment (NCEA) will be consulted if a constituent does not have a dose-response value in either IRIS or HEAST. Appropriate criteria may also be derived by qualified toxicologists using current USEPA-approved methodologies.

Dose-response values used in the risk assessment will be presented in tabular format. For each constituent the table will present the Chemical Abstracts Service (CAS) number, dose-response value, source, study animal, study method, and where appropriate, target organ, critical effect, uncertainty factors, and confidence level.

Dose-response values are available for inhalation and oral exposures. Oral dose-response values will be used to evaluate dermal exposures, provided appropriate dermal absorption values are available. COPC will be evaluated quantitatively for the dermal exposure pathway. For inhalation pathways, reference concentrations (in units of $mg/m^3$) will be converted to reference doses (in units of mg/kg-day) for calculating risk for systemic toxicants. For direct acting toxicants, the oral, dermal, and inhalation pathways will be evaluated separately.

## 4.1 PCB Dose-Response

Risks from potential exposures to PCBs will be calculated using the most current guidance available from USEPA. Currently, USEPA-approved guidance is provided in IRIS (USEPA, 1999). Total PCB concentrations will be calculated by summing the separate homolog concentrations. The total PCB concentrations will be multiplied by the verified cancer slope factors listed in IRIS (USEPA, 1999). Guidance provided in IRIS specifies three tiers of human slope factors for environmental PCBs: high risk and persistence, low risk and persistence, and lowest risk and persistence. The choice of slope factors for use depends on the medium of exposure and PCB chlorine content, as outlined in IRIS

(USEPA, 1999). Thus, a slightly differing approach to calculating potential cancer risks will be taken for different media.

Non-cancer risks from potential exposures to PCBs will be calculated using the most conservative RfD for a PCB mixture. In addition, uncertainty surrounding the use of USEPA-verified toxicity criteria will be discussed.

## 4.2 Dioxin Dose-Response

The potential carcinogenic effects associated with exposure to dioxin and furan congeners in environmental media will be assessed in accordance with the approach developed by USEPA (1989b). Risks will be calculated for 2,3,7,8-TCDD and the dioxin and furan congeners using the cancer slope factor for 2,3,7,8-TCDD listed in HEAST and using the TEFs provided in USEPA (1989b). The TEFs are fractions that equate the potential toxicity of each congener to that of 2,3,7,8-TCDD. The World Health Organization (WHO) (Van den Berg et al., 1998) has assigned a TEF to each of the dioxin and furan congeners that slightly differ from the USEPA-approved values. The TEFs provided by USEPA (1989b) and proposed by Van den Berg et al. (1998) are listed in Table 4-1. The exposure point concentration for each dioxin and furan congener will be multiplied by its TEF, resulting in a TCDD toxic equivalence concentration (TCDD-TEQ). The TCDD-TEQ values for each of the congeners will then be added together. The cancer slope factor for 2,3,7,8-TCDD will then be used to calculate potential carcinogenic risks resulting from potential exposure to 2,3,7,8-TCDD, and the dioxin and furan congeners.

TABLE 4-1
TEFs FOR DIOXIN AND FURAN CONGENERS
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | TEF (a) | TEF (b) |
|---|---|---|---|
| | | | |
| **Dioxins** | | | |
| 2,3,7,8-TetraCDD | 1746-01-6 | 1 | 1 |
| 1,2,3,7,8-PentaCDD | 40321-76-4 | 0.5 | 1 |
| 1,2,3,4,7,8-HexaCDD | 39227-28-6 | 0.1 | 0.1 |
| 1,2,3,6,7,8-HexaCDD | 57653-85-7 | 0.1 | 0.1 |
| 1,2,3,7,8,9-HexaCDD | 19408-74-3 | 0.1 | 0.1 |
| 1,2,3,4,6,7,8-HeptaCDD | 35822-39-4 | 0.01 | 0.01 |
| OctaCDD | 3268-87-9 | 0.001 | 0.0001 |
| 2,3,7,8-PentaCDDs | NA | 0.5 | NA |
| 2,3,7,8-HexaCDDs | NA | 0.1 | NA |
| 2,3,7,8-HeptaCDDs | NA | 0.01 | NA |
| | | | |
| **Furans** | | | |
| 2,3,7,8-TetraCDF | 51207-31-9 | 0.1 | 0.1 |
| 1,2,3,7,8-PentaCDF | 57117-41-6 | 0.05 | 0.05 |
| 2,3,4,7,8-PentaCDF | 57117-31-4 | 0.5 | 0.5 |
| 1,2,3,4,7,8-HexaCDF | 70648-26-9 | 0.1 | 0.1 |
| 1,2,3,6,7,8-HexaCDF | 57117-44-9 | 0.1 | 0.1 |
| 1,2,3,7,8,9-HexaCDF | 72918-21-9 | 0.1 | 0.1 |
| 2,3,4,6,7,8-HexaCDF | 60851-34-5 | 0.1 | 0.1 |
| 1,2,3,4,6,7,8-HeptaCDF | 67562-39-4 | 0.01 | 0.01 |
| 1,2,3,4,7,8,9-HeptaCDF | 55673-89-7 | 0.01 | 0.01 |
| OctaCDF | 39001-02-0 | 0.001 | 0.0001 |
| 2,3,7,8-HexaCDFs | NA | 0.1 | NA |
| 2,3,7,8-HeptaCDFs | NA | 0.01 | NA |
| | | | |

Notes:
CAS - Chemical Abstracts Service.
CDD- Chorodibenzodioxin
CDF - Chlorodibenzofuran.
TEF - Toxicity Equivalency Factor.
(a) USEPA, 1989b. Interim Procedures for Estimating Risks Associated with Mixtures of Chlorinated Dibenzo-p-dioxins and Chlorinated Dibenzofurans (CDDs and CDFs) and 1989 Update.
(b) - "Toxic Equivalency Factors for PCBs, PCDDs, PCDFs for Humans and Wildlife." Van den Berg, et al. 1998.

# 5.0 EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to predict the magnitude and frequency of potential human exposure to each of the COPC retained for quantitative evaluation in the HHRA. The first step in the exposure assessment process is the characterization of the setting of the site and surrounding area. Current and potential future site uses and potential receptors (i.e., people who may contact the impacted environmental media of interest) are then identified. Potential exposure scenarios appropriate to current and potential future site uses and receptors are then developed. Those potential exposure pathways for which COPC are identified and are judged to be complete will be evaluated quantitatively in the risk assessment. Reasonable maximum exposure (RME) assumptions, and most likely exposure (MLE) assumptions based on appropriate USEPA guidance, will be employed in the quantitative risk assessment.

## 5.1 Identification of Potential Exposure Scenarios

Exposure scenarios are developed on the basis of the CSM for a site. The CSM for Sauget Area 1 was presented in Section 2.0 (Figure 2-1). The CSM was used to develop the potential exposure scenarios identified below and in Table 5-1. Table 5-1 provides a more detailed presentation of receptors and pathways by exposure area to be evaluated in the risk assessment.

Sauget Area 1 fill areas have been used for industrial purposes for many years (since the 1930s or earlier) and use of these areas is expected to remain industrial. The fill areas within Sauget Area 1 are zoned commercial/industrial and it is likely that the fill areas will continue to be used well into the reasonably foreseeable future for commercial/industrial purposes.

As discussed in Sections 1.0 and 2.0 of the SSP, Sites G, H, I, L, M and N contain wastes that came from a wide variety of municipal and industrial sources. Site M is a fenced former sand borrow pit that is now filled with water and is hydrologically connected to Dead Creek. Site G is a fill area stabilized by USEPA in an emergency response that solidified organic wastes, placed a temporary soil cover over the site, and controlled site access by the installation of a fence. Recent inspection indicates that the site and fence are still stable. Recent inspection of Site H indicated that the site is stable with a vegetative cover and no exposed wastes at the surface. Site L also appears to be stable. It is covered with cinders and is located in a vegetated field. Site N reportedly contains construction rubble. Site I was originally used as a sand and gravel pit that received industrial and municipal wastes. The site is currently graded and covered with crushed stone and used for equipment and truck parking.

Because these source areas are generally covered and stable with no evidence of exposed wastes at the surface, sampling in these areas is focused on collection of waste samples. Although wastes are not present at the surface, surface soil sampling will also be conducted.

An on-site outdoor industrial worker and a trespassing teen will be evaluated for potential exposure to COPC where identified in surface soil, and to COPC that may volatilize into outdoor air from underlying groundwater and wastes.

Because the wastes are at depth, a construction/utility worker will be evaluated for potential exposure to constituents in the waste. Construction/utility work is assumed to occur only up to depths of 12 to 15 feet bgs, however, to be conservative, analytical data from waste samples composited throughout the depth of the fill material will be used in the risk assessment (see discussion in Section 3.1.3.2). Due to the shallow depth of groundwater, the construction/utility worker may contact groundwater during excavation.

Due to the presence of a plume of VOCs in groundwater in the source areas and wastes present in the subsurface, an on-site indoor industrial worker will be evaluated for potential exposure to COPC via inhalation of volatile constituents present in indoor air due to vapor intrusion from groundwater and/or wastes. Analytical data collected from shallow groundwater from the existing wells at the sites and analytical data from subsurface waste samples will be used in the risk assessment. If VOCs are detected in shallow groundwater in other groundwater areas of the site, an indoor industrial worker receptor will be evaluated.

Dead Creek bisects Sauget Area 1, passing through areas of commercial land use, areas of open land, and areas of residential land use, and eventually discharges to Borrow Pit Lake and Prairie DuPont Creek. As such, Dead Creek serves as a potential migration pathway for COPC from the impacted fill areas. It is possible that windblown dust or periods of overbank flow (i.e., flooding) have resulted in the deposition of site-related COPC on soil of the adjacent residential/commercial/undeveloped areas. Therefore, it is possible that residents in the vicinity of Dead Creek may be exposed to site-related COPC in soil. Recent inspection indicates that some residences have vegetable gardens. Site-related COPC may be taken up by plant material and subsequently ingested. If VOCs are present in shallow groundwater and/or subsurface soils in these areas, they may infiltrate into indoor air and outdoor air. If these are complete exposure pathways, they will be evaluated in the HHRA.

In addition, a construction/utility worker may contact COPC in surface and subsurface soil and shallow groundwater in the residential/commercial/undeveloped area. The major potential COPC migration pathway is overbank flow. Due to this migration pathway, COPC are expected to occur at the surface. If COPC are located at depth in this area, it would be due to infiltration from the surface. Such infiltration is not expected to move COPC to great depths; thus, the purpose for collecting subsurface soils in the 0.5-6 foot interval. Although construction and utility work may proceed to depths of 12 to 15 bgs, COPC concentrations in the 0.5 to 6 foot interval are expected to be higher than for deeper intervals. Therefore, these data will be used to evaluate potential exposure to COPC in subsurface soil, which will provide a conservative estimate of risk for this pathway.

An indoor industrial or commercial worker in the residential/commercial/undeveloped area may be exposed to COPC in indoor air via inhalation due to volatilization of COPC from underlying soil and/or groundwater in this area. Similarly, an outdoor industrial or commercial worker may be exposed to COPC in surface soil via incidental ingestion, dermal contact and inhalation of volatiles and particulates. Inhalation of COPC volatilizing from groundwater and/or subsurface soil may also occur.

As access to Dead Creek is generally uncontrolled, it is possible that recreational receptors (i.e., trespassing children/teenagers) could be exposed to COPC in surface water and sediment of Dead Creek and Site M while wading. Although access to Borrow Pit Lake is uncontrolled, it is located on private property, and access is very difficult due to its setting. However, recreational teenagers could be exposed to COPC in surface water and sediment of Borrow Pit Lake while wading or swimming. Again, although access is difficult, recreational fishing may occur in Borrow Pit Lake.

Groundwater is not used as a source of drinking water in the area. However, there are some private wells in the area that may be used for outdoor household activities. Therefore, residents may be exposed to COPC in groundwater in these areas via incidental ingestion and dermal contact. If it is determined that groundwater is being used as a sole source of drinking water for any of the residences downgradient of the fill areas, a drinking water scenario will be added to the HHRA.

Final receptor selection will be made once site analytical data have been evaluated and COPCs identified. If no COPCs are identified in a particular medium (e.g., fish), and/or the potential exposure pathway, upon further investigation, is judged to be incomplete (e.g., recreational fishing), then the exposure scenarios associated with that medium/pathway will not be quantitatively evaluated in the HHRA. The potential receptors and their associated exposure scenarios are discussed below and summarized in Table 5-1.

## 5.2 Sample Collection Strategy

Table 5-2 presents a summary of the sampling strategy for each environmental medium and identifies the number of samples to be collected. In addition, the exposure areas, receptor(s) and potential exposure route(s) to be evaluated using the data are identified, based on the CSM developed for the site (see Figure 2-1, and Table 5-1). Sample collection in residential areas has been focused on areas adjacent to Dead Creek upstream of Route 3, as these areas are closer to the fill areas than those downstream of Route 3.

## 5.3 Receptor Identification

The following subsections discuss the parameters that will be used to evaluate each of the potential receptors in the HHRA. Both RME and MLE scenarios will be evaluated for each receptor. Exposure factors common to several of the receptors are discussed in Section 5.4.

### 5.3.1 Indoor Industrial Worker

Exposure assumptions for the indoor industrial worker under the RME and MLE scenarios are shown in Table 5-3. Given the relatively shallow depth of groundwater, it is possible an indoor industrial worker may be exposed indirectly to groundwater via inhalation of volatile COPC migrating from groundwater and the subsurface to indoor air of an industrial/commercial building. The indoor industrial worker receptor will be evaluated for the fill areas and the residential/commercial/undeveloped areas of Sauget Area 1.

### 5.3.2 Outdoor Industrial Worker

Exposure assumptions for the outdoor industrial worker under the RME and MLE scenarios are shown in Table 5-4. The outdoor industrial worker may contact COPC in surface soil via incidental ingestion and dermal contact, and may inhale COPC via volatilization from the surface and subsurface and via particulate emissions from the surface.

### 5.3.3 Trespassing Teenager

Exposure assumptions for the trespassing teenager under the RME and MLE scenarios are shown in Table 5-5. It is assumed that this receptor can be exposed to COPC in surface soil in the fill areas via accidental ingestion, dermal contact, and inhalation of volatiles and particulates, and can be exposed to COPC in subsurface wastes and/or groundwater via inhalation of volatiles.

### 5.3.4 Construction/Utility Worker

Exposure assumptions for the construction/utility worker under the RME and MLE scenarios are shown in Table 5-6. Exposure media of interest in the evaluation of potential risk to a future construction/utility worker will potentially include surface soil, subsurface soil/wastes and groundwater. Exposure could occur via incidental ingestion of and dermal contact with soil/waste and shallow groundwater and via inhalation of fugitive dust and/or vapors from soil and groundwater. A construction/utility worker receptor will be evaluated for the fill areas and the residential/commercial/undeveloped areas of Sauget Area 1. The soil ingestion rate listed in Table 5-6 for the construction worker under the MLE scenario is discussed in Section 5.4.

### 5.3.5 Resident

Given the potential for migration of site-related COPC from the fill areas to a residential area, it is possible that a resident may be exposed to COPC in environmental media. The exposure media of interest are surface soil, subsurface soil, plant tissue, and groundwater. A resident may potentially be exposed directly to COPC in soil via incidental ingestion, dermal contact, and inhalation of volatiles and particulates. Indirect exposure to COPC in soil may occur and through ingestion of produce grown in

impacted residential soil. Public water is provided to residential areas; however, some private wells exist. Residents could be exposed to COPC in groundwater in these areas via incidental ingestion and dermal contact during outdoor household use. In addition, if VOCs are present in groundwater and/or subsurface soil in this area, residents could be exposed via inhalation of vapors migrating to indoor air. Table 5-7 presents the exposure assumptions for evaluation of a child resident (0 to 6 yrs of age) and an adult resident under RME and MLE scenarios. Because several of the Dead Creek segments are adjacent to the residential areas under evaluation, the recreational teenager (below) and residential receptor risks will be evaluated both separately and in total, as indicated in Table 5-1. In addition, a future residential exposure scenario will be evaluated for areas M and N. Because area M is a lagoon, the future exposure pathway to be evaluated will be inhalation of sediment–derived dusts by residential receptors in transects 1 and 2, assuming the lagoon could be drained and dried in the future.

### 5.3.6 Recreational Teenager

It is assumed that an adolescent could access Dead Creek and Borrow Pit Lake surface water and sediment for recreational purposes. Therefore, it is possible that a receptor (aged 7 to 18 years) (referred to here as a recreational teenager for ease of discussion) could be exposed to COPC present in surface water and sediment of Dead Creek and Borrow Pit Lake while wading or swimming, respectively. Exposure assumptions for the recreational teenager under the RME and MLE scenarios are shown in Table 5-8.

### 5.3.7 Recreational Fisher

Recreational fishing may take place at Borrow Pit Lake. As Dead Creek may serve as a potential migration pathway for COPC from the source areas, fish in Borrow Pit Lake may contain COPC in their tissue. Therefore, a recreational fisher has the potential to be exposed to site-related COPC through ingestion of fish from Borrow Pit Lake. This receptor may also contact COPC in surface water and sediment while fishing. The exposure assumptions for the recreational fish ingestion pathway for the RME and MLE receptors are summarized in Table 5-9. To determine if this pathway is complete, two field surveys will be conducted. An ecological evaluation of the Borrow Pit Lake will be used to determine if it can sustain a recreational fishery. In addition, a creel survey will be conducted to determine if Borrow Pit Lake is fished and what fish may be caught.

## 5.4 Exposure Parameters

### 5.4.1 Soil Ingestion Rate – Adult Construction Worker

Incidental soil ingestion occurs at all ages as a result of hand-to-mouth activities. Currently, there are little or no reliable quantitative data available for estimating adult soil ingestion rates. USEPA risk assessment guidance suggests a soil ingestion rate of 100 mg/day for adults in a residential scenario (USEPA, 1989a, 1991a), and a soil ingestion rate of 50 mg/day for adults in an industrial scenario (USEPA, 1991a).

USEPA presented an estimate of a soil ingestion rate for adults doing yard work of 480 mg/day in their supporting evidence for the commercial/industrial soil ingestion rate of 50 mg/day in the "Standard Default Exposure Factors" Directive (USEPA, 1991a); the 480 mg/day value was not presented in the table of default exposure factors. The Agency states: "For certain outdoor activities in the commercial/industrial setting (e.g., construction or landscaping), a soil ingestion rate of 480 mg/day may be used; however, this type of work is usually short-term and is often dictated by the weather. Thus, exposure frequency would generally be less than one year and exposure duration would vary according to site-specific construction/maintenance plans." However, some regions and state agencies have stipulated the use of this value to evaluate a construction worker exposure scenario. The Hawley (1985) study, which is the basis for the soil ingestion rate of 480 mg/day, was recently reviewed by the USEPA (USEPA, 1997a), which stated that, "Given the lack of supporting measurements, these estimates must be considered conjectural."

In the Hawley (1985) study, the author assumed that soil adheres to the surface area of the hands at a loading of 3.5 mg/cm$^2$. This value was based on a layer of soil on skin assumed to be 0.005 cm deep, a soil density of 1.5 g/cm$^2$, and 50% void space. Using the author's derived soil-to-skin adherence loading of 3.5 mg/cm$^2$ and assuming that the amount of soil covering a fraction of the hands (approximately 70 cm$^2$) is ingested twice a day, Hawley calculated a soil ingestion rate of 480 mg/day.

Hawley's 1985 analysis was one of the first published health risk assessments and was performed before any of the quantitative fecal tracer soil ingestion studies for either children or adults were conducted (Calabrese et al., 1989; Davis et al., 1990; Clausing et al., 1987; Calabrese et al., 1990). Thus, the estimate of 480 mg/day predates all of our current knowledge about soil ingestion among both children and adults, as well as recent published data on soil-to-skin adherence rates.

In 1993, USEPA sponsored a workshop to evaluate soil-to-skin adherence data. As a result, a study to determine a more accurate characterization of soil-to-skin adherence was sponsored by the USEPA and conducted by John C. Kissel and associates at the University of Washington (Kissel et al., 1996; Holmes et al., 1998). The intent of this study was to resolve uncertainties and develop more accurate measures of soil-to-skin loading rates for individuals involved in various occupational and recreational activities. As reported in the Exposure Factors Handbook (EFH) (USEPA ,1997a), soil loading on skin surfaces as a result of various occupational and recreational activities was directly measured. This study indicates that soil loadings vary with the type of activity and the body parts contacted. As one would expect, adherence appears to be greatest during outdoor activities such as farming and gardening, and more soil/dust tends to adhere to the hands and knees than to other areas of the body.

Average hand soil loading factors are as presented in the EFH (USEPA, 1997a) for the adult outdoor workers evaluated by Kissel and Holmes. In every case, soil adherence during occupational exposure was measured to be considerably lower than Hawley's estimate of 3.5 mg/cm$^2$. The range of soil adherence loadings measured by Kissel and Holmes falls within the USEPA range of 0.2 to 1.0 mg/cm$^2$ (USEPA, 1992b).

For this evaluation, the construction worker receptor is assumed to be exposed to COPC in surface and subsurface soils during excavation activity. Based on this exposure scenario, the "farmer" receptor provided in the EFH is considered to provide an upper-bound estimate of soil adherence. A soil ingestion rate can be calculated by substituting the soil adherence value for the receptor for the estimated value derived by Hawley (1985), as follows:

$$\frac{480\ mg/day}{3.5\ mg/cm^2} = \frac{ingestion\ rate\ (mg/day)}{soil\ adherence\ (mg/cm^2)}$$

The soil adherence value for the "farmer" is 0.47 mg/cm$^2$. The calculated soil ingestion value is 64 mg/day; therefore, a soil ingestion rate of 64 mg/day is used for the MLE construction worker receptor in this risk evaluation.

Additional support for this value comes from a new paper by Kissel and coworkers (Kissel et al., 1998) that presents the results of a study of the transfer of soil from hand to mouth by intentional licking. Soil was loaded onto the skin by pressing the hand onto soil, and the amount transferred to the mouth was measured. The thumb sucking, finger mouthing, and palm licking activities resulted in geometric mean soil mass transfers of 7.4 to 16 mg per event. The author concludes that "transfer of 10 mg or more of soil from a hand to the oral cavity in one event is possible, but requires moderate soil loading and more than incidental hand-to-mouth contact." However, "the fraction of soil transferred from hand to mouth that is subsequently swallowed is unknown but may be less than 100 percent." In addition, "the adult volunteers in this study reported that the presence of roughly 10 mg of soil in the mouth is readily detected (and unpleasant). Repeated unintentional ingestion of that mass of soil by adults therefore seems unlikely. In light of this observation, the 480 mg per day estimate [of Hawley, 1985] would require hundreds or perhaps thousands of hand-to-mouth contacts that resulted in soil transfer per day."

The 64 mg/day soil ingestion rate for the industrial and construction worker receptors recommended here is supported by this study, as 5 hand to mouth events during the course of a workday is more reasonable to assume than 48 or more.

For the RME scenario, a soil ingestion rate of 100 mg/day is assumed for the construction worker. This is the adult soil ingestion rate provided by USEPA (1991).

### 5.4.2 Frequency of Exposure to COPC in Soil

A meteorological factor is generally used to account for the fraction of the year during which exposure to constituents in soils may occur (Sheehan et al., 1991; USEPA, 1989a). It is reasonable to assume that direct contact with soil or intrusive activities will not occur for residential receptors during inclement weather, i.e., when it is raining or snowing, when the ground is wet or frozen, or when snow or ice (32

degrees F) are covering the ground. Thus the frequency of contact with potentially impacted soil is adjusted for these site-specific meteorological conditions (USEPA, 1989a).

There are only a few metrics that can be used to describe the fraction of the year when meteorological conditions are likely to limit exposure. These include temperature and the amount of precipitation per day and per year, which includes rain, snow and ice. While measures are collected hourly, the National Weather Service reports the number of days when precipitation is greater than 0.01 inches (one one-hundredth), greater than 0.1 inches (one tenth), and greater than 1 inch in their annual summary data. The number of days with precipitation greater than 0.1 inches is selected as the best representation of when exposure is likely to be limited by snow, rain, or ice. The National Oceanographic and Atmospheric Administration (NOAA) provides daily temperature data. It is assumed that exposure to soils is limited by temperatures less than 32 degrees F. Therefore, limiting the assumption of exposure to soils to those days with less than 0.1 inch of precipitation and temperatures above 32 degrees F is reasonable.

Based on ten years of meteorological data (1986-1995) provided by NOAA (1996), a meteorological factor is derived for use in the exposure equations. On the average, 66 days/year in this area receive 0.1 or greater inches of precipitation, and there are typically 27 days/year with a mean temperature of 32 degrees F or below. Accounting for days when both events occur (assumed to be 10% of the rain days or 6 days/year), the number of inclement days, 87, can be calculated (27 + 66 – 6 = 87). It is assumed that these days are evenly spaced throughout the course of the year. The meteorological factor is then calculated (87/365 = 24%). Thus it is assumed that exposure to soils will not occur for the "receptor" 24% of the assumed days of exposure (exposure frequency) due to weather restrictions.

The choice of a precipitation target of 0.1 inches is in keeping with guidance provided in the Compilation of Air Pollution Emission Factors, which assumes that soil suspension will not occur on days with more than 0.01 inches of precipitation (USEPA, 1995b). It is probable, however, that this metric both over- and under-estimates the potential exposure in some conditions. For, example, it is possible that some exposure to soils may occur on days when it rains just over 0.1 inches in the early morning and then the ground dries during the course of the day. Alternatively, significant rainfall, such as greater than 1 inch, is likely to saturate the soil for consecutive days, and several inches of snow (which may fall all on one day with one storm) may cover the ground and inhibit direct contact for several days. With both of these considerations in mind, it is likely that a meteorological factor based on inclement days defined as precipitation greater than 0.1 inches and average temperatures less than 32 degrees F is reasonable.

## 5.5 Quantification of Potential Exposures

To estimate the potential risk to human health that may be posed by the presence of COPC at the site, it is first necessary to estimate the potential exposure dose of each COPC. The exposure dose is estimated for each constituent via each exposure pathway by which the receptor is assumed to be

exposed. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day).

Exposure doses are defined differently for potential carcinogenic and noncarcinogenic effects. The Chronic Average Daily Dose (CADD) is used to estimate a receptor's potential intake from exposure to a COPC with noncarcinogenic effects. According to USEPA (1989a), the CADD should be calculated by averaging the dose over the period of time for which the receptor is assumed to be exposed. Therefore, the averaging period is the same as the exposure duration. For COPC with potential carcinogenic effects, however, the Lifetime Average Daily Dose (LADD) is employed to estimate potential exposures. In accordance with USEPA (1989a) guidance, the LADD is calculated by averaging exposure over the receptor's assumed lifetime (70 years). Therefore, the averaging period is the same as the receptor's assumed lifetime. The standardized equations for estimating a receptor's average daily dose (both lifetime and chronic) are presented below, followed by descriptions of receptor-specific exposure parameters and constituent-specific parameters.

### 5.5.1 Estimating Potential Exposure from Ingestion of and Dermal Contact with Soil or Sediment

Both incidental ingestion of, and dermal contact with, soil and/or sediment are assumed to occur for many of the receptors. The following equations are used to calculate the estimated exposure.

Average Daily Dose (Lifetime and Chronic) Following Incidental Ingestion of Soil or Sediment (mg/kg-day):

$$ADD = \frac{CS \times IR \times EF \times ED \times AAF_o \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CS | = | Soil concentration (mg/kg soil) |
| IR | = | Ingestion rate (mg soil/day) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| $AAF_o$ | = | Oral-Soil Absorption Adjustment Factor (AAF) (unitless) |
| CF | = | Unit conversion factor (kg soil/$10^6$ mg soil) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

Average Daily Dose (Lifetime and Chronic) Following Dermal Contact with Soil or Sediment (mg/kg-day):

$$ADD = \frac{CS \times SA \times AF \times EF \times ED \times AAF_d \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CS | = | Soil concentration (mg/kg soil) |
| SA | = | Exposed skin surface area ($cm^2$/day) |
| AF | = | Soil to skin adherence factor (mg soil/$cm^2$) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| $AAF_d$ | = | Dermal-Soil AAF (unitless) |
| CF | = | Unit conversion factor (kg soil/$10^6$ mg soil) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

### 5.5.2 Estimating Potential Exposure via Inhalation

Exposure to COPC migrating from soil to air is assumed to occur for many of the potential receptors. The equation used to estimate exposure to COPC via inhalation is as follows:

Average Daily Dose (Lifetime and Chronic) Following Inhalation of COPC (mg/kg-day):

$$ADD = \frac{CA \times IR \times AAF_i \times ET \times EF \times ED}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CA | = | Air concentration (mg/$m^3$) |
| IR | = | Inhalation rate ($m^3$ /hr) |
| $AAF_i$ | = | Inhalation AAF (unitless) |
| ET | = | Exposure time (hours/day) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

### 5.5.3 Estimating Potential Exposure from Groundwater/Surface Water

A potential construction worker may contact COPC in groundwater during soil excavation. The risk assessment assumes that the recreational teenager will come in contact with surface waters of Dead Creek and Borrow Pit Lake. In addition, residents could contact groundwater via outdoor use of private well water. The equation used to estimate a receptor's potential exposure via incidental ingestion of groundwater/surface water is:

Average Daily Dose (Lifetime and Chronic) Following Ingestion of Water (mg/kg-day):

$$ADD = \frac{CW \times IR \times EF \times ED \times AAF_o \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CW | = | Water concentration (mg/L) |
| IR | = | Water ingestion rate (L/day) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| $AAF_o$ | = | Oral-water AAF (unitless) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

The equation used to estimate a receptor's potential exposure via dermal contact with groundwater/surface water is as follows:

Average Daily Dose (Lifetime and Chronic) Following Dermal Contact with Water (mg/kg-day):

$$ADD = \frac{CW \times SA \times PC \times ET \times EF \times ED \times AAF_d \times CF}{BW \times AT}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CW | = | Water concentration (mg/L) |
| SA | = | Exposed skin surface area ($cm^2$/day) |
| PC | = | Dermal permeability constant (cm/hr) |
| ET | = | Exposure time (hours/day) |
| EF | = | Days exposed per year (day/365 day) |
| ED | = | Years exposed (year) |

| | | |
|---|---|---|
| $AAF_d$ | = | Dermal-water AAF (unitless) |
| CF | = | Unit conversion factor ($L/10^3cm^3$) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (year) |

### 5.5.4 Estimating Potential Exposure From Food Consumption

A recreational fisher may be exposed to COPC through ingestion of fish obtained from Borrow Pit Lake. A residential receptor may be exposed to COPC in garden produce. The equation used to estimate a receptor's potential exposure via food consumption is:

Average Daily Dose (Lifetime and Chronic) Following Food Consumption (mg/kg-day):

$$ADD = \frac{CF \times IR \times AAF \times EF \times ED}{AT \times BW}$$

where:

| | | |
|---|---|---|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CF | = | Concentration in food (mg/kg) |
| IR | = | Ingestion rate (kg/day) |
| AAF | = | Oral-diet AAF (unitless) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (days) |
| AT | = | Averaging time (days) |
| BW | = | Body weight (kg) |

## 5.6 Calculation of Exposure Point Concentrations

Exposure points are located where potential receptors may contact COPCs at or from the site. The concentration of COPCs in the environmental medium that receptors may contact must be estimated in order to determine the magnitude of potential exposure.

Measured data will be available for surface soil, subsurface waste, subsurface soil, groundwater, surface water, sediment, and fish tissue. Groundwater will be evaluated on a plume or well-by-well basis as appropriate. The exposure point concentration is defined as the lower of the maximum or 95$^{th}$ percentile UCL arithmetic mean concentrations (USEPA, 1992a) for the RME scenario and the arithmetic mean concentration for the MLE scenario.

Other pathways will require modeling to derive exposure point concentrations. These pathways include volatile chemicals in groundwater and the subsurface migrating upwards and infiltrating into

indoor air, and generation of fugitive dust and volatiles from undisturbed soils as well as during construction activities.

The model to be used to predict indoor air concentrations of VOCs will be the model of Johnson and Ettinger recommended by the USEPA (1996a and 1997c) to predict concentrations of COPC migrating from groundwater or soil to indoor air of an overlying building. Concentrations of volatile COPC in outdoor air due to migration from subsurface soil and/or groundwater will be estimated using the methodology recommended by the American Society for Testing and Materials (ASTM, 1995).

The calculation of concentrations of inorganic and semivolatile organic COPC bound to soil in fugitive dust involves multiplying the soil exposure point concentrations by the concentration of dust in air as follows:

1) Ambient Air:

   COPC concentration in ambient air ($mg/m^3$) = Exposure point concentration in soil (mg/kg soil) x Dust concentration (kg soil/$m^3$)

   The dust concentration in air to be used in the evaluation of ambient outdoor air pathways in this risk evaluation is the inverse of the particulate emission factor derived in accordance with USEPA guidance (USEPA, 1996a).

2) Excavation Air (i.e., during construction activities):

   COPC concentration in excavation air ($mg/m^3$) = Exposure point concentration in soil (mg/kg soil) x Dust concentration (mg soil/$m^3$) x Unit correction factor (1 kg/$10^6$ mg)

   The dust concentration in air to be used in the evaluation of excavation air pathways in this risk evaluation is 60 $mg/m^3$. This value is the recommended concentration of respirable particulate with a mean diameter of 10 microns or less (PM10) for excavation activities (MADEP, 1995).

COPC concentrations in homegrown produce are dependent upon the potential for direct uptake of COPC from soil through plant roots and will be estimated via the following equation:

COPC Concentration in Produce (mg COPC/kg plant tissue) = Concentration of COPC in soil (mg COPC/kg Soil) x Root Uptake Factor (unitless)

The root uptake factor accounts for uptake from soil to the homegrown produce. As appropriate, chemical-specific root uptake factors will be identified from sources such as Baes et al. (1984) for use in the risk assessment.

TABLE 5-1
RECEPTOR-AREA MATRIX
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| ***Receptor*** | Exposure Areas | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Medium | Fill Area/Sites | | | | | | Creek Segments | | | | | | Residential/Commercial/Undeveloped Transects | | | | | | | Total |
| Secondary Medium (Pathways) | G | H | I | L | M (lagoon) | N | Ref. Area | CS-B | CS-C | CS-D | CS-E | CS-F | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Receptors |
| ***Indoor Industrial Worker (IW)*** | | | | | | | | | | | | | | | | | | | | |
| Fill Area: Subsurface Waste | IW-RME-G | IW-RME-H | IW-RME-I | IW-RME-L | | IW-RME-N | | | | | | | IW-RME-C/R-1 | IW-RME-C/R-2 | IW-RME-C/R-3 | IW-RME-C/R-4 | IW-RME-C/R-5 | IW-RME-C/R-6 | IW-RME-C/R-7 | 12 |
| *Indoor Air (inh)* | IW-MLE-G | IW-MLE-H | IW-MLE-I | IW-MLE-L | | IW-MLE-N | | | | | | | IW-MLE-C/R-1 | IW-MLE-C/R-2 | IW-MLE-C/R-3 | IW-MLE-C/R-4 | IW-MLE-C/R-5 | IW-MLE-C/R-6 | IW-MLE-C/R-7 | 12 |
| Transects: Subsurface Soil | | | | | | | | | | | | | | | | | | | | |
| *Indoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| Groundwater | | | | | | | | | | | | | | | | | | | | |
| *Indoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| ***Outdoor Industrial Worker (OW)*** | | | | | | | | | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| Fill Area: Subsurface Waste | OW-RME-G | OW-RME-H | OW-RME-I | OW-RME-L | | OW-RME-N | | | | | | | OW-RME-C/R-1 | OW-RME-C/R-2 | OW-RME-C/R-3 | OW-RME-C/R-4 | OW-RME-C/R-5 | OW-RME-C/R-6 | OW-RME-C/R-7 | 12 |
| *Outdoor Air (inh)* | OW-MLE-G | OW-MLE-H | OW-MLE-I | OW-MLE-L | | OW-MLE-N | | | | | | | OW-MLE-C/R-1 | OW-MLE-C/R-2 | OW-MLE-C/R-3 | OW-MLE-C/R-4 | OW-MLE-C/R-5 | OW-MLE-C/R-6 | OW-MLE-C/R-7 | 12 |
| Transects: Subsurface Soil | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| Groundwater | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| ***Construction Worker (CW)*** | | | | | | | | | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| Fill Area: Subsurface Waste (ing/derm) | CW-RME-G | CW-RME-H | CW-RME-I | CW-RME-L | | CW-RME-N | | | | | | | CW-RME-C/R-1 | CW-RME-C/R-2 | CW-RME-C/R-3 | CW-RME-C/R-4 | CW-RME-C/R-5 | CW-RME-C/R-6 | CW-RME-C/R-7 | 12 |
| *Outdoor Air (inh)* | CW-MLE-G | CW-MLE-H | CW-MLE-I | CW-MLE-L | | CW-MLE-N | | | | | | | CW-MLE-C/R-1 | CW-MLE-C/R-2 | CW-MLE-C/R-3 | CW-MLE-C/R-4 | CW-MLE-C/R-5 | CW-MLE-C/R-6 | CW-MLE-C/R-7 | 12 |
| Transects: Subsurface Soil (ing/derm) | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| Groundwater (ing/derm) | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| ***Trespassing Teenager (TT)*** | | | | | | | | | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| Subsurface Waste | TT-RME-G | TT-RME-H | TT-RME-I | TT-RME-L | | TT-RME-N | | | | | | | | | | | | | | 5 |
| *Outdoor Air (inh)* | TT-MLE-G | TT-MLE-H | TT-MLE-I | TT-MLE-L | | TT-MLE-N | | | | | | | | | | | | | | 5 |
| Groundwater | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| ***Recreational Teen (RT)*** | | | | | | | | | | | | | | | | | | | | |
| Sediment (ing/derm) | | | | | * | | | * | ** | ** | *** | | | | | | | | | |
| Surface Water (ing/derm) | | | | | RT-RME-M<br>RT-MLE-M | | RT-RME-REF<br>RT-MLE-REF | RT-RME-CS-B<br>RT-MLE-CS-B | RT-RME-CS-C<br>RT-MLE-CS-C | RT-RME-CS-D<br>RT-MLE-CS-D | RT-RME-CS-E<br>RT-MLE-CS-E | RT-RME-CS-F<br>RT-MLE-CS-F | | | | | | | | 7<br>7 |
| ***Recreational Fisher (RF)*** | | | | | | | | | | | | | | | | | | | | |
| Sediment (ing/derm) | | | | | | | | | | | | | | | | | | | | |
| Surface Water (ing/derm) | | | | | | | RF-RME-REF<br>RF-MLE-REF | | | | | RF-RME-F<br>RF-MLE-F | | | | | | | | 2<br>2 |
| Fish Tissue (ing) | | | | | | | | | | | | | | | | | | | | |
| ***Resident (RES)*** | | | | | | | | | | | | | | | | | | | | |
| Surface Soil (ing/derm) | | | | | | | | | | | | | | | | | | | | |
| *Outdoor Air (inh)* | | | | | | | | | | | | | | | | | | | | |
| Subsurface Soil (or Waste in Site N) | | | | | | | | | | | | | | | | | | | | |
| *Indoor/Outdoor Air (inh)* | | | | | | | | | | | | | * | * | ** | ** | ** | *** | *** | |
| Groundwater (ing/derm) | | | | | RES-RME-M | RES-RME-N | | | | | | | RES-RME-C/R-1 | RES-RME-C/R-2 | RES-RME-C/R-3 | RES-RME-C/R-4 | RES-RME-C/R-5 | RES-RME-C/R-6 | RES-RME-C/R-7 | 9 |
| *Indoor/Outdoor Air (inh)* | | | | | RES-MLE-M (a) | RES-MLE-N | | | | | | | RES-MLE-C/R-1 | RES-MLE-C/R-2 | RES-MLE-C/R-3 | RES-MLE-C/R-4 | RES-MLE-C/R-5 | RES-MLE-C/R-6 | RES-MLE-C/R-7 | 9 |
| Produce (ing) | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | **** |
| **Total Receptors** | 8 | 8 | 8 | 8 | 4 | 10 | 4 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | **118** |

Notes:
RME - Reasonable Maximum Exposure
MLE - Most Likely Exposure
ing - ingestion
derm - dermal contact
inh - inhalation

* In addition to separate risk calculations, due to proximity, risks for residential receptors for transects 1 and 2 will be added to risks for the recreational teen in CS-B and site M.
** In addition to separate risk calculations, due to proximity, risks for residential receptors for transects 3,4 and 5 will be added to risks for the recreational teen in CS-C and CS-D.
*** In addition to separate risk calculations, due to proximity, risks for residential receptors for transects 6 and 7 will be added to risks for the recreational teen in CS-E.
****There are 116 receptors - each is evaluated for several exposure pathways.
(a) - The residential scenario for area M will consider inhalation of sediment derived dust by nearby residential receptors (i.e., transects 1 and 2) should the lagoon be drained and dried in the future.

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Receptor / Exposure Route | | Environmental Medium | Sampling Strategy | Number of Samples |
|---|---|---|---|---|
| Indoor Industrial Worker | Inhalation of Indoor Air | Fill Area Waste | At Sites G,H,I,L and N:<br>Collect 1 sample from each of 4 borings at each site. | 20 samples |
| Outdoor Industrial Worker | Inhalation of Outdoor Air | | | |
| Teenage Trespasser | Inhalation of Outdoor Air | | | |
| Construction/Utility Worker | • Incidental Ingestion of and Dermal Contact with Waste<br>• Inhalation of Particulates and Volatiles | | | |
| Outdoor Industrial Worker | • Incidental Ingestion of and Dermal Contact with Soil<br>• Inhalation of Particulates and Volatiles | Fill Area Surface Soil<br>(0-0.5 ft bgs) | At Sites G,H,I,L and N:<br>Collect 1 sample from each of 4 borings at each site. | 20 samples |
| Teenage Trespasser | • Incidental Ingestion of and Dermal Contact with Soil<br>• Inhalation of Particulates and Volatiles | | | |
| Construction/Utility Worker | • Incidental Ingestion of and Dermal Contact with Soil<br>• Inhalation of Particulates and Volatiles | | | |

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Receptor / Exposure Route | Environmental Medium | Sampling Strategy | Number of Samples |
|---|---|---|---|
| Indoor Industrial Worker<br>Inhalation of Indoor Air | Fill Area Groundwater | Indoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs. | • Fill Area shallow groundwater - 19 samples from 19 wells. |
| Outdoor Industrial Worker<br>Inhalation of Outdoor Air | | Outdoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs. | • Downgradient shallow alluvial aquifer |
| Construction/Utility Worker<br>Inhalation of Outdoor Air | | | |
| Recreational Teenager<br>Inhalation of Outdoor Air | | | |
| Construction/Utility Worker<br>Incidental Ingestion of and Dermal Contact with Groundwater | | Sample Shallow groundwater. Excavation is generally not expected to exceed 15 ft bgs; however, most shallow samples from each well will be used. | 1) Sites G,H, and L: 3-6 samples from 3 locations.<br>2) Site I: 3-6 samples from 3 locations.<br>3) Areas southwest of sites G,H, and L: 3-6 samples from 3 wells. |
| Indoor Industrial Worker<br>Inhalation of Indoor Air | Residential Area Groundwater | Indoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs. | Developed and Undeveloped Areas in Dead Creek Floodplain closest to source areas: |
| Resident<br>Inhalation of Indoor Air | | | |
| Outdoor Industrial Worker<br>Inhalation of Outdoor Air | | Outdoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs. | |
| Construction/Utility Worker<br>Inhalation of Outdoor Air | | | |
| Resident<br>Inhalation of Outdoor Air | | | |
| Construction/Utility Worker<br>Incidental Ingestion of and Dermal Contact with Groundwater | | Sample Shallow groundwater. Excavation is generally not expected to exceed 15 ft bgs; however, most shallow samples from each well will be used. | 6 samples from 2 wells at water table (Walnut St. and Judith Ln.) |
| Resident<br>Incidental Ingestion of and Dermal Contact with Groundwater | | Sample groundwater in the developed and undeveloped areas of the Dead Creek Floodplain. | 4 samples from yet to be identified private wells in the Walnut St. and Judith Ln. area. |

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Receptor / Exposure Route | Environmental Medium | Sampling Strategy | Number of Samples |
|---|---|---|---|
| Construction/Utility Worker<br>• Incidental Ingestion of and Dermal Contact with Soil<br>• Inhalation of Particulates and Volatiles | Residential Area Surface Soils (0-0.5 ft bgs) | Seven transects in undeveloped areas sampled at 200 ft. intervals.<br>Three residences along each of Transects 1-6, and two residences along Transect 7. | 45 samples<br>20 samples |
| Outdoor Industrial Worker<br>• Incidental Ingestion of and Dermal Contact with Soil<br>• Inhalation of Particulates and Volatiles | | | |
| Resident<br>• Incidental Ingestion of and Dermal Contact with Soil<br>• Inhalation of Particulates and Volatiles in Outdoor Air | | | |
| Resident<br>• Produce Ingestion | | Produce constituent concentrations will be modeled based on surface soil data collected along undeveloped area transects and at residences. | |
| Construction/Utility Worker<br>• Incidental Ingestion of and Dermal Contact with Soil<br>• Inhalation of Particulates and Volatiles | Residential Area Subsurface Soils (0.5- 6 ft bgs) | Seven transects in undeveloped areas sampled at 200 ft. intervals.<br>Three residences along each of Transects 1-6, and two residences along Transect 7. | 45 samples<br>20 samples |
| Outdoor Industrial Worker<br>• Inhalation of Volatiles | | | |
| Resident<br>• Inhalation of Volatiles | | | |
| Indoor Industrial Worker<br>• Inhalation of Volatiles | | | |

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Receptor / Exposure Route | Environmental Medium | Sampling Strategy | Number of Samples |
|---|---|---|---|
| Recreational Teenager<br>Incidental Ingestion of and Dermal Contact with Sediment while Wading | Dead Creek Sediment * | Sample undeveloped areas of Dead Creek (CS-B and CS-F) at 200 ft. intervals for industry-specific constituents.<br>Sample developed areas of Dead Creek (CS-C,D and E) at 150 ft. intervals for industry-specific constituents.<br>Sample entire length of Dead Creek at 1000 ft. intervals for full suite of analytes. | 50 samples<br>47 samples<br>20 samples |
| | Site M sediment | Sample Site M sediments. | 4 samples |
| Recreational Teenager<br>Incidental Ingestion of and Dermal Contact with Sediment while Swimming | Borrow Pit Lake Sediment North of Dead Creek Discharge * | Sample Borrow Pit Lake at 400 ft. intervals for industry-specific constituents. | 8 samples |
| Recreational Fisher<br>Incidental Ingestion of and Dermal Contact with Sediment while Wading | | | |
| Recreational Teenager<br>Incidental Ingestion of and Dermal Contact with Surface Water while Wading | Dead Creek Surface Water | Sample Dead Creek Surface Water at approximately 1000 ft. intervals for full suite of analytes. | 18 samples |
| Recreational Teenager<br>Incidental Ingestion of and Dermal Contact with Surface Water while Swimming | Borrow Pit Lake Surface Water North of Dead Creek Discharge | Sample Borrow Pit Lake Surface Water at approximately 1000 ft. intervals for site-specific constituents. | 2 samples |
| Recreational Fisher<br>Incidental Ingestion of and Dermal Contact with Surface Water while Wading | | | |
| Recreational Fisher<br>Fish Ingestion | Various Fish in Borrow Pit Lake | 9 predator fish, 9 bottom feeding fish and 9 forage fish whole fish samples will be collected. Compositing will be conducted as necessary to achieve appropriate sample size. Data from game fish will be used in the HHRA. | 27 samples |

Notes:
bgs - below ground surface.
ft - feet
* In ad[illegible], sediment sampling conducted in support of the ecological risk assessment will[illegible]sed in the human heath risk assessment.

TABLE 5-3

SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - INDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Parameter | RME On-Site Indoor Worker | | MLE On-Site Indoor Worker | |
|---|---|---|---|---|
| Parameters Used in the Indoor Air Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 250 | (b) | 250 | (b) |
| Exposure Duration (yr) | 25 | (b) | 7 | (c) |
| Inhalation Rate (m^3/hour) | 1.6 | (d) | 1.0 | (e) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended value for occupational tenure listed in Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for moderate activity.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for light activity.

6/22/99

TABLE 5-4
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - OUTDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Parameter | RME Future Outdoor Industrial Worker | | MLE Future Outdoor Industrial Worker | |
|---|---|---|---|---|
| Parameters Used in the Outdoor Air Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 190 | (i) | 190 | (i) |
| Exposure Duration (yr) | 25 | (b) | 7 | (c) |
| Inhalation Rate (m^3/hour) | 1.6 | (d) | 1 | (e) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |
| Parameters Used in the Surface Soil Pathway | | | | |
| Exposure Frequency (days/year) | 190 | (i) | 190 | (i) |
| Exposure Duration (yr) | 25 | (b) | 7 | (c) |
| Soil Ingestion Rate (mg/day) | 50 | (f) | 30 | (j) |
| Skin Contacting Medium (cm^2) | 3339 | (g) | 3339 | (g) |
| Soil on Skin (mg/cm^2) | 0.02 | (h) | 0.02 | (h) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended value for occupational tenure listed in Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for moderate activity.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for light activity.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(g) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, forearms, and face.
(h) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-10 for calculation.
(i) - Exposure frequency of 250 days (USEPA, 1991a) adjusted for percentage of days with inclement weather (24%), [250-(250*0.24) = 190]; see text.
(j) - Calabrese, E.J., et. al. 1990. Preliminary adult soil ingestion estimates; results of a pilot study. Regul. Toxicol. Pharmacol. 12L88-95. As cited in USEPA, 1997a. Exposure Factors Handbook. Low end of range.

6/22/99

TABLE 5-5
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - TRESPASSING TEENAGER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Parameter | RME Trespassing Teenager (7 to 18 yrs) | | MLE Trespassing Teenager (7 to 18 yrs) | |
|---|---|---|---|---|
| Parameters Used in the Surface Soil Pathway | | | | |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Soil Ingestion Rate (mg/day) | 100 | (d) | 50 | (e) |
| Skin Contacting Medium (cm^2) | 3677 | (f) | 3677 | (f) |
| Soil on Skin (mg/cm^2) | 0.02 | (g) | 0.02 | (g) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Parameters Used in the Outdoor Air Pathway | | | | |
| Exposure Time (hr/day) | 2 | (i) | 2 | (i) |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Inhalation Rate (m^3/hour) | 1.2 | (j) | 1 | (k) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - 1 day per week for 26 weeks (6 months) of the year.
(b) - 1 day per 2 weeks for 26 weeks (6 months) of the year.
(c) - Trespassing teenager is assumed to range in age from 7 to 18. Therefore, total exposure duration is 11 years.
(d) - USEPA, 1991a. Standard Default Exposure Factors.
(e) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rate for an adult listed in Table 1-2.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average surface are of hands, forearms and lower legs of males and females aged 7 to 18.
(g) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-14 for calculation.
(h) - USEPA, 1997a. Exposure Factors Handbook. Body weight is the average of males and females aged 7 to 18.
(i) - The trespassing teen is assumed to stay in the fill area for two hours.
(j) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates is the value for moderate activity (children) listed in Table 5-23.
(k) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates is the value for light activity (children) listed in Table 5-23.

6/22/99

TABLE 5-6
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - CONSTRUCTION WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Parameter | RME Future Construction/Utility Worker | | MLE Future Construction/Utility Worker | |
|---|---|---|---|---|
| Parameters Used in the Surface Soil and Subsurface Soil Inhalation Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 40 | (b) | 20 | (c) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Inhalation Rate (m^3/hour) | 2.5 | (e) | 1.5 | (f) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |
| Parameters Used in the Surface and Subsurface Soil Pathway | | | | |
| Exposure Frequency (days/year) | 40 | (b) | 20 | (c) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Soil Ingestion Rate (mg/day) | 100 | (g) | 64 | (h) |
| Skin Contacting Medium (cm^2) | 3339 | (i) | 3339 | (i) |
| Soil on Skin (mg/cm^2) | 0.19 | (j) | 0.19 | (j) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |
| Parameters Used in the Groundwater Pathway | | | | |
| Exposure Time (hr/event) | 1 | (k) | 1 | (k) |
| Exposure Frequency (days/year) | 10 | (k) | 5 | (k) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Water Ingestion Rate (l/event) | 0.005 | (l) | 0.005 | (l) |
| Skin Contacting Medium (cm^2) | 3339 | (i) | 3339 | (i) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |
| Parameters Used in the Groundwater Inhalation Pathway | | | | |
| Exposure Time (hr/day) | 8 | (a) | 8 | (a) |
| Exposure Frequency (days/year) | 40 | (b) | 20 | (c) |
| Exposure Duration (yr) | 1 | (d) | 1 | (d) |
| Inhalation Rate (m^3/hour) | 2.5 | (e) | 1.5 | (f) |
| Body Weight (kg) | 70 | (g) | 70 | (g) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - Exposure frequency is equivalent to 5 days per week for 2 months.
(c) - Exposure frequency is equivalent to five days per week for one month.
(d) - Construction activities are assumed to occur over a 1 year period.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate is the value for heavy activity for an outdoor worker listed in Table 5-23.
(f) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate is the value for moderate activity for an outdoor worker listed in Table 5-23.
(g) - USEPA, 1991a. Standard Default Exposure Factors.
(h) - ENSR-derived value; described briefly in the text.
(i) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, forearms, and face.
(j) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-11 for calculation.
(k) - Assumed that contact with water occurs only for a fraction of the total exposure duration and time.
(l) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.

6/22/99

TABLE 5-7
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RESIDENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Parameter | RME Resident | | | | MLE Resident | | | |
|---|---|---|---|---|---|---|---|---|
| | Adult | | Child (0 to 6 yrs) | | Adult | | Child (0 to 6 yrs) | |
| Parameters Used in the Outdoor Air Inhalation Pathway | | | | | | | | |
| Exposure Time (hr/day) | 2 | (a) | 6 | (a) | 2 | (a) | 6 | (a) |
| Exposure Frequency (days/year) | 266 | (c) | 266 | (c) | 178 | (e) | 178 | (e) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Inhalation Rate (m^3/hour) | 1.6 | (g) | 1.2 | (g) | 0.55 | (h) | 0.32 | (i) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Surface Soil Pathway | | | | | | | | |
| Exposure Frequency (days/year) | 266 | (c) | 266 | (c) | 178 | (e) | 178 | (e) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Soil Ingestion Rate (mg/day) | 100 | (b) | 200 | (b) | 50 | (j) | 100 | (j) |
| Skin Contacting Medium (cm^2) | 5729 | (k) | 2058 | (k) | 5729 | (k) | 2058 | (k) |
| Soil on Skin (mg/cm^2) | 0.12 | (l) | 0.06 | (l) | 0.12 | (l) | 0.06 | (l) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Homegrown Produce Pathway | | | | | | | | |
| Exposure Frequency (days/year) | 365 | (p) | 365 | (p) | 365 | (p) | 365 | (p) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Produce Ingestion Rate (g/day) | 525 | (m) | 113 | (m) | 147 | (n) | 31.5 | (n) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Indoor Air Inhalation Pathway | | | | | | | | |
| Exposure Time (hr/day) | 16.4 | (o) | 18 | (o) | 16.4 | (o) | 18 | (o) |
| Exposure Frequency (days/year) | 266 | (c) | 266 | (c) | 178 | (e) | 178 | (e) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Inhalation Rate (m^3/hour) | 1.6 | (g) | 1.2 | (g) | 0.55 | (h) | 0.32 | (i) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |
| Parameters Used in the Groundwater Pathway | | | | | | | | |
| Exposure Time (hr/event) | 1 | (r) | 1 | (r) | 1 | (r) | 1 | (r) |
| Exposure Frequency (days/year) | 26 | (s) | 26 | (s) | 13 | (t) | 13 | (t) |
| Exposure Duration (yr) | 24 | (b) | 6 | (b) | 7 | (f) | 2 | (f) |
| Water Ingestion Rate (l/event) | 0.005 | (q) | 0.005 | (q) | 0.001 | (u) | 0.001 | (u) |
| Skin Contacting Medium (cm^2) | 5729 | (k) | 2058 | (k) | 5729 | (k) | 2058 | (k) |
| Body Weight (kg) | 70 | (b) | 15 | (b) | 70 | (b) | 15 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. Values for time spent outdoors listed in Table 1-2 (average of weekends /weekdays for children).
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - Exposure frequency of 350 days (USEPA, 1991a) adjusted for percentage of days with inclement weather (24%), [350-(350*0.24) = 266]; See text.
(d) - USEPA, 1993b. Central tendency residential exposure frequency = 234 days.
(e) - Exposure frequency of 234 days (USEPA, 1993b) adjusted for percentage of days with inclement weather (24%), [234 - (234*0.24) = 178]; See text.
(f) - USEPA, 1997a. Exposure Factors Handbook. Recommended average for time residing in a household, Table 1-2. (9 years total, assuming 7 years as an adult and 2 as a child - assumes that the 2 years as a child can occur anywhere between the ages of 0 to 6. Therefore, exposure factors for a 0 to 6 year old child are employed).
(g) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates are the values for moderate activity listed in Table 5-23.
(h) - USEPA, 1997a. Exposure Factors Handbook. Average daily inhalation rate for men and women, Table 5-23.
(i) - USEPA, 1997a. Exposure Factors Handbook. Average of recommended inhalation rates for children age 0-6 years, Table 5-23.
(j) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(k) - USEPA, 1997a. Exposure Factors Handbook. Represents average 50th percentile surface area for males and females of hands, forearms, lower legs, and feet.
(l) - USEPA, 1997a. Exposure Factors Handbook. See Tables 5-12 and 5-13 for calculation.
(m) - USEPA, 1997a. Exposure Factors Handbook. Based on recommended 95th percentile homegrown vegetable intake of 7.5 g/kg body weight-day, Table 1-2.
(n) - USEPA, 1997a. Exposure Factors Handbook. Based on average homegrown vegetable intake of 2.1 g/kg body weight-day, Table 1-2.
(o) - USEPA, 1997a. Exposure Factors Handbook. Values for time spent indoors listed in Table 1-2 (average of weekends /weekdays for children; assumes that adult spends time away from the household).
(p) - Produce ingestion rate is based on 365 days per year.
(q) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.
(r) - The adult and child are assumed to be in contact with groundwater outdoors for one hour per event.
(s) - Two days per week for three months.
(t) - One day per week for three months.
(u) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fiftieth of that assumed to occur during a swimming event.

TABLE 5-8
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RECREATIONAL TEENAGER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Parameter | RME Recreational Teenager (7 to 18 yrs) | | MLE Recreational Teenager (7 to 18 yrs) | |
|---|---|---|---|---|
| Parameters Used in the Dead Creek Sediment Pathway - Wading | | | | |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Soil Ingestion Rate (mg/day) | 100 | (d) | 50 | (e) |
| Skin Contacting Medium (cm^2) | 2029 | (f) | 2029 | (f) |
| Sediment on Skin (mg/cm^2) | 1 | (g) | 1 | (g) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Parameters Used in the Dead Creek Surface Water Pathway - Wading | | | | |
| Exposure Frequency (days/year) | 26 | (a) | 13 | (b) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Surface Water Ingestion Rate (l/event) | 0.01 | (i) | 0.005 | (j) |
| Skin Contacting Medium (cm^2) | 2029 | (f) | 2029 | (f) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Paramaters Used in the Borrow Pit Lake Sediment Pathway - Swimming | | | | |
| Exposure Frequency (days/year) | 12 | (k) | 6 | (l) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Soil Ingestion Rate (mg/day) | 100 | (d) | 50 | (e) |
| Skin Contacting Medium (cm^2) | 2029 | (f) | 2029 | (f) |
| Sediment on Skin (mg/cm^2) | 1 | (g) | 1 | (g) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |
| Parameters Used in the Borrow Pit Lake Surface Water Pathway - Swimming | | | | |
| Exposure Frequency (days/year) | 12 | (k) | 6 | (l) |
| Exposure Duration (yr) | 11 | (c) | 11 | (c) |
| Surface Water Ingestion Rate (l/event) | 0.05 | (m) | 0.01 | (i) |
| Skin Contacting Medium (cm^2) | 13533 | (n) | 13533 | (n) |
| Body Weight (kg) | 47 | (h) | 47 | (h) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - 1 day per week for 26 weeks (6 months) of the year.
(b) - 1 day per 2 weeks for 26 weeks (6 months) of the year.
(c) - Recreational teenager is assumed to range in age from 7 to 18. Therefore, total exposure duration is 11 years.
(d) - USEPA, 1991a. Standard Default Exposure Factors.
(e) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rate for an adult listed in Table 1-2.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average surface are of feet and 1/4 the legs of males and females aged 7-18.
(g) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.
(h) - USEPA, 1997a. Exposure Factors Handbook. Body weight is the average of males and females aged 7-18.
(i) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fifth of that assumed to occur during a swimming event.
(j) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.
(k) - Two events per month for the 6 warmest months of the year.
(l) - One events per month for the 6 warmest months of the year.
(m) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value for a swimming event.
(n) - Value represents average total body surface area of males and females aged 7 to 18. Assumed 100% of skin surface exposed while swimming.

6/22/99

TABLE 5-9
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RECREATIONAL FISHER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Parameter | RME Adult Recreational Fisher | | MLE Adult Recreational Fisher | |
|---|---|---|---|---|
| Parameters Used in the Fish Ingestion Pathway | | | | |
| Exposure Frequency (days/year) | 365 | (a) | 365 | (a) |
| Exposure Duration (yr) | 30 | (b) | 9 | (c) |
| Fish Ingestion Rate (g/day) | 8 | (d) | 1 | (e) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |
| Parameters Used in the Surface Water Pathway - Wading | | | | |
| Exposure Frequency (days/year) | 22 | (k) | 3 | (l) |
| Exposure Duration (yr) | 30 | (b) | 9 | (c) |
| Surface Water Ingestion Rate (l/event) | 0.01 | (f) | 0.005 | (m) |
| Skin Contacting Medium (cm^2) | 4500 | (g) | 4500 | (g) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |
| Paramaters Used in the Sediment Pathway - Wading | | | | |
| Exposure Frequency (days/year) | 22 | (k) | 3 | (l) |
| Exposure Duration (yr) | 30 | (b) | 9 | (c) |
| Sediment Ingestion Rate (mg/day) | 100 | (h) | 50 | (i) |
| Skin Contacting Medium (cm^2) | 4500 | (g) | 4500 | (g) |
| Sediment on Skin (mg/cm^2) | 1 | (j) | 1 | (j) |
| Body Weight (kg) | 70 | (b) | 70 | (b) |

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - Fish ingestion rates are based on 365 days per year.
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended average for time residing in a household. Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. 8 g/day is equivalent to approximately 22 fish meals of 129 g per year.
(e) - 1 g/day is equivalent to approximately three 129 g fish meals per year (equivalent to one fish meal per month in the three summer months).
(f) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fifth of that assumed to occur during a swimming event.
(g) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, lower legs, and feet.
(h) - USEPA, 1991a. Standard Default Exposure Factors.
(i) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(j) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.
(k) - One day per month for 5 months.
(l) - One day per month during the three summer months.
(m) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.

6/22/99

TABLE 5-10
SOIL ADHERANCE FACTORS- OUTDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Body Part | Outdoor Industrial Worker Scenario | | |
|---|---|---|---|
| | Surface Area 50th percentile ($cm^2$) (a) | Soil Loading Groundskeeper ($mg/cm^2$) (b) | Total Soil Mass (mg) |
| Head | 1,205 | 0.005 | 5.543 |
| Hands | 904 | 0.071 | 64.1485 |
| Forearms | 1,230 | 0.009 | 11.1438 |
| Total | 3,339 | | 80.8 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.02 |

Notes:
(a) - Data from U.S. EPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from U.S. EPA (1997a), Table 6-12. Average of Groundskeeper Nos. 1,2,3,4, and 5.

TABLE 5-11
SOIL ADHERANCE FACTORS- CONSTRUCTION WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Body Part | Construction Worker Scenario | | |
|---|---|---|---|
| | Surface Area 50th percentile ($cm^2$) (a) | Soil Loading Farmer ($mg/cm^2$) (a) | Total Soil Mass (mg) |
| Head | 1,205 | 0.041 | 49.405 |
| Hands | 904 | 0.47 | 424.645 |
| Forearms | 1,230 | 0.13 | 159.9 |
| Total | 3,339 | | 634.0 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.19 |

Notes:
(a) - Data from U.S. EPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from U.S. EPA (1997a), Table 6-12. Average of Farmer Nos. 1 and 2.

TABLE 5-12
SOIL ADHERENCE FACTORS- RESIDENT ADULT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Body Part | Adult Resident | | |
|---|---|---|---|
| | Surface Area 50th percentile (a) ($cm^2$) | Soil Loading Gardeners ($mg/cm^2$) (b) | Total Soil Mass (mg) |
| Hands | 904 | 0.19 | 171.67 |
| Forearms | 1,230 | 0.052 | 63.96 |
| Lower legs | 2,370 | 0.047 | 111.39 |
| Feet | 1,225 | 0.215 | 347.02 |
| Total | 5,729 | – | 694.03 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.12 |

Notes:
(a) - Data from U.S. EPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from U.S. EPA (1997a) Table 6-12. Average of gardeners Nos. 1 and 2.

TABLE 5-13
SOIL ADHERENCE FACTORS- RESIDENT CHILD
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| Body Part | Child Resident (0 to 6 years old) | | |
|---|---|---|---|
| | Surface Area 50th percentile (a) ($cm^2$) | Soil Loading Day Care Kids ($mg/cm^2$) (b) | Total Soil Mass (mg) |
| Hands | 358 | 0.0923 | 33.04 |
| Forearms | 437 | 0.0230 | 10.05 |
| Lower legs | 812 | 0.0195 | 15.83 |
| Feet | 451 | 0.0646 | 58.93 |
| Total | 2,058 | – | 117.86 |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.06 |

Notes:
(a) - Data from U.S. EPA (1997a). Based on average of boys (Table 6-6) and girls (Table 6-7) total body surface area (6,557 cm2), and mean percentages of total surface area for individual body parts Table 6-8).
(b) - Data from U.S. EPA (1997a), Table 6-12, Daycare kids Nos. #1a, #1b ,#2c, #3.

TABLE 5-14
SOIL ADHERENCE FACTORS- TRESPASSING TEENAGER (7 TO 18)
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| | Trespassing Teenager (7 to 18) | | |
|---|---|---|---|
| **Body Part** | **Surface Area 50th percentile (a) ($cm^2$)** | **Soil Loading Soccer Kids ($mg/cm^2$) (b)** | **Total Soil Mass (mg)** |
| Hands | 715 | 0.0547 | 39.09 |
| Forearms | 894 | 0.0061 | 5.42 |
| Lower legs | 2,068 | 0.0177 | 36.60 |
| Total | 3,677 | -- | |
| Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area = | | | 0.02 |

Notes:
(a) - Data from U.S. EPA (1997a). Based on average of boys (Table 6-6) and girls (Table 6-7) total body surface area , and mean percentages of total surface area for individual body parts Table 6-8).
(b) - Data from U.S. EPA (1997a) Table 6-12. Average of Soccer Kids Nos. 1, 2, and 3.

# 6.0 RISK CHARACTERIZATION

The purpose of the risk characterization is to provide estimates of the potential risk to human health from exposure to COPC at or from the site by receptors at or near the site. To accomplish this objective, this section will include quantitative estimates of potential carcinogenic and noncarcinogenic risk.

The results of the exposure assessment are combined with the results of the dose-response assessment to derive quantitative estimates of risk, or the probability of adverse health effects following assumed potential exposure to the COPCs. Using the exposure point concentrations derived in the exposure assessment, each exposure pathway for each receptor will be evaluated for both potential carcinogenic and noncarcinogenic effects.

## 6.1 Carcinogenic Risk Characterization

The purpose of carcinogenic risk characterization is to estimate the upper-bound likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of exposure to a chemical in environmental media at the site. This likelihood is a function of the dose of a chemical (described in the Exposure Assessment) and the Cancer Slope Factor (CSF) (described in the Toxicity Assessment) for that chemical. The Excess Lifetime Cancer Risk (ELCR) is the likelihood over and above the background cancer rate, which currently in the U.S. is between 1 in 3 and 1 in 4 (Landis et al., 1998), that an individual will contract cancer in his or her lifetime. The risk value is expressed as a probability (e.g., $10^{-6}$, or one in one million). The relationship between the ELCR and the estimated Lifetime Average Daily Dose (LADD) of a chemical may be expressed as:

$$ELCR = 1 - e^{-(CSF \times LADD)}$$

When the product of the CSF and the LADD is much greater than 1, the ELCR approaches 1 (i.e., 100 percent probability). When the product is less than 0.01 (one chance in 100), the equation can be closely approximated by:

$$ELCR = LADD\ (mg/kg\text{-}day) \times CSF\ (mg/kg\text{-}day)^{-1}$$

The product of the CSF and the LADD is unitless, and provides an upper-bound estimate of the potential carcinogenic risk associated with a receptor's exposure to that chemical via that pathway.

The potential carcinogenic risk for each exposure pathway will be calculated for each receptor. In current regulatory risk assessment, it is assumed that cancer risks are additive or cumulative. Pathway and area-specific risks will be summed to estimate the total site potential cancer risk for each

receptor. A summary of the total site cancer risks for each receptor group will be presented in this section and compared to the USEPA's target risk range of $10^{-4}$ to $10^{-6}$. Any COPC that causes an exceedance of $10^{-4}$ risk level for a particular receptor will be designated a COC. Both RME and MLE results will be considered in the identification of COC. Remedial goals (RGs) will be calculated for each COC.

## 6.2 Noncarcinogenic Risk Characterization

The potential for exposure to a chemical to result in adverse noncarcinogenic health effects is estimated for each receptor by comparing the Chronic Average Daily Dose (CADD) for each COPC with the RfD for that COPC. The resulting ratio, which is unitless, is known as the Hazard Quotient (HQ) for that chemical. The HQ is calculated using the following equation:

$$HQ = \frac{CADD\ (mg/kg\text{-}day)}{RfD\ (mg/kg\text{-}day)}$$

The target HQ is defined as an HQ of less than or equal to one (U.S. EPA, 1989a). When the HQ is less than or equal to 1, the RfD has not been exceeded, and no adverse noncarcinogenic effects are expected. If the HQ is greater than 1, there may be a potential for adverse noncarcinogenic health effects to occur; however, the magnitude of the HQ cannot be directly equated to a probability or effect level.

The total Hazard Index (HI) is calculated for each exposure pathway by summing the HQs for each individual chemical. The total site HI will be calculated for each potential receptor by summing the HIs for each pathway associated with the receptor. If the total site HI is greater than one for any receptor, a more detailed evaluation of potential noncarcinogenic effects based on specific health endpoints will be performed (USEPA, 1989a; IEPA, 1998).

A summary of all HI for each receptor group will be presented in this section and compared to the USEPA's target hazard index of one. COPC that causes an exceedance of the Hazard Index of 1 for a particular receptor and target endpoint will be designated a COC. Both RME and MLE results will be considered in the identification of COC. Remedial goals will be calculated for each COC.

## 6.3 Risk Assessment Refinement

As stated in the AOC SOW, the risk assessment for Sauget Area 1 is a streamlined HHRA, and as such, utilizes conservative exposure and toxicity parameters. The results of the HHRA will be reviewed and the risk drivers identified. Solutia may choose to refine the risk estimates by using, for example, the following: site-specific exposure data (creel census or well survey), site-specific bioavailability factors, or probabilistic (or Monte Carlo) analysis. Use of such refinements, such as a probabilistic risk assessment, will allow the public to put the risks in perspective and provide

information that the risk manager needs to more accurately characterize risks on a site-specific basis and to communicate the nature of the risks to the public.

## 6.4 Cumulative Risk

Although the AOC SOW identifies separate risk evaluations for groundwater and other media, many potential receptors identified herein are assumed to be exposed to both groundwater and other media simultaneously. To account for cumulative risk, the risk assessment will be conducted for all media, and total site risks will be calculated for each receptor. COC for potentially carcinogenic and noncarcinogenic effects will be identified, and pathways that contribute significantly to target risk exceedances will be identified. RGs will be calculated for appropriate COPC in the appropriate medium. RGs will be presented for COC in groundwater in the RI/FS report, and RGs will be presented for other media in the EE/CA report.

## 6.5 Uncertainty Analysis

Uncertainty is introduced into the risk assessment in several places throughout the process. Every time an assumption is made, some level of uncertainty is introduced into the risk assessment. In accordance with USEPA guidance (USEPA, 1989a), the uncertainty associated with each step of the risk characterization process will be discussed in this section of the report.

There are many potential sources of uncertainty in the risk assessment process; some are more important than others. The major areas of uncertainty include: the adequacy of the sampling plan, the quality of the analytical data, assumptions about the frequency, duration, and magnitude of exposure, the receptors identified, assumptions made in the modeling performed to predict concentrations at locations where measurement data are lacking, and the availability and accuracy of dose-response data. The uncertainties will be discussed qualitatively in the report, including steps taken to compensate for uncertainty, and the impact on the risk assessment results.

# 7.0 SUMMARY AND CONCLUSIONS

A summary and conclusions section will contain discussions of the results of the risk assessment. The selection of final COC and the remedial goals for each COC will be presented.

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# APPENDIX A

# DATA QUALITY LEVELS FOR HUMAN HEALTH RISK ASSESSMENT

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) (q) | | Basis |
|---|---|---|---|---|
| | | | | |
| **TCL Volatiles** | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 2.00E+00 | | A |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 3.60E-01 | | F |
| 1,1,2-Trichloroethane | 79-00-5 | 2.00E-02 | | A |
| 1,1-Dichloroethane | 75-34-3 | 1.77E+00 | | B |
| 1,1-Dichloroethylene | 75-35-4 | 4.62E-03 | | B |
| 1,2-Dichloroethane | 107-06-2 | 2.00E-02 | | A |
| 1,2-Dichloroethylene (total) | 540-59-0 | 3.64E-02 | | B |
| 1,2-Dichloropropane | 78-87-5 | 1.00E-02 | | B |
| 2-Butanone | 78-93-3 | 6.90E+03 | | E |
| 2-Hexanone | 591-78-6 | 7.50E+02 | (m) | E |
| 4-Methyl-2-pentanone | 108-10-1 | 7.50E+02 | | E |
| Acetone | 67-64-1 | 1.23E+00 | | B |
| Benzene | 71-43-2 | 3.00E-02 | | A |
| Bromodichloromethane | 75-27-4 | 6.00E-01 | | A |
| Bromoform | 75-25-2 | 8.00E-01 | | A |
| Bromomethane | 74-83-9 | 3.80E+00 | | E |
| Carbon Disulfide | 75-15-0 | 4.57E+00 | | B |
| Carbon tetrachloride | 56-23-5 | 7.00E-02 | | A |
| Chlorobenzene | 108-90-7 | 7.69E-02 | | B |
| Chloroethane | 75-00-3 | 1.53E+02 | (p) | F |
| Chloroform | 67-66-3 | 3.00E-01 | | C |
| Chloromethane | 74-87-3 | 1.20E+00 | | F |
| cis-1,3-Dichloropropene | 10061-01-5 | 4.00E-03 | | A |
| Dibromochloromethane | 124-48-1 | 4.00E-01 | | A |
| Ethyl Benzene | 100-41-4 | 1.00E+00 | | B |
| Methylene chloride | 75-09-2 | 2.00E-02 | | A |
| Styrene | 100-42-5 | 3.08E-01 | | B |
| Tetrachloroethene | 127-18-4 | 6.00E-02 | | A |
| Toluene | 108-88-3 | 9.23E-01 | | B |
| Total Xylenes | 1330-20-7 | 2.11E+01 | (d) | B |
| trans-1,3-Dichloropropene | 10061-02-6 | 4.00E-03 | | A |
| Trichloroethene | 79-01-6 | 6.00E-02 | | A |
| Vinyl chloride | 75-01-4 | 1.00E-02 | | A |
| | | | | |
| **TCL Semi-Volatiles** | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 2.50E+00 | | B |
| 1,2-Dichlorobenzene | 95-50-1 | 1.70E+01 | | A |
| 1,3-Dichlorobenzene | 541-73-1 | 2.00E+00 | (e) | A |
| 1,4-Dichlorobenzene | 106-46-7 | 2.00E+00 | | A |
| 2,2'-oxybis(1-Chloropropane) | 108-60-1 | 2.54E+00 | | F |
| 2,4,5-Trichlorophenol | 95-95-4 | 6.40E+01 | | H |
| 2,4,6-Trichlorophenol | 88-06-2 | 7.00E-02 | | H |
| 2,4-Dichlorophenol | 120-83-2 | 6.90E-01 | | H |
| 2,4-Dimethylphenol | 105-67-9 | 9.00E-01 | | B |
| 2,4-Dinitrophenol | 51-28-5 | 1.10E+02 | | E |
| 2,4-Dinitrotoluene | 121-14-2 | 8.00E-04 | | A |
| 2,6-Dinitrotoluene | 606-20-2 | 7.00E-04 | | A |
| 2-Chloronaphthalene | 91-58-7 | 3.70E+03 | | E |
| 2-Chlorophenol | 95-57-8 | 3.10E+00 | | H |
| 2-Methylnaphthalene | 91-57-6 | 8.40E+01 | | A |
| 2-Methylphenol | 95-48-7 | 1.67E+00 | | B |
| 2-Nitroaniline | 88-74-4 | 3.30E+00 | | E |
| 2-Nitrophenol | 88-75-5 | 3.40E+03 | (n) | E |
| 3,3'-Dichlorobenzidine | 91-94-1 | 7.00E-03 | | A |
| 3-Nitroaniline | 99-09-2 | 3.30E+00 | (o) | E |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | NA | | K |
| 4-Bromophenyl phenyl ether | 101-55-3 | NA | | K |

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) (q) | | Basis |
|---|---|---|---|---|
| | | | | |
| 4-Chloraniline | 106-47-8 | 3.50E-01 | | B |
| 4-Chloro-3-methylphenol | 59-50-7 | NA | | K |
| 4-Chlorophenol phenyl ether | 7005-72-3 | NA | | K |
| 4-Methylphenol | 106-44-5 | 1.67E+00 | (g) | B |
| 4-Nitroaniline | 100-01-6 | 3.30E+00 | (o) | E |
| 4-Nitrophenol | 100-02-7 | 3.40E+03 | | E |
| Acenaphthene | 83-32-9 | 4.38E+01 | | B |
| Acenaphthylene | 208-96-8 | 4.38E+01 | (h) | B |
| Anthracene | 120-12-7 | 1.20E+04 | | A |
| Benz[a]anthracene | 56-55-3 | 9.00E-01 | | D |
| Benzo[a]pyrene | 50-32-8 | 9.00E-02 | | D |
| Benzo[b]fluoranthene | 205-99-2 | 9.00E-01 | | D |
| Benzo[g,h,i]perylene | 191-24-2 | 1.77E+02 | (a) | B,D |
| Benzo[k]fluoranthene | 207-08-9 | 9.00E+00 | | D |
| bis(2-Chloroethoxy)methane | 111-91-1 | NA | | K |
| bis(2-Chloroethyl)ether | 111-44-4 | 4.00E-04 | | A |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 4.60E+01 | | A |
| Butyl benzyl phthalate | 85-68-7 | 9.30E+02 | | A |
| Carbazole | 86-74-8 | 6.00E-01 | | A |
| Chrysene | 218-01-9 | 8.80E+01 | | D |
| Dibenz[a,h]anthracene | 53-70-3 | 9.00E-02 | | D |
| Dibenzofuran | 132-64-9 | 2.10E+02 | | E |
| Diethylphthalate | 84-66-2 | 4.70E+02 | | A |
| Dimethyl phthalate | 131-11-3 | 1.00E+05 | | G |
| Di-n-butyl phthalate | 84-74-2 | 2.30E+03 | | A |
| Di-n-octyl phthalate | 117-84-0 | 1.23E+02 | | B,D |
| Fluoranthene | 206-44-0 | 2.38E+02 | | B,D |
| Fluorene | 86-73-7 | 5.60E+01 | | B |
| Hexachlorobenzene | 118-74-1 | 7.00E-02 | | D |
| Hexachlorobutadiene | 87-68-3 | 5.70E+00 | | F |
| Hexachlorocyclopentadiene | 77-47-4 | 3.33E+00 | | B,C |
| Hexachloroethane | 67-72-1 | 5.00E-01 | | A |
| Indeno[1,2,3-cd]pyrene | 193-39-5 | 9.00E-01 | | D |
| Isophorone | 78-59-1 | 8.00E+00 | | A |
| Naphthalene | 91-20-3 | 8.40E+01 | | |
| Nitrobenzene | 98-95-3 | 7.69E-03 | | B |
| N-Nitroso-di-n-propylamine | 621-64-7 | 5.00E-05 | | A |
| N-Nitrosodiphenylamine | 86-30-6 | 1.00E+00 | | A |
| Pentachlorophenol | 87-86-5 | 2.00E-02 | | H |
| Phenanthrene | 85-01-8 | 1.20E+04 | (b) | A |
| Phenol | 108-95-2 | 1.43E+01 | | B |
| Pyrene | 129-00-0 | 1.77E+02 | | B,D |
| | | | | |
| **TAL Metals** | | | | |
| Aluminum | 7429-90-5 | 7.50E+04 | | E |
| Antimony | 7440-36-0 | 5.00E+00 | | H |
| Arsenic | 7440-38-2 | 4.00E-01 | | D |
| Barium | 7440-39-3 | 2.60E+02 | | H |
| Beryllium | 7440-41-7 | 1.00E-01 | | D |
| Cadmium | 7440-43-9 | 1.00E+00 | | H |
| Calcium | 7440-70-2 | NA | | J |
| Chromium | 7440-47-3 | 2.80E+01 | (c) | H |
| Cobalt | 7440-48-4 | 4.70E+03 | | D |

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) (q) | | Basis |
|---|---|---|---|---|
| | | | | |
| Iron | 7439-89-6 | 2.20E+04 | | E |
| Lead | 7439-92-1 | 4.00E+02 | | D |
| Magnesium | 7439-95-4 | NA | | J |
| Manganese | 7439-96-5 | 4.11E+02 | | D |
| Mercury | 7439-97-6 | 1.00E-01 | | H |
| Nickel | 7440-02-0 | 2.00E+01 | | C |
| Potassium | 7440-09-7 | NA | | J |
| Selenium | 7782-49-2 | 2.40E+00 | | H |
| Silver | 7440-22-4 | 2.40E-01 | | H |
| Sodium | 7440-23-5 | NA | | J |
| Thallium | 7440-28-0 | 1.60E+00 | | H |
| Vanadium | 7440-62-2 | 5.50E+02 | | D |
| Copper | 7440-50-8 | 3.30E+02 | | H |
| Zinc | 7440-66-6 | 1.00E+03 | | H |
| Cyanide | 57-12-5 | 4.00E+01 | | H |
| | | | | |
| **Pesticides** | | | | |
| Alpha-BHC | 319-84-6 | 5.00E-04 | | A |
| Beta-BHC | 319-85-7 | 5.00E-04 | (j) | A |
| Delta-BHC | 319-86-8 | 5.00E-04 | (j) | A |
| Gamma-BHC (Lindane) | 58-89-9 | 9.00E-03 | | A |
| Aldrin | 309-00-2 | 4.00E-02 | | D |
| alpha-Chlordane | 5103-71-9 | 5.00E-01 | (i) | D |
| gamma-Chlordane | 5103-74-2 | 5.00E-01 | (i) | D |
| Chlordane | 57-74-9 | 5.00E-01 | | D |
| Chlorobenzilate | 510-15-6 | 1.60E+00 | | F |
| 1,2-Dibromo-3-Chloropropane | 96-12-8 | 2.00E-03 | | A |
| 4,4'-DDD | 72-54-8 | 3.00E+00 | | D |

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) (q) | | Basis |
|---|---|---|---|---|
| | | | | |
| 4,4'-DDE | 72-55-9 | 2.00E+00 | | D |
| 4,4'-DDT | 50-29-3 | 2.00E+00 | | D |
| Diallate | 2303-16-4 | 7.30E+00 | | F |
| Dieldrin | 60-57-1 | 4.00E-03 | | A |
| Endosulfan I | 959-98-8 | 1.38E+00 | (k) | B |
| Endosulfan II | 33213-65-9 | 1.38E+00 | (k) | B |
| Endosulfan sulfate | 1031-07-8 | 1.38E+00 | (k) | B |
| Endrin | 72-20-8 | 7.69E-02 | | B |
| Endrin aldehyde | 7421-93-4 | 7.69E-02 | (l) | B |
| Endrin Ketone | 53494-70-5 | 7.69E-02 | (l) | B |
| Heptachlor | 76-44-8 | 1.00E-01 | | C,D |
| Heptachlor epoxide | 1024-57-3 | 7.00E-02 | | D |
| Hexachlorobenzene | 118-74-1 | 4.00E-01 | | D |
| Hexachlorocyclopentadiene | 77-47-4 | 3.33E+00 | | B,C |
| Isodrin | 465-73-6 | NA | | K |
| Methoxychlor | 72-43-5 | 2.29E+01 | | B |
| Toxaphene | 8001-35-2 | 6.00E-01 | | D |
| | | | | |
| **Herbicides** | | | | |
| 2,4-D | 94-75-7 | 1.36E-01 | | B |
| 2,4-DB | 94-82-6 | 4.40E+02 | | E |
| 2,4,5-TP | 93-72-1 | 1.10E+01 | | H |
| 2,4,5-T | 93-76-5 | 7.82E+02 | (p) | E |
| Dalapon | 75-99-0 | 6.54E-02 | | B |
| Dicamba | 1918-00-9 | 1.60E+03 | | E |
| Dichloroprop | 120-36-5 | NA | | K |
| Dinoseb | 88-85-7 | 2.50E-01 | | H |
| MCPA | 94-74-6 | 3.91E+01 | (p) | E |
| MCPP | 93-65-2 | 7.82E+01 | (p) | E |
| 4-Nitrophenol | 100-02-7 | 3.40E+03 | | E |
| Pentachlorophenol | 87-86-5 | 2.00E-02 | | H |
| | | | | |
| **Dioxins and Furans** | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 1.00E-03 | | I |
| 1,2,3,7,8-PentaCDD | 40321-76-4 | 1.00E-03 | | I |
| 1,2,3,4,7,8-HexaCDD | 39227-28-6 | 1.00E-03 | | I |
| 1,2,3,6,7,8-HexaCDD | 57653-85-7 | 1.00E-03 | | I |
| 1,2,3,7,8,9-HexaCDD | 19408-74-3 | 1.00E-03 | | I |
| 1,2,3,4,6,7,8-HeptaCDD | 35822-39-4 | 1.00E-03 | | I |
| OctaCDD | 3268-87-9 | 1.00E-03 | | I |
| 2,3,7,8-TetraCDF | 51207-31-9 | 1.00E-03 | | I |
| 1,2,3,7,8-PentaCDF | 57117-41-6 | 1.00E-03 | | I |
| 2,3,4,7,8-PentaCDF | 57117-31-4 | 1.00E-03 | | I |
| 1,2,3,4,7,8-HexaCDF | 70648-26-9 | 1.00E-03 | | I |
| 1,2,3,6,7,8-HexaCDF | 57117-44-9 | 1.00E-03 | | I |
| 1,2,3,7,8,9-HexaCDF | 72918-21-9 | 1.00E-03 | | I |
| 2,3,4,6,7,8-HexaCDF | 60851-34-5 | 1.00E-03 | | I |
| 1,2,3,4,6,7,8-HeptaCDF | 67562-39-4 | 1.00E-03 | | I |
| 1,2,3,4,7,8,9-HeptaCDF | 55673-89-7 | 1.00E-03 | | I |
| OctaCDF | 39001-02-0 | 1.00E-03 | | I |
| | | | | |

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) (q) | Basis |
|---|---|---|---|
| **TPH** | | | |
| GRO | NA | 5.00E+00 | L |
| DRO | NA | 4.00E+00 | L |
| | | | |
| **Additional (added 4/17/99)** | | | |
| | | | |
| Copper,method 7211 | 7440-50-8 | 3.30E+02 | H |
| Zinc, method 7151 | 7440-66-6 | 1.00E+03 | H |
| TOC, method 9060 | NA | NA | K |
| TPH, method 8015B | NA | 5.00E+00 | L |
| Naphthalene | 91-20-3 | 8.40E+01 | B |
| Total PCBs | NA | 1.00E+00 | M |

Notes:
(a) Due to structural similarities, the value for Pyrene was used.
(b) Due to structural similarities, the value for Anthracene was used.
(c) Value for Chromium IV.
(d) Value for o-Xylene.
(e) IEPA, 1998, No Appendix Table B value available, therefore, due to structural similarities, value for 1,2-Dichlorobenene used.
(f) Due to structural similarities, the value for Naphthalene was used.
(g) Due to structural similarities, the value for 2-Methylphenol was used.
(h) Due to structural similarities, the value for Acenaphthene was used.
(i) Due to structural similarities, the value for Chlordane was used.
(j) Due to structural similarities, the value for alpha-BHC was used.
(k) Due to structural similarities, the value for Endosulfan was used.
(l) Due to structural similarities, the value for Endrin was used.
(m) Due to structural similarities, the value for 4-Methyl 2-Pentanone was used.
(n) Due to structural similarities, the value for 4-Nitrophenol was used.
(o) Due to structural similarities, the value for 2-Nitroaniline was used.
(p) PRG calculated based on equations in PRG table.
(q) - The following hierarchy was used to determine the appropriate DQL:
1. The lower of Illinois Tiered Approach to Corrective Action (TACO) Program Tier 1 values from Appendix B, Table C or Appendix B, Table A, with adjustmentsmade for additivity for noncarcinogens.
2. For constituents not listed on Appendix B, Table A, Region IX PRGs for residential soil were used.
CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA - Not Available.
PCB = Polychlorinated Biphenyl.
PRG = USEPA Region 9 Preliminary Remediation Goal (USEPA, 1998c).
TAL = Target Analyte List.
TCL = Target Compound List.
TPH = Total Petroleum Hydrocarbons.
A = IEPA, 1998, Appendix B, Table A, Value for Class I Groundwater.
B = IEPA, 1998, Appendix B, Table A, Value for Class I Groundwater adjusted for additivity of noncarcinogenic effects.
C = IEPA, 1998, Appendix B, Table A, Value for Inhalation.
D = IEPA, 1998, Appendix B, Table A, Value for Ingestion.
E = Region IX PRG based on noncarcinogenic effects.
F = Region IX PRG based on carcinogenic effects.
G = Region IX PRG based on ceiling limit.
H = IEPA, 1998, Appendix B, Table C. Lowest value was selected.
I = USEPA, 1998g. Value for Dioxins.
J = No value is available as this constituent is an essential nutrient.
K = No toxicity information is available for this constituent therefore DQL was not developed.
L = Estimated data quality limits based on previous testing.
M = USEPA, 1998f. PCB Mega Rule.

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | Surface Water (m) DQL (mg/L) | Ground Water (a) DQL (mg/L) | Basis | Selected DQL (p) (mg/L) |
|---|---|---|---|---|---|
| **TCL Volatiles** | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | NA | 0.2 | B | 2.00E-01 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 0.011 | 0.000055 | C (ca) | 5.50E-05 |
| 1,1,2-Trichloroethane | 79-00-5 | 0.042 | 0.005 | B | 5.00E-03 |
| 1,1-Dichloroethane | 75-34-3 | NA | 0.7 | B | 7.00E-01 |
| 1,1-Dichloroethylene | 75-35-4 | 0.0032 | 0.007 | B | 3.20E-03 |
| 1,2-Dichloroethane | 107-06-2 | 0.099 | 0.00003 | A | 3.00E-05 |
| 1,2-Dichloroethylene (total) | 540-59-0 | 140 | 0.07 (c) | B | 7.00E-02 |
| 1,2-Dichloropropane | 78-87-5 | 0.039 | 0.005 | B | 5.00E-03 |
| 2-Butanone | 78-93-3 | NA | 1.9 | C (nc) | 1.90E+00 |
| 2-Hexanone | 591-78-6 | NA | 0.16 (g) | C (nc) | 1.60E-01 |
| 4-Methyl-2-pentanone | 108-10-1 | NA | 0.16 | C (nc) | 1.60E-01 |
| Acetone | 67-64-1 | NA | 0.7 | B | 7.00E-01 |
| Benzene | 71-43-2 | 0.071 | 0.005 | B | 5.00E-03 |
| Bromodichloromethane | 75-27-4 | 0.046 | 0.00002 | B | 2.00E-05 |
| Bromoform | 75-25-2 | 0.36 | 0.0002 | B | 2.00E-04 |
| Bromomethane | 74-83-9 | NA | 0.0098 | B | 9.80E-03 |
| Carbon Disulfide | 75-15-0 | NA | 0.7 | B | 7.00E-01 |
| Carbon tetrachloride | 56-23-5 | 0.0044 | 0.00003 | A | 3.00E-05 |
| Chlorobenzene | 108-90-7 | 21 | 0.1 | B | 1.00E-01 |
| Chloroethane | 75-00-3 | NA | 1.26E+01 (o) | C (ca) | 1.26E+01 |
| Chloroform | 67-66-3 | 0.47 | 0.00002 | B | 2.00E-05 |
| Chloromethane | 74-87-3 | NA | 0.0015 | C (ca) | 1.50E-03 |
| cis-1,3-Dichloropropene | 10061-01-5 | 1.7 | 0.001 | B | 1.00E-03 |
| Dibromochloromethane | 124-48-1 | 0.034 | 0.14 | B | 3.40E-02 |
| Ethyl Benzene | 100-41-4 | 29 | 0.7 | B | 7.00E-01 |
| Methylene chloride | 75-09-2 | 1.6 | 0.005 | B | 5.00E-03 |
| Styrene | 100-42-5 | NA | 0.1 | B | 1.00E-01 |
| Tetrachloroethene | 127-18-4 | 0.00885 | 0.00001 | A | 1.00E-05 |
| Toluene | 108-88-3 | 200 | 1 | B | 1.00E+00 |
| Total Xylenes | 1330-20-7 | NA | 10 | B | 1.00E+01 |
| trans-1,3-Dichloropropene | 10061-02-6 | 1.7 | 0.001 | B | 1.00E-03 |
| Trichloroethene | 79-01-6 | 0.081 | 0.005 | B | 5.00E-03 |
| Vinyl chloride | 75-01-4 | 0.525 | 0.00006 | A | 6.00E-05 |
| | | | | | |
| **TCL Semi-Volatiles** | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 0.94 | 0.07 | B | 7.00E-02 |
| 1,2-Dichlorobenzene | 95-50-1 | 17 | 0.6 | B | 6.00E-01 |
| 1,3-Dichlorobenzene | 541-73-1 | 2.6 | 0.075 | B | 7.50E-02 |
| 1,4-Dichlorobenzene | 106-46-7 | 2.6 | 0.075 | B | 7.50E-02 |
| 2,2'-oxybis(1-Chloropropane) | 108-60-1 | 170 | 0.00027 | C (ca) | 2.70E-04 |
| 2,4,5-Trichlorophenol | 95-95-4 | 9.8 | 0.7 | B | 7.00E-01 |
| 2,4,6-Trichlorophenol | 88-06-2 | 0.0065 | 0.0064 | B | 6.40E-03 |
| 2,4-Dichlorophenol | 120-83-2 | 0.79 | 0.021 | B | 2.10E-02 |
| 2,4-Dimethylphenol | 105-67-9 | 2.3 | 0.14 | B | 1.40E-01 |
| 2,4-Dinitrophenol | 51-28-5 | 14 | 0.014 | B | 1.40E-02 |
| 2,4-Dinitrotoluene | 121-14-2 | 0.0091 | 0.00002 | B | 2.00E-05 |
| 2,6-Dinitrotoluene | 606-20-2 | NA | 0.0001 | B | 1.00E-04 |
| 2-Chloronaphthalene | 91-58-7 | 4.3 | 0.49 | C (nc) | 4.90E-01 |
| 2-Chlorophenol | 95-57-8 | 0.4 | 0.035 | B | 3.50E-02 |
| 2-Methylnaphthalene | 91-57-6 | NA | 0.025 (d) | B | 2.50E-02 |
| 2-Methylphenol | 95-48-7 | NA | 0.35 | B | 3.50E-01 |
| 2-Nitroaniline | 88-74-4 | NA | 2.2 | C (nc) | 2.20E+00 |
| 2-Nitrophenol | 88-75-5 | NA | 2.3 (h) | C (nc) | 2.30E+00 |
| 3,3'-Dichlorobenzidine | 91-94-1 | 0.000077 | 0.02 | A | 7.70E-05 |
| 3-Nitroaniline | 99-09-2 | NA | 0.0022 (i) | C (nc) | 2.20E-03 |

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | Surface Water (m) DQL (mg/L) | Ground Water (a) DQL (mg/L) | Ground Water (a) Basis | Selected DQL (p) (mg/L) |
|---|---|---|---|---|---|
| 4,6-Dinitro-2-methylphenol | 534-52-1 | 0.765 | NA | E | 7.65E-01 |
| 4-Bromophenyl phenyl ether | 101-55-3 | NA | NA | E | NA |
| 4-Chloraniline | 106-47-8 | NA | 0.028 | B | 2.80E-02 |
| 4-Chloro-3-methylphenol | 59-50-7 | NA | NA | E | NA |
| 4-Chlorophenol phenyl ether | 7005-72-3 | NA | NA | E | NA |
| 4-Methylphenol | 106-44-5 | NA | 0.35 | B | 3.50E-01 |
| 4-Nitroaniline | 100-01-6 | NA | 0.0022 (i) | C (nc) | 2.20E-03 |
| 4-Nitrophenol | 100-02-7 | NA | 2.3 | C (nc) | 2.30E+00 |
| Acenaphthene | 83-32-9 | 2.7 | 0.42 | B | 4.20E-01 |
| Acenaphthylene | 208-96-8 | 2.7 (b) | 0.42 (b) | B | 4.20E-01 |
| Anthracene | 120-12-7 | 110 | 2.1 | B | 2.10E+00 |
| Benz[a]anthracene | 56-55-3 | 0.000049 | 0.00013 | B | 4.90E-05 |
| Benzo[a]pyrene | 50-32-8 | 0.000049 | 0.00023 | A | 4.90E-05 |
| Benzo[b]fluoranthene | 205-99-2 | 0.000049 | 0.00018 | B | 4.90E-05 |
| Benzo[g,h,i]perylene | 191-24-2 | NA | 0.21 (e) | B | 2.10E-01 |
| Benzo[k]fluoranthene | 207-08-9 | 0.000049 | 0.00017 | B | 4.90E-05 |
| bis(2-Chloroethoxy)methane | 111-91-1 | NA | NA | E | NA |
| bis(2-Chloroethyl)ether | 111-44-4 | 0.0014 | 0.01 | A | 1.40E-03 |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 0.0059 | 0.006 | B | 5.90E-03 |
| Butyl benzyl phthalate | 85-68-7 | 5.2 | 1.4 | B | 1.40E+00 |
| Carbazole | 86-74-8 | NA | 0.0034 | C (ca) | 3.40E-03 |
| Chrysene | 218-01-9 | 0.000049 | 0.0015 | B | 4.90E-05 |
| Dibenz[a,h]anthracene | 53-70-3 | 0.000049 | 0.0003 | A | 4.90E-05 |
| Dibenzofuran | 132-64-9 | NA | 0.024 | C (nc) | 2.40E-02 |
| Diethylphthalate | 84-66-2 | 120 | 5.6 | B | 5.60E+00 |
| Dimethyl phthalate | 131-11-3 | 2900 | 370 | C (nc) | 3.70E+02 |
| Di-n-butyl phthalate | 84-74-2 | 12 | 0.7 | B | 7.00E-01 |
| Di-n-octyl phthalate | 117-84-0 | NA | 0.14 | B | 1.40E-01 |
| Fluoranthene | 206-44-0 | 0.37 | 0.28 | B | 2.80E-01 |
| Fluorene | 86-73-7 | 14 | 0.28 | B | 2.80E-01 |
| Hexachlorobenzene | 118-74-1 | 0.00000077 | 0.00006 | A | 7.70E-07 |
| Hexachlorobutadiene | 87-68-3 | 0.05 | 0.00086 | C (ca) | 8.60E-04 |
| Hexachlorocyclopentadiene | 77-47-4 | 17 | 0.05 | B | 5.00E-02 |
| Hexachloroethane | 67-72-1 | 0.0089 | 0.007 | B | 7.00E-03 |
| Indeno[1,2,3-cd]pyrene | 193-39-5 | 0.000049 | 0.00043 | B | 4.90E-05 |
| Isophorone | 78-59-1 | 2.6 | 1.4 | B | 1.40E+00 |
| Naphthalene | 91-20-3 | NA | 0.025 | B | 2.50E-02 |
| Nitrobenzene | 98-95-3 | 1.9 | 0.0035 | B | 3.50E-03 |
| N-Nitroso-di-n-propylamine | 621-64-7 | 0.0014 | 0.01 | A | 1.40E-03 |
| N-Nitrosodiphenylamine | 86-30-6 | 0.016 | 0.01 | B | 1.00E-02 |
| Pentachlorophenol | 87-86-5 | 0.0082 | 0.001 | A | 1.00E-03 |
| Phenanthrene | 85-01-8 | 110 (f) | 2.1 (f) | B | 2.10E+00 |
| Phenol | 108-95-2 | 4600 | 0.1 | B | 1.00E-01 |
| Pyrene | 129-00-0 | 11 | 0.21 | B | 2.10E-01 |
| | | | | | |

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | Surface Water (m) DQL (mg/L) | Ground Water (a) DQL (mg/L) | Ground Water (a) Basis | Selected DQL (p) (mg/L) |
|---|---|---|---|---|---|
| **TAL Metals** | | | | | |
| Aluminum | 7429-90-5 | NA | 37 | C (nc) | 3.70E+01 |
| Antimony | 7440-36-0 | 4.3 | 0.006 | B | 6.00E-03 |
| Arsenic | 7440-38-2 | 0.00014 | 0.001 | A | 1.40E-04 |
| Barium | 7440-39-3 | NA | 2 | B | 2.00E+00 |
| Beryllium | 7440-41-7 | NA | 0.004 | A | 4.00E-03 |
| Cadmium | 7440-43-9 | NA | 0.005 | B | 5.00E-03 |
| Calcium | 7440-70-2 | NA | NA | F | NA |
| Chromium | 7440-47-3 | NA | 0.1 | B | 1.00E-01 |
| Cobalt | 7440-48-4 | NA | 1 | B | 1.00E+00 |
| Iron | 7439-89-6 | NA | 5 | B | 5.00E+00 |
| Lead | 7439-92-1 | NA | 0.0075 | B | 7.50E-03 |
| Magnesium | 7439-95-4 | NA | NA | F | NA |
| Manganese | 7439-96-5 | 0.1 | 0.15 | B | 1.00E-01 |
| Nickel | 7440-02-0 | 4.6 | 0.1 | B | 1.00E-01 |
| Potassium | 7440-09-7 | NA | NA | F | NA |
| Selenium | 7782-49-2 | 11 | 0.05 | B | 5.00E-02 |
| Silver | 7440-22-4 | NA | 0.05 | B | 5.00E-02 |
| Sodium | 7440-23-5 | NA | NA | F | NA |
| Thallium | 7440-28-0 | 0.0063 | 0.002 | B | 2.00E-03 |
| Vanadium | 7440-62-2 | NA | 0.049 | B | 4.90E-02 |
| Mercury | 7439-97-6 | 0.000051 | 0.002 | B | 5.10E-05 |
| Copper | 7440-50-8 | NA | 0.65 | B | 6.50E-01 |
| Zinc | 7440-66-6 | 69 | 5 | B | 5.00E+00 |
| Cyanide | 57-12-5 | 220 | 0.2 | B | 2.00E-01 |
| | | | | | |
| **Pesticides** | | | | | |
| Alpha-BHC | 319-84-6 | 0.000013 | 0.00003 | A | 1.30E-05 |
| Beta-BHC | 319-85-7 | 0.000046 | 0.00003 (n) | A | 3.00E-05 |
| Delta-BHC | 319-86-8 | NA | 0.00003 (n) | A | 3.00E-05 |
| Gamma-BHC (Lindane) | 58-89-9 | 0.000063 | 0.0002 | B | 6.30E-05 |
| Aldrin | 309-00-2 | 0.00000014 | 0.00004 | A | 1.40E-07 |
| alpha-Chlordane | 5103-71-9 | 0.0000022 (j) | 0.00014 (j) | A | 2.20E-06 |
| gamma-Chlordane | 5103-74-2 | 0.0000022 (j) | 0.00014 (j) | A | 2.20E-06 |
| Chlordane | 57-74-9 | 0.0000022 | 0.00014 | A | 2.20E-06 |
| Chlorobenzilate | 510-15-6 | NA | 0.00025 | C (ca) | 2.50E-04 |
| 1,2-Dibromo-3-Chloropropane (DBCP) | 96-12-8 | NA | 0.002 | A | 2.00E-03 |
| 4,4'-DDD | 72-54-8 | 0.00000084 | 0.00011 | B | 8.40E-07 |
| 4,4'-DDE | 72-55-9 | 0.00000059 | 0.00004 | B | 5.90E-07 |
| 4,4'-DDT | 50-29-3 | 0.00000059 | 0.00012 | B | 5.90E-07 |
| Diallate | 2303-16-4 | NA | 0.0011 | C (ca) | 1.10E-03 |
| Dieldrin | 60-57-1 | 0.00000014 | 0.00002 | A | 1.40E-07 |
| Endosulfan I | 959-98-8 | 0.24 | 0.042 (k) | B | 4.20E-02 |
| Endosulfan II | 33213-65-9 | 0.24 | 0.042 (k) | B | 4.20E-02 |
| Endosulfan sulfate | 1031-07-8 | 0.24 | 0.042 (k) | B | 4.20E-02 |
| Endrin | 72-20-8 | 0.00081 | 0.002 | B | 8.10E-04 |
| Endrin aldehyde | 7421-93-4 | 0.00081 | 0.002 (l) | B | 8.10E-04 |
| Endrin Ketone | 53494-70-5 | 0.00081 (l) | 0.002 (l) | B | 8.10E-04 |
| Heptachlor | 76-44-8 | 0.00000021 | 0.00003 | A | 2.10E-07 |
| Heptachlor epoxide | 1024-57-3 | 0.00000011 | 0.00032 | A | 1.10E-07 |
| Hexachlorobenzene | 118-74-1 | 0.00000077 | 0.00006 | A | 7.70E-07 |
| Hexachlorocyclopentadiene | 77-47-4 | 17 | 0.05 | B | 5.00E-02 |
| Isodrin | 465-73-6 | NA | NA | E | NA |
| Methoxychlor | 72-43-5 | NA | 0.04 | B | 4.00E-02 |
| Toxaphene | 8001-35-2 | 0.00000075 | 0.00086 | A | 7.50E-07 |
| | | | | | |

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | Surface Water (m) DQL (mg/L) | Ground Water (a) DQL (mg/L) | Ground Water (a) Basis | Selected DQL (p) (mg/L) |
|---|---|---|---|---|---|
| **Herbicides** | | | | | |
| 2,4-D | 94-75-7 | NA | 0.07 | B | 7.00E-02 |
| 2,4-DB | 94-82-6 | NA | 2.92E+02 (o) | C (nc) | 2.92E+02 |
| 2,4,5-TP | 93-72-1 | NA | 0.05 | B | 5.00E-02 |
| 2,4,5-T | 93-76-5 | NA | 7.82E+02 (o) | C (nc) | 7.82E+02 |
| Dalapon | 75-99-0 | NA | 0.2 | B | 2.00E-01 |
| Dicamba | 1918-00-9 | NA | 1.1 | C (nc) | 1.10E+00 |
| Dichloroprop | 120-36-5 | NA | NA | E | NA |
| Dinoseb | 88-85-7 | NA | 0.007 | B | 7.00E-03 |
| MCPA | 94-74-6 | NA | 1.83E+01 (o) | C (nc) | 1.83E+01 |
| MCPP | 93-65-2 | NA | 3.65E+01 (o) | C (nc) | 3.65E+01 |
| 4-Nitrophenol | 100-02-7 | NA | 2.3 | C (nc) | 2.30E+00 |
| Pentachlorophenol | 87-86-5 | 0.0082 | 0.001 | A | 1.00E-03 |
| | | | | | |
| **Dioxins and Furans** | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,7,8-PentaCDD | 40321-76-4 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,4,7,8-HexaCDD | 39227-28-6 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,6,7,8-HexaCDD | 57653-85-7 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,7,8,9-HexaCDD | 19408-74-3 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,4,6,7,8-HeptaCDD | 35822-39-4 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| OctaCDD | 3268-87-9 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 2,3,7,8-TetraCDF | 51207-31-9 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,7,8-PentaCDF | 57117-41-6 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 2,3,4,7,8-PentaCDF | 57117-31-4 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,4,7,8-HexaCDF | 70648-26-9 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,6,7,8-HexaCDF | 57117-44-9 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,7,8,9-HexaCDF | 72918-21-9 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 2,3,4,6,7,8-HexaCDF | 60851-34-5 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,4,6,7,8-HeptaCDF | 67562-39-4 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| 1,2,3,4,7,8,9-HeptaCDF | 55673-89-7 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |
| OctaCDF | 39001-02-0 | 1.40E-11 | 4.50E-07 | C | 1.40E-11 |

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | Surface Water (m) | Ground Water (a) | | Selected DQL (p) (mg/L) |
|---|---|---|---|---|---|
| | | DQL (mg/L) | DQL (mg/L) | Basis | |
| **Additional (added 4/17/99)** | | | | | |
| | | | | | |
| Copper, method 7211 | 7440-50-8 | NA | 6.50E-01 | B | 6.50E-01 |
| Zinc, method 7151 | 7440-66-6 | 6.90E+01 | 5.00E+00 | B | 5.00E+00 |
| TOC, method 9060 | NA | NA | NA | E | NA |
| Hardness, method 130.1 | NA | NA | NA | E | NA |
| TPH, method 8015B | NA | NA | NA | E | NA |
| Residue, dissolved | NA | NA | NA | E | NA |
| Residue, suspended | NA | NA | NA | E | NA |
| Total PCBs | NA | 1.70E-07 | 5.00E-04 | B | 1.70E-07 |
| Fluoride | 7782-41-4 | NA | (q) | | NA |
| Phosphorous | 7723-14-0 | NA | (q) | | NA |
| Ortho-phosphate | NA | NA | (q) | | NA |
| | | | | | |

Notes:
(a) - The following hierarchy was used to determine the appropriate DQL:
1. ADL value from Appendix A Table H from the Illinois Tiered Approach to Corrective Action (TACO) Program.
2. For constituents not on Table H, the value for Class I GW from Appendix B Table E was used.
3. For constituents with no TACO values, the Region IX PRG for tap water was used.
4. For remaining constituents, a default value equivalent to the lowest DQL for that type of constituent was used.

(b) Due to structural similarities, the value for Acenaphthene was used.
(c) Value for cis-1,2-Dichloroethylene.
(d) Due to structural similarities, the value for Naphthalene was used.
(e) Due to structural similarities, the value for Pyrene was used.
(f) Due to structural similarities, the value for Anthracene was used.
(g) Due to structural similarities, the value for 4-Methyl-2-Pentanone was used.
(h) Due to structural similarities, the value for 4-Nitrophenol was used.
(i) Due to structural similarities, the value for 2-Nitroaniline was used.
(j) Due to structural similarities, the value for Chlordane was used.
(k) Due to structural similarities, the value for Endosulfan was used.
(l) Due to structural similarities, the value for Endrin was used.
(m) Surface Water Values were obtained from Federal Register, Vol. 63, No. 237. Value for Human Health Consumption of Organisms.
(n) Due to structural similarities, the value for alpha-BHC was used.
(o) PRG calculated based on equations in PRG table.
(p) - Selected DQL is the lower of the surface water and groundwater DQLs.
(q) - Constituent will not be analyzed for in groundwater.
nc - Based on noncarcinogenic effects.
ca - Based on carcinogenic effects.
CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA = Not available.
PCB = Polychlorinated Biphenyl.
PRG = USEPA Region 9 Preliminary Remediation Goal (USEPA, 1998c).
TAL = Target Analyte List.
TCL = Target Compound List.
A = IEPA, 1998, Appendix A, Table H, Acceptable Detection Limit (ADL) Value.
B = IEPA, 1998, Appendix B, Table E, Value for Class I Groundwater.
C = Region IX PRG.
D = Default Value based on lowest DQL.
E = No toxicity information is available for this constituent therefore DQL was not developed.
F = No value is available as this constituent is an essential nutrient.

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) | (n) | Basis |
|---|---|---|---|---|
| **TCL Semi-Volatiles** | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 14 | | N |
| 1,2-Dichlorobenzene | 95-50-1 | 120 | | N |
| 1,3-Dichlorobenzene | 541-73-1 | 41 | | N |
| 1,4-Dichlorobenzene | 106-46-7 | 0.13 | | C |
| 2,2'-oxybis(1-Chloropropane) | 108-60-1 | 0.045 | (m) | C |
| 2,4,5-Trichlorophenol | 95-95-4 | 140 | | N |
| 2,4,6-Trichlorophenol | 88-06-2 | 0.29 | | C |
| 2,4-Dichlorophenol | 120-83-2 | 4.1 | | N |
| 2,4-Dimethylphenol | 105-67-9 | 27 | | N |
| 2,4-Dinitrophenol | 51-28-5 | 2.7 | | N |
| 2,4-Dinitrotoluene | 121-14-2 | 2.7 | | N |
| 2,6-Dinitrotoluene | 606-20-2 | 1.4 | | N |
| 2-Chloronaphthalene | 91-58-7 | 110 | | N |
| 2-Chlorophenol | 95-57-8 | 6.8 | | N |
| 2-Methylnaphthalene | 91-57-6 | 27 | | N |
| 2-Methylphenol | 95-48-7 | 68 | | N |
| 2-Nitroaniline | 88-74-4 | NA | | O |
| 2-Nitrophenol | 88-75-5 | 11 | (a) | N |
| 3,3'-Dichlorobenzidine | 91-94-1 | 0.007 | | C |
| 3-Nitroaniline | 99-09-2 | NA | | O |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | NA | | D |
| 4-Bromophenyl phenyl ether | 101-55-3 | NA | | D |
| 4-Chloraniline | 106-47-8 | 5.4 | | N |
| 4-Chloro-3-methylphenol | 59-50-7 | NA | | D |
| 4-Chlorophenol phenyl ether | 7005-72-3 | NA | | D |
| 4-Methylphenol | 106-44-5 | 6.8 | | N |
| 4-Nitroaniline | 100-01-6 | NA | | O |
| 4-Nitrophenol | 100-02-7 | 11 | | N |
| Acenaphthene | 83-32-9 | 81 | | N |
| Acenaphthylene | 208-96-8 | 81 | (b) | N |
| Anthracene | 120-12-7 | 410 | | N |
| Benz[a]anthracene | 56-55-3 | 0.0043 | | C |
| Benzo[a]pyrene | 50-32-8 | 0.00043 | | C |
| Benzo[b]fluoranthene | 205-99-2 | 0.0043 | | C |
| Benzo[g,h,i]perylene | 191-24-2 | 41 | (c) | N |
| Benzo[k]fluoranthene | 207-08-9 | 0.043 | | C |
| bis(2-Chloroethoxy)methane | 111-91-1 | NA | | D |
| bis(2-Chloroethyl)ether | 111-44-4 | 0.0029 | | C |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 0.23 | | C |
| Butyl benzyl phthalate | 85-68-7 | 270 | | N |
| Carbazole | 86-74-8 | 0.16 | | C |
| Chrysene | 218-01-9 | 0.43 | | C |
| Dibenz[a,h]anthracene | 53-70-3 | 0.00043 | | C |
| Dibenzofuran | 132-64-9 | 5.4 | | N |
| Diethylphthalate | 84-66-2 | 1100 | | N |

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) | (n) | Basis |
|---|---|---|---|---|
| Dimethyl phthalate | 131-11-3 | 14000 | | N |
| Di-n-butyl phthalate | 84-74-2 | 140 | | N |
| Di-n-octyl phthalate | 117-84-0 | 27 | | N |
| Fluoranthene | 206-44-0 | 54 | | N |
| Fluorene | 86-73-7 | 54 | | N |
| Hexachlorobenzene | 118-74-1 | 0.002 | | C |
| Hexachlorobutadiene | 87-68-3 | 0.04 | | C |
| Hexachlorocyclopentadiene | 77-47-4 | 9.5 | | N |
| Hexachloroethane | 67-72-1 | 0.23 | | C |
| Indeno[1,2,3-cd]pyrene | 193-39-5 | 0.0043 | | C |
| Isophorone | 78-59-1 | 3.3 | | C |
| Naphthalene | 91-20-3 | 27 | | N |
| Nitrobenzene | 98-95-3 | 0.68 | | N |
| N-Nitroso-di-n-propylamine | 621-64-7 | 0.00045 | | C |
| N-Nitrosodiphenylamine | 86-30-6 | 0.64 | | C |
| Pentachlorophenol | 87-86-5 | 0.026 | | C |
| Phenanthrene | 85-01-8 | 410 | (d) | N |
| Phenol | 108-95-2 | 810 | | N |
| Pyrene | 129-00-0 | 41 | | N |
| | | | | |
| **TAL Metals** | | | | |
| Aluminum | 7429-90-5 | 1400 | | N |
| Antimony | 7440-36-0 | 0.54 | | N |
| Arsenic | 7440-38-2 | 0.0021 | | C |
| Barium | 7440-39-3 | 95 | | N |
| Beryllium | 7440-41-7 | 2.7 | | N |
| Cadmium | 7440-43-9 | 1.4 | (f) | N |
| Calcium | 7440-70-2 | NA | | B |
| Chromium | 7440-47-3 | 4.1 | (g) | N |
| Cobalt | 7440-48-4 | 81 | | N |
| Iron | 7439-89-6 | 410 | | N |
| Lead | 7439-92-1 | NA | | O |
| Magnesium | 7439-95-4 | NA | | B |
| Manganese | 7439-96-5 | 190 | (h) | N |
| Nickel | 7440-02-0 | 27 | | N |
| Potassium | 7440-09-7 | NA | | B |
| Selenium | 7782-49-2 | 6.8 | | N |
| Silver | 7440-22-4 | 6.8 | | N |
| Sodium | 7440-23-5 | NA | | B |
| Thallium | 7440-28-0 | 0.095 | | N |
| Vanadium | 7440-62-2 | 9.5 | | N |
| Mercury | 7439-97-6 | 0.14 | (e) | N |
| Copper | 7440-50-8 | 54 | | N |
| Zinc | 7440-66-6 | 410 | | N |
| Cyanide | 57-12-5 | 27 | | N |
| | | | | |

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) | (n) | Basis |
|---|---|---|---|---|
| | | | | |
| **PCBs** | | | | |
| Total PCBs | NA | 0.0016 | | C |
| | | | | |
| **Pesticides** | | | | |
| Alpha-BHC | 319-84-6 | 0.0005 | | C |
| Beta-BHC | 319-85-7 | 0.0018 | | C |
| Delta-BHC | 319-86-8 | 0.0018 | (i) | C |
| Gamma-BHC (Lindane) | 58-89-9 | 0.0024 | | C |
| Aldrin | 309-00-2 | 0.00019 | | C |
| alpha-Chlordane | 5103-71-9 | 0.009 | (j) | C |
| gamma-Chlordane | 5103-74-2 | 0.009 | (j) | C |
| Chlordane | 57-74-9 | 0.009 | | C |
| Chlorobenzilate | 510-15-6 | 0.012 | | C |
| 1,2-Dibromo-3-Chloropropane (DBCP) | 96-12-8 | 0.0023 | | C |
| 4,4'-DDD | 72-54-8 | 0.013 | | C |
| 4,4'-DDE | 72-55-9 | 0.0093 | | C |
| 4,4'-DDT | 50-29-3 | 0.0093 | | C |
| Diallate | 2303-16-4 | NA | | O |
| Dieldrin | 60-57-1 | 0.0002 | | C |
| Endosulfan I | 959-98-8 | 8.1 | (k) | N |
| Endosulfan II | 33213-65-9 | 8.1 | (k) | N |
| Endosulfan sulfate | 1031-07-8 | 8.1 | (k) | N |
| Endrin | 72-20-8 | 0.41 | | N |
| Endrin aldehyde | 7421-93-4 | 0.41 | (l) | N |
| Endrin Ketone | 53494-70-5 | 0.41 | (l) | N |
| Heptachlor | 76-44-8 | 0.0007 | | C |
| Heptachlor epoxide | 1024-57-3 | 0.00035 | | C |
| Hexachlorobenzene | 118-74-1 | 0.002 | | C |
| Hexachlorocyclopentadiene | 77-47-4 | 9.5 | | N |
| Isodrin | 465-73-6 | NA | | D |
| Methoxychlor | 72-43-5 | 6.8 | | N |
| Toxaphene | 8001-35-2 | 0.0029 | | C |
| | | | | |
| **Herbicides** | | | | |
| 2,4-D | 94-75-7 | 14 | | N |
| 2,4-DB | 94-82-6 | NA | | O |
| 2,4,5-TP | 93-72-1 | NA | | O |
| 2,4,5-T | 93-76-5 | 14 | | N |
| Dalapon | 75-99-0 | 41 | | N |
| Dicamba | 1918-00-9 | 41 | | N |
| Dichloroprop | 120-36-5 | NA | | O |
| Dinoseb | 88-85-7 | 1.4 | | N |
| MCPA | 94-74-6 | NA | | O |
| MCPP | 93-65-2 | NA | | O |
| 4-Nitrophenol | 100-02-7 | 11 | | N |
| Pentachlorophenol | 87-86-5 | 0.026 | | C |

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) (n) | Basis |
|---|---|---|---|
| | | | |
| | | | |
| **Dioxins and Furans** | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 2.10E-08 | C |
| 1,2,3,7,8-PentaCDD | 40321-76-4 | 2.10E-08 | C |
| 1,2,3,4,7,8-HexaCDD | 39227-28-6 | 2.10E-08 | C |
| 1,2,3,6,7,8-HexaCDD | 57653-85-7 | 2.10E-08 | C |
| 1,2,3,7,8,9-HexaCDD | 19408-74-3 | 2.10E-08 | C |
| 1,2,3,4,6,7,8-HeptaCDD | 35822-39-4 | 2.10E-08 | C |
| OctaCDD | 3268-87-9 | 2.10E-08 | C |
| 2,3,7,8-TetraCDF | 51207-31-9 | 2.10E-08 | C |
| 1,2,3,7,8-PentaCDF | 57117-41-6 | 2.10E-08 | C |
| 2,3,4,7,8-PentaCDF | 57117-31-4 | 2.10E-08 | C |
| 1,2,3,4,7,8-HexaCDF | 70648-26-9 | 2.10E-08 | C |
| 1,2,3,6,7,8-HexaCDF | 57117-44-9 | 2.10E-08 | C |
| 1,2,3,7,8,9-HexaCDF | 72918-21-9 | 2.10E-08 | C |

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (mg/kg) (n) | Basis |
|---|---|---|---|
| | | | |
| 2,3,4,6,7,8-HexaCDF | 60851-34-5 | 2.10E-08 | C |
| 1,2,3,4,6,7,8-HeptaCDF | 67562-39-4 | 2.10E-08 | C |
| 1,2,3,4,7,8,9-HeptaCDF | 55673-89-7 | 2.10E-08 | C |
| OctaCDF | 39001-02-0 | 2.10E-08 | C |
| | | | |

Notes:
B = No value is available as this constituent is an essential nutrient.
C = USEPA, 1998e, Based on carcinogenic USEPA Region 3 RBC value.
D = No toxicological value available, therefore, no DQL was developed.
N = USEPA, 1998e, Based on non-carcinogenic USEPA Region 3 RBC value.
O = No RBC available; therefore, no DQL developed.
CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA = Not Available.
PCB = Polychlorinated Biphenyl.
PRG = USEPA Region 9 Preliminary Remediation Goal (USEPA, 1998c).
RBC = USEPA Region 3 Risk Based Concentration (USEPA, 1998e).
TAL = Target Analyte List.
TCL = Target Compound List.
(a) Due to structural similarities, the value for 4-Nitrophenol was used.
(b) Due to structural similarities, the value for Acenaphthene was used.
(c) Due to structural similarities, the value for Pyrene was used.
(d) Due to structural similarities, the value for Anthracene was used.
(e) Value for Methyl Mercury.
(f) Value for Cadmium-food.
(g) Value for Chromium IV.
(h) Value for Manganese-food.
(i) Due to structural similarities, the value for Beta BHC was used.
(j) Due to structural similarities, the value for Chlordane was used.
(k) Due to structural similarities, the value for Endosulfan was used.
(l) Due to structural similarities, the value for Endrin was used.
(m) Due to structural similarities, the value for Bis(2-Chloroisopropyl) ether was used.
(n) DQLs for Fish Tissue based on USEPA Region 3 RBCs (USEPA, 1998e).

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (ug/m$^3$) (a) | Basis |
|---|---|---|---|
| | | | |
| **TCL Volatiles** | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 1000 | A |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 0.033 | B |
| 1,1,2-Trichloroethane | 79-00-5 | 0.12 | B |
| 1,1-Dichloroethane | 75-34-3 | 520 | A |
| 1,1-Dichloroethylene | 75-35-4 | 0.038 | B |
| 1,2-Dichloroethane | 107-06-2 | 0.074 | B |
| 1,2-Dichloroethylene (total) | 540-59-0 | 37 (c) | A |
| 1,2-Dichloropropane | 78-87-5 | 0.099 | B |
| 2-Butanone | 78-93-3 | 1000 | A |
| 2-Hexanone | 591-78-6 | 83 (d) | A |
| 4-Methyl-2-pentanone | 108-10-1 | 83 | A |
| Acetone | 67-64-1 | 370 | A |
| Benzene | 71-43-2 | 0.23 | B |
| Bromodichloromethane | 75-27-4 | 0.11 | B |
| Bromoform | 75-25-2 | 1.7 | B |
| Bromomethane | 74-83-9 | 5.2 | A |
| Carbon Disulfide | 75-15-0 | 730 | A |
| Carbon tetrachloride | 56-23-5 | 0.13 | B |
| Chlorobenzene | 108-90-7 | 21 | A |
| Chloroethane | 75-00-3 | NA | D |
| Chloroform | 67-66-3 | 0.084 | B |
| Chloromethane | 74-87-3 | 1.1 | B |
| cis-1,3-Dichloropropene | 10061-01-5 | 0.052 (e) | B |
| Dibromochloromethane | 124-48-1 | 0.08 | B |
| Ethyl Benzene | 100-41-4 | 1100 | A |
| Methylene chloride | 75-09-2 | 4.1 | B |
| Styrene | 100-42-5 | 1100 | A |
| Tetrachloroethene | 127-18-4 | 3.3 | B |
| Toluene | 108-88-3 | 400 | A |
| Total Xylenes | 1330-20-7 | 730 | A |
| trans-1,3-Dichloropropene | 10061-02-6 | 0.052 (e) | B |
| Trichloroethene | 79-01-6 | 1.1 | B |
| Vinyl chloride | 75-01-4 | 0.022 | B |
| | | | |
| **TCL Semi-Volatiles** | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 210 | A |
| 1,2-Dichlorobenzene | 95-50-1 | 210 | A |
| 1,3-Dichlorobenzene | 541-73-1 | 8.4 | A |
| 1,4-Dichlorobenzene | 106-46-7 | 0.28 | B |
| 2,2'-oxybis(1-Chloropropane) | 108-60-1 | 0.19 (b) | B |
| 2,4,5-Trichlorophenol | 95-95-4 | 370 | A |
| 2,4,6-Trichlorophenol | 88-06-2 | 0.62 | B |
| 2,4-Dichlorophenol | 120-83-2 | 11 | A |
| 2,4-Dimethylphenol | 105-67-9 | 73 | A |
| 2,4-Dinitrophenol | 51-28-5 | 7.3 | A |
| 2,4-Dinitrotoluene | 121-14-2 | 7.3 | A |
| 2,6-Dinitrotoluene | 606-20-2 | 3.7 | A |
| 2-Chloronaphthalene | 91-58-7 | 290 | A |
| 2-Chlorophenol | 95-57-8 | 18 | A |

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (ug/m$^3$) (a) | | Basis |
|---|---|---|---|---|
| 2-Methylnaphthalene | 91-57-6 | 3.1 | (f) | A |
| 2-Methylphenol | 95-48-7 | 180 | | A |
| 2-Nitroaniline | 88-74-4 | 0.21 | | A |
| 2-Nitrophenol | 88-75-5 | 230 | (g) | A |
| 3,3'-Dichlorobenzidine | 91-94-1 | 0.015 | | B |
| 3-Nitroaniline | 99-09-2 | 0.21 | (h) | A |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | NA | | C |
| 4-Bromophenyl phenyl ether | 101-55-3 | NA | | C |
| 4-Chloraniline | 106-47-8 | 15 | | A |
| 4-Chloro-3-methylphenol | 59-50-7 | NA | | C |
| 4-Chlorophenol phenyl ether | 7005-72-3 | NA | | C |
| 4-Methylphenol | 106-44-5 | 18 | | A |
| 4-Nitroaniline | 100-01-6 | 0.21 | (h) | A |
| 4-Nitrophenol | 100-02-7 | 230 | | A |
| Acenaphthene | 83-32-9 | 220 | | A |
| Acenaphthylene | 208-96-8 | 220 | (i) | A |
| Anthracene | 120-12-7 | 1100 | | A |
| Benz[a]anthracene | 56-55-3 | 0.022 | | B |
| Benzo[a]pyrene | 50-32-8 | 0.0022 | | B |
| Benzo[b]fluoranthene | 205-99-2 | 0.022 | | B |
| Benzo[g,h,i]perylene | 191-24-2 | 110 | (j) | A |
| Benzo[k]fluoranthene | 207-08-9 | 0.22 | | B |
| bis(2-Chloroethoxy)methane | 111-91-1 | NA | | C |
| bis(2-Chloroethyl)ether | 111-44-4 | 0.0058 | | B |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 0.48 | | B |
| Butyl benzyl phthalate | 85-68-7 | 730 | | A |
| Carbazole | 86-74-8 | 0.34 | | B |
| Chrysene | 218-01-9 | 2.2 | | B |
| Dibenz[a,h]anthracene | 53-70-3 | 0.0022 | | B |
| Dibenzofuran | 132-64-9 | 15 | | A |
| Diethylphthalate | 84-66-2 | 2900 | | A |
| Dimethyl phthalate | 131-11-3 | 37000 | | B |
| Di-n-butyl phthalate | 84-74-2 | 370 | | A |
| Di-n-octyl phthalate | 117-84-0 | 73 | | A |
| Fluoranthene | 206-44-0 | 150 | | A |
| Fluorene | 86-73-7 | 150 | | A |
| Hexachlorobenzene | 118-74-1 | 0.0042 | | B |
| Hexachlorobutadiene | 87-68-3 | 0.087 | | B |
| Hexachlorocyclopentadiene | 77-47-4 | 0.073 | | A |
| Hexachloroethane | 67-72-1 | 0.48 | | B |
| Indeno[1,2,3-cd]pyrene | 193-39-5 | 0.022 | | B |
| Isophorone | 78-59-1 | 7.1 | | B |
| Naphthalene | 91-20-3 | 3.1 | | A |
| Nitrobenzene | 98-95-3 | 2.1 | | A |
| N-Nitroso-di-n-propylamine | 621-64-7 | 0.00096 | | B |
| N-Nitrosodiphenylamine | 86-30-6 | 1.4 | | B |
| Pentachlorophenol | 87-86-5 | 0.056 | | B |
| Phenanthrene | 85-01-8 | 1100 | (k) | A |
| Phenol | 108-95-2 | 2200 | | A |
| Pyrene | 129-00-0 | 110 | | A |

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (ug/m$^3$) (a) | Basis |
|---|---|---|---|
| | | | |
| | | | |
| **TAL Metals** | | | |
| Aluminum | 7429-90-5 | NA | |
| Antimony | 7440-36-0 | NA | |
| Arsenic | 7440-38-2 | 0.00045 | B |
| Barium | 7440-39-3 | 0.52 | A |
| Beryllium | 7440-41-7 | 0.0008 | B |
| Cadmium | 7440-43-9 | 0.0011 | B |
| Calcium | 7440-70-2 | NA | |
| Chromium | 7440-47-3 | 0.000023 (l) | B |
| Cobalt | 7440-48-4 | 0.021 | A |
| Iron | 7439-89-6 | NA | |
| Lead | 7439-92-1 | NA | |
| Magnesium | 7439-95-4 | NA | |
| Manganese | 7439-96-5 | 0.051 | A |
| Nickel | 7440-02-0 | 0.008 (m) | B |
| Potassium | 7440-09-7 | NA | |
| Selenium | 7782-49-2 | NA | |
| Silver | 7440-22-4 | NA | |
| Sodium | 7440-23-5 | NA | |
| Thallium | 7440-28-0 | NA | |
| Vanadium | 7440-62-2 | NA | |
| Mercury | 7439-97-6 | 0.31 | A |
| Copper | 7440-50-8 | NA | |
| Zinc | 7440-66-6 | NA | |
| Cyanide | 57-12-5 | NA | |
| | | | |
| | | | |
| **PCBs** | | | |
| Total PCBs | NA | 0.0034 | B |
| | | | |

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (ug/m$^3$) (a) | Basis |
|---|---|---|---|
| | | | |
| **Dioxins and Furans** | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 4.50E-08 | B |
| 1,2,3,7,8-PentaCDD | 40321-76-4 | 4.50E-08 | B |
| 1,2,3,4,7,8-HexaCDD | 39227-28-6 | 4.50E-08 | B |
| 1,2,3,6,7,8-HexaCDD | 57653-85-7 | 4.50E-08 | B |
| 1,2,3,7,8,9-HexaCDD | 19408-74-3 | 4.50E-08 | B |
| 1,2,3,4,6,7,8-HeptaCDD | 35822-39-4 | 4.50E-08 | B |
| OctaCDD | 3268-87-9 | 4.50E-08 | B |
| 2,3,7,8-TetraCDF | 51207-31-9 | 4.50E-08 | B |
| 1,2,3,7,8-PentaCDF | 57117-41-6 | 4.50E-08 | B |
| 2,3,4,7,8-PentaCDF | 57117-31-4 | 4.50E-08 | B |
| 1,2,3,4,7,8-HexaCDF | 70648-26-9 | 4.50E-08 | B |
| 1,2,3,6,7,8-HexaCDF | 57117-44-9 | 4.50E-08 | B |
| 1,2,3,7,8,9-HexaCDF | 72918-21-9 | 4.50E-08 | B |
| 2,3,4,6,7,8-HexaCDF | 60851-34-5 | 4.50E-08 | B |
| 1,2,3,4,6,7,8-HeptaCDF | 67562-39-4 | 4.50E-08 | B |
| 1,2,3,4,7,8,9-HeptaCDF | 55673-89-7 | 4.50E-08 | B |
| OctaCDF | 39001-02-0 | 4.50E-08 | B |
| | | | |
| **Additional (added 4/17/99)** | | | |
| | | | |
| Benzyl Alcohol | 100-51-6 | 1.1E+03 | A |
| Bis(2-chloroisopropyl)ether (2,2'-oxybi | 108-60-1 | 1.9E-01 (b) | B |
| Dichlorodifluoromethane | 75-71-8 | 2.1E+02 | A |
| Trichlorofluoromethane | 75-69-4 | 7.3E+02 | A |
| 1,1-Dichloroethene | 75-35-4 | 3.8E-02 | B |
| Trans-1,2-dichloroethene | 156-60-5 | 7.3E+01 | A |
| 2,2-Dichloropropane | 594-20-7 | NA | C |
| Cis-1,2-dichloroethene | 156-59-2 | 3.7E+01 | A |
| Bromochloromethane | 74-97-5 | NA | C |
| 1,1-Dichloropropylene | 563-58-6 | NA | C |
| Dibromomethane | 74-95-3 | 3.7E+01 | A |
| 1,3-Dichloropropane | 142-28-9 | NA | C |
| 1,2-Dibromomethane | 106-93-4 | 8.7E-03 | B |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 2.6E-01 | B |
| M & p xylenes | 108-38-3 | 7.3E+02 | A |
| o-xylene | 95-47-6 | 7.3E+02 | A |
| isopropylbenzene | 104-5-18 | 3.7E+01 | A |
| 1,2,3,-trichloropropane | 96-18-4 | 9.6E-04 | B |
| n-proplybenzene | 104-51-8 | 3.7E+01 | A |
| Bromobenzene | 108-86-1 | 1.0E+01 | A |
| 1,3,5-Trimethylbenzene | 108-67-8 | 6.2E+00 | A |
| 2-Chlorotoluene | 95-49-8 | 7.3E+01 | A |
| 4-Chlorotoluene | 106-43-4 | 7.3E+01 (n) | A |
| t-Butylbenzene | 104-5-18 | 3.7E+01 | A |
| 1,2,4-Trimethylbenzene | 95-63-6 | 6.2E+00 | A |
| s-Butylbenzene | 135-9-88 | 3.7E+01 | A |
| p-Isopropyltoluene | 99-87-6 | NA | C |
| n-Butylbenzene | 104-51-8 | 3.7E+01 | A |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 2.1E-01 | A |

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

| CONSTITUENT | CAS NO. | DQL (ug/m$^3$) (a) | Basis |
|---|---|---|---|
| | | | |
| 1,2,3-Trichlorobenzene | 87-61-6 | NA | C |
| Vinyl acetate | 108-05-4 | 2.1E+02 | A |
| | | | |

Notes:
CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA = Not available.
PCB = Polychlorinated Biphenyl.
PRG = Preliminary Remedial Goal.
TAL = Target Analyte List.
TCL = Target Compound List.
(a) Air DQLs are based on USEPA Region IX PRG Table. (USEPA, 1998c)
(b) Synonym of Bis(2-Chloroisopropyl ether)
(c) Value for cis-1,2-Dichloroethylene used.
(d) Due to structural similarities, the value for 4-Methyl-2-Pentanone was used.
(e) Value for 1,3-Dichloropropene.
(f) Due to structural similarities, the value for Naphthalene was used.
(g) Due to structural similarities, the value for 4-Nitrophenol was used.
(h) Due to structural similarities, the value for 2-Nitroaniline was used.
(i) Due to structural similarities, the value for Acenaphthene was used.
(j) Due to structural similarities, the value for Pyrene was used.
(k) Due to structural similarities, the value for Anthracene was used.
(l) Value for Chromium IV.
(m) Value for Nickel Refinery Dust.
(n) - Due to structural similarities, the value for 2-Chlorotoluene was used.
A = Region IX PRG, based on non-carcinogenic effects.
B = Region IX PRG, based on carcinogenic effects.
C = No Toxicological value available.

# APPENDIX B

# TACO TIER I CRITERIA

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Section 742.TABLE A: Tier 1 Soil Remediation Objectives[a] for Residential Properties

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 83-32-9 | Acenaphthene | 4,700[b] | ---[c] | 570[b] | 2,900 | * |
| 67-64-1 | Acetone | 7,800[b] | 100,000[d] | 16[b] | 16 | * |
| 15972-60-8 | Alachlor[o] | 8[e] | ---[c] | 0.04 | 0.2 | NA |
| 116-06-3 | Aldicarb[o] | 78[b] | ---[c] | 0.013 | 0.07 | NA |
| 309-00-2 | Aldrin | 0.04[e] | 3[e] | 0.5[e] | 2.5 | * |
| 120-12-7 | Anthracene | 23,000[b] | ---[c] | 12,000[b] | 59,000 | * |
| 1912-24-9 | Atrazine[o] | 2700[b] | ---[c] | 0.066 | 0.33 | NA |
| 71-43-2 | Benzene | 22[e] | 0.8[e] | 0.03 | 0.17 | * |
| 56-55-3 | Benzo(*a*)anthracene | 0.9[e] | ---[c] | 2 | 8 | * |
| 205-99-2 | Benzo(*b*)fluoranthene | 0.9[e] | ---[c] | 5 | 25 | * |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 207-08-9 | Benzo(*k*)fluroanthene | 9[e] | ---[c] | 49 | 250 | * |
| 50-32-8 | Benzo(*a*)pyrene | 0.09[e,f] | ---[c] | 8 | 82 | * |
| 111-44-4 | Bis(2-chloroethyl)ether | 0.6[e] | 0.2[e,f] | 0.0004[e,f] | 0.0004 | 0.66 |
| 117-81-7 | Bis(2-ethylhexyl)phthalate | 46[e] | 31,000[d] | 3,600 | 31,000[d] | * |
| 75-27-4 | Bromodichloromethane (Dichlorobromomethane) | 10[e] | 3,000[d] | 0.6 | 0.6 | * |
| 75-25-2 | Bromoform | 81[e] | 53[e] | 0.8 | 0.8 | * |
| 71-36-3 | Butanol | 7,800[b] | 10,000[d] | 17[b] | 17 | NA |
| 85-68-7 | Butyl benzyl phthalate | 16,000[b] | 930[d] | 930[d] | 930[d] | * |
| 86-74-8 | Carbazole | 32[e] | ---[c] | 0.6[e] | 2.8 | NA |
| 1563-66-2 | Carbofuran[o] | 390[b] | ---[c] | 0.22 | 1.1 | NA |
| 75-15-0 | Carbon disulfide | 7,800[b] | 720[d] | 32[b] | 160 | * |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 56-23-5 | Carbon tetrachloride | 5[e] | 0.3[e] | 0.07 | 0.33 | * |
| 57-74-9 | Chlordane | 0.5[e] | 20[e] | 10 | 48 | * |
| 106-47-8 | 4-Chloroaniline (*p*-Chloroaniline) | 310[b] | ---[c] | 0.7[b] | 0.7 | 1.3 |
| 108-90-7 | Chlorobenzene (Monochlorobenzene) | 1,600[b] | 130[b] | 1 | 6.5 | * |
| 124-48-1 | Chlorodibromomethane (Dibromochloromethane) | 1,600[b] | 1,300[d] | 0.4 | 0.4 | * |
| 67-66-3 | Chloroform | 100[e] | 0.3[e] | 0.6 | 2.9 | * |
| 218-01-9 | Chrysene | 88[e] | ---[c] | 160 | 800 | * |
| 94-75-7 | 2,4-D | 780[b] | ---[c] | 1.5 | 7.7 | * |
| 75-99-0 | Dalapon | 2,300[b] | ---[c] | 0.85 | 8.5 | 1.2 |
| 72-54-8 | DDD | 3[e] | ---[c] | 16[e] | 80 | * |
| 72-55-9 | DDE | 2[e] | ---[c] | 54[e] | 270 | * |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 50-29-3 | DDT | 2[e] | ---[g] | 32[e] | 160 | * |
| 53-70-3 | Dibenzo(*a,h*)anthracene | 0.09[e,f] | ---[c] | 2 | 7.6 | * |
| 96-12-8 | 1,2-Dibromo-3-chloropropane | 0.46[e] | 11[b] | 0.002 | 0.002 | * |
| 106-93-4 | 1,2-Dibromoethane (Ethylene dibromide) | 0.0075[e] | 0.17[e] | 0.0004 | 0.004 | 0.005 |
| 84-74-2 | Di-*n*-butyl phthalate | 7,800[b] | 2,300[d] | 2,300[d] | 2,300[d] | * |
| 95-50-1 | 1,2-Dichlorobenzene (*o* - Dichlorobenzene) | 7,000[b] | 560[d] | 17 | 43 | * |
| 106-46-7 | 1,4-Dichlorobenzene (*p* - Dichlorobenzene) | ---[c] | ---[g] | 2 | 11 | * |
| 91-94-1 | 3,3'-Dichlorobenzidine | 1[e] | ---[c] | 0.007[e,f] | 0.033 | 1.3 |
| 75-34-3 | 1,1-Dichloroethane | 7,800[b] | 1,300[b] | 23[b] | 110 | * |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 107-06-2 | 1,2-Dichloroethane (Ethylene dichloride) | 7[e] | 0.4[e] | 0.02 | 0.1 | * |
| 75-35-4 | 1,1-Dichloroethylene | 700[b] | 1,500[d] | 0.06 | 0.3 | * |
| 156-59-2 | *cis*-1,2-Dichloroethylene | 780[b] | 1,200[d] | 0.4 | 1.1 | * |
| 156-60-5 | *trans*-1,2-Dichloroethylene | 1,600[b] | 3,100[d] | 0.7 | 3.4 | * |
| 78-87-5 | 1,2-Dichloropropane | 9[e] | 15[b] | 0.03 | 0.15 | * |
| 542-75-6 | 1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*) | 4[e] | 0.1[e] | 0.004[e] | 0.02 | 0.005 |
| 60-57-1 | Dieldrin[n] | 0.04[e] | 1[e] | 0.004[e] | 0.02 | * |
| 84-66-2 | Diethyl phthalate | 63,000[b] | 2,000[d] | 470[b] | 470 | * |
| 105-67-9 | 2,4-Dimethylphenol | 1,600[b] | ---[c] | 9[b] | 9 | * |
| 121-14-2 | 2,4-Dinitrotoluene | 0.9[e] | ---[c] | 0.0008[e,f] | 0.0008 | 0.013 |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 606-20-2 | 2,6-Dinitrotoluene | 0.9[e] | ---[c] | 0.0007[e,f] | 0.0007 | 0.0067 |
| 117-84-0 | Di-*n*-octyl phthalate | 1,600[b] | 10,000[d] | 10,000[d] | 10,000[d] | * |
| 115-29-7 | Endosulfan | 470[b] | ---[c] | 18[b] | 90 | * |
| 145-73-3 | Endothall[o] | 1,600[b] | ---[c] | 0.4 | 0.4 | NA |
| 72-20-8 | Endrin | 23[b] | ---[c] | 1 | 5 | * |
| 100-41-4 | Ethylbenzene | 7,800[b] | 400[d] | 13 | 19 | * |
| 206-44-0 | Fluoranthene | 3,100[b] | ---[c] | 4,300[b] | 21,000 | * |
| 86-73-7 | Fluorene | 3,100[b] | ---[c] | 560[b] | 2,800 | * |
| 76-44-8 | Heptachlor | 0.1[e] | 0.1[e] | 23 | 110 | * |
| 1024-57-3 | Heptachlor epoxide | 0.07[e] | 5[e] | 0.7 | 3.3 | * |
| 118-74-1 | Hexachlorobenzene | 0.4[e] | 1[e] | 2 | 11 | * |
| 319-84-6 | *alpha*-HCH (*alpha*-BHC) | 0.1[e] | 0.8[e] | 0.0005[e,f] | 0.003 | 0.002 |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 58-89-9 | *gamma*-HCH (Lindane)[n] | 0.5[e] | ---[c] | 0.009 | 0.047 | * |
| 77-47-4 | Hexachlorocyclopentadiene | 550[b] | 10[b] | 400 | 2,200[d] | * |
| 67-72-1 | Hexachloroethane | 78[b] | ---[c] | 0.5[b] | 2.6 | * |
| 193-39-5 | Indeno(1,2,3-*c,d*)pyrene | 0.9[e] | ---[c] | 14 | 69 | * |
| 78-59-1 | Isophorone | 15,600[b] | 4,600[d] | 8[b] | 8 | * |
| 72-43-5 | Methoxychlor | 390[b] | ---[c] | 160 | 780 | * |
| 74-83-9 | Methyl bromide (Bromomethane) | 110[b] | 10[b] | 0.2[b] | 1.2 | * |
| 75-09-2 | Methylene chloride (Dichloromethane) | 85[e] | 13[e] | 0.02[e] | 0.2 | * |
| 95-48-7 | 2-Methylphenol (*o* - Cresol) | 3,900[b] | ---[c] | 15[b] | 15 | * |
| 91-20-3 | Naphthalene | 3,100[b] | ---[c] | 84[b] | 420 | * |
| 98-95-3 | Nitrobenzene | 39[b] | 92[b] | 0.1[b,f] | 0.1 | 0.26 |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 86-30-6 | *N*-Nitrosodiphenylamine | 130[f] | ---[c] | 1[e] | 5.6 | * |
| 621-64-7 | *N*-Nitrosodi-*n*-propylamine | 0.09[e,f] | ---[c] | 0.00005[e,f] | 0.00005 | 0.66 |
| 108-95-2 | Phenol | 47,000[b] | ---[c] | 100[b] | 100 | * |
| 1918-02-1 | Picloram[o] | 5,500[b] | ---[c] | 2 | 20 | NA |
| 1336-36-3 | Polychlorinated biphenyls (PCBs)[n] | 1; 10[h] | ---[c,h] | ---[h] | ---[h] | * |
| 129-00-0 | Pyrene | 2,300[b] | ---[c] | 4,200[b] | 21,000 | * |
| 122-34-9 | Simazine[o] | 390[b] | ---[c] | 0.04 | 0.37 | NA |
| 100-42-5 | Styrene | 16,000[b] | 1,500[d] | 4 | 18 | * |
| 127-18-4 | Tetrachloroethylene (Perchloroethylene) | 12[e] | 11[e] | 0.06 | 0.3 | * |
| 108-88-3 | Toluene | 16,000[b] | 650[d] | 12 | 29 | * |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 8001-35-2 | Toxaphene[n] | 0.6[e] | 89[e] | 31 | 150 | * |
| 120-82-1 | 1,2,4-Trichlorobenzene | 780[b] | 3,200[b] | 5 | 53 | * |
| 71-55-6 | 1,1,1-Trichloroethane | ---[c] | 1,200[d] | 2 | 9.6 | * |
| 79-00-5 | 1,1,2-Trichloroethane | 310[b] | 1,800[d] | 0.02 | 0.3 | * |
| 79-01-6 | Trichloroethylene | 58[e] | 5[e] | 0.06 | 0.3 | * |
| 108-05-4 | Vinyl acetate | 78,000[b] | 1,000[b] | 170[b] | 170 | * |
| 75-01-4 | Vinyl chloride | 0.3[e] | 0.03[e] | 0.01[f] | 0.07 | * |
| 108-38-3 | m-Xylene | 160,000[b] | 420[d] | 210 | 210 | * |
| 95-47-6 | o-Xylene | 160,000[b] | 410[d] | 190 | 190 | * |
| 106-42-3 | p-Xylene | 160,000[b] | 460[d] | 200 | 200 | * |

| | | Exposure Route-Specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 1330-20-7 | Xylenes (total) | 160,000[b] | 410[d] | 150 | 150 | * |
| | **Ionizable Organics** | | | | | |
| 65-85-0 | Benzoic Acid | 310,000[b] | ---[c] | 400[b,i] | 400[i] | * |
| 95-57-8 | 2-Chlorophenol | 390[b] | 53,000[d] | 4[b,i] | 4[i] | * |
| 120-83-2 | 2,4-Dichlorophenol | 230[b] | ---[c] | 1[b,i] | 1[i] | * |
| 51-28-5 | 2,4-Dinitrophenol | 160[b] | ---[c] | 0.2[b,f] | 0.2 | 3.3 |
| 88-85-7 | Dinoseb[o] | 78[b] | ---[c] | 0.34[b,i] | 3.4[i] | * |
| 87-86-5 | Pentachlorophenol | 3[e,j] | ---[c] | 0.03[f,i] | 0.14[i] | 2.4 |
| 93-72-1 | 2,4,5-TP (Silvex) | 630[b] | ---[c] | 11[i] | 55[i] | * |
| 95-95-4 | 2,4,5-Trichlorophenol | 7,800[b] | ---[c] | 270[b,i] | 1,400[i] | * |
| 88-06-2 | 2,4,6 Trichlorophenol | 58[e] | 200[e] | 0.2[e,f,i] | 0.77[i] | 0.43 |

| | | Exposure Route-specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/L) | Class II (mg/L) | ADL (mg/kg) |
| | **Inorganics** | | | | | |
| 7440-36-0 | Antimony | 31[b] | ---[c] | 0.006[m] | 0.024[m] | * |
| 7440-38-2 | Arsenic[l,n] | 0.4[e,t] | 750[e] | 0.05[m] | 0.2[m] | * |
| 7440-39-3 | Barium | 5,500[b] | 690,000[b] | 2.0[m] | 2.0[m] | * |
| 7440-41-7 | Beryllium | 0.1[e,t] | 1,300[e] | 0.004[m] | 0.5[m] | * |
| 7440-42-8 | Boron | 7,000[b] | ---[g] | 2.0[m] | 2.0[m] | * |
| 7440-43-9 | Cadmium[l,n] | 78[b,r] | 1,800[e] | 0.005[m] | 0.05[m] | * |
| 16887-00-6 | Chloride | ---[c] | ---[c] | 200[m] | 200[m] | * |
| 7440-47-3 | Chromium, total | 390[b] | 270[e] | 0.1[m] | 1.0[m] | * |
| 16065-83-1 | Chromium, ion, trivalent | 78,000[b] | ---[c] | ---[g] | ---[g] | * |
| 18540-29-9 | Chromium, ion, hexavalent | 390[b] | 270[e] | --- | --- | * |
| 7440-48-4 | Cobalt | 4,700[b] | ---[c] | 1.0[m] | 1.0[m] | * |

| | | Exposure Route-specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/L) | Class II (mg/L) | ADL (mg/kg) |
| 7440-50-8 | Copper[n] | 2,900[b] | ---[c] | 0.65[m] | 0.65[m] | * |
| 57-12-5 | Cyanide (amenable) | 1,600[b] | ---[c] | 0.2[q] | 0.6[q] | * |
| 7782-41-4 | Fluoride | 4,700[b] | ---[c] | 4.0[m] | 4.0[m] | * |
| 15438-31-0 | Iron | ---[c] | ---[c] | 5.0[m] | 5.0[m] | * |
| 7439-92-1 | Lead | 400[k] | ---[c] | 0.0075[m] | 0.1[m] | * |
| 7439-96-5 | Manganese | 3,700[b] | 69,000[b] | 0.15[m] | 10.0[m] | * |
| 7439-97-6 | Mercury[l,n] | 23[b,s] | 10[b,i] | 0.002[m] | 0.01[m] | * |
| 7440-02-0 | Nickel[l] | 1,600[b] | 13,000[e] | 0.1[m] | 2.0[m] | * |
| 14797-55-8 | Nitrate as N[p] | 130,000[b] | ---[c] | 10.0[q] | 100[q] | * |
| 7782-49-2 | Selenium[l,n] | 390[b] | ---[c] | 0.05[m] | 0.05[m] | * |

| | | Exposure Route-specific Values for Soils | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/L) | Class II (mg/L) | ADL (mg/kg) |
| 7440-22-4 | Silver | 390[b] | ---[c] | 0.05[m] | --- | * |
| 14808-79-8 | Sulfate | ---[c] | ---[c] | 400[m] | 400[m] | * |
| 7440-28-0 | Thallium | 6.3[b,u] | ---[c] | 0.002[m] | 0.02[m] | * |
| 7440-62-2 | Vanadium | 550[b] | ---[c] | 0.049[m] | --- | * |
| 7440-66-6 | Zinc[l] | 23,000[b] | ---[c] | 5.0[m] | 10[m] | * |

"*" indicates that the ADL is less than or equal to the specified remediation objective.
NA means not available; no PQL or EQL available in USEPA analytical methods.

Chemical Name and Soil Remediation Objective Notations

[a] Soil remediation objectives based on human health criteria only.
[b] Calculated values correspond to a target hazard quotient of 1.
[c] No toxicity criteria available for the route of exposure.
[d] Soil saturation concentration ($C_{(sat)}$) = the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.
[e] Calculated values correspond to a cancer risk level of 1 in 1,000,000.
[f] Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).
[g] Chemical-specific properties are such that this route is not of concern at any soil contaminant concentration.
[h] A preliminary goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540G-90/007, and on USEPA efforts to manage PCB contamination. See 40 CFR 761.120 - USEPA "PCB Spill Cleanup Policy." This regulation goes on to say that the remediation goal for an unrestricted area is 10 ppm and 25 ppm for a restricted area, provided both have at least 10 inches of clean cover.
[i] Soil remediation objective for pH of 6.8. If soil pH is other than 6.8, refer to Appendix B, Tables C and D of this Part.
[j] Ingestion soil remediation objective adjusted by a factor of 0.5 to account for dermal route.
[k] A preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12.
[l] Potential for soil-plant-human exposure.
[m] The person conducting the remediation has the option to use: 1) TCLP or SPLP test results to compare with the remediation objectives listed in this Table; or 2) the total amount of contaminant in the soil sample results to compare with pH specific remediation objectives listed in Appendix B, Table C or D of this Part. (See Section 742.510.) If the person conducting the remediation wishes to calculate soil remediation objectives based on background concentrations, this should be done in accordance with Subpart D of this Part.
[n] The Agency reserves the right to evaluate the potential for remaining contaminant concentrations to pose significant threats to crops, livestock, or wildlife.
[o] For agrichemical facilities, remediation objectives for surficial soils which are based on field application rates may be more appropriate for currently registered pesticides. Consult the Agency for further information.
[p] For agrichemical facilities, soil remediation objectives based on site-specific background concentrations of Nitrate as N may be more appropriate. Such determinations shall be conducted in accordance with the procedures set forth in Subparts D and I of this Part.
[q] The TCLP extraction must be done using water at a pH of 7.0.
[r] Value based on dietary Reference Dose.
[s] Value based on Reference Dose for Mercuric chloride (CAS No. 7487-94-7).
[t] Note that Table value is likely to be less than background concentration for this chemical; screening or remediation concentrations using the procedures of Subpart D of this Part may be more appropriate.

[u] Value based on Reference Dose for thallium sulfate (CAS No. 7446-18-6).

## Section 742.APPENDIX B: Tier 1 Tables and Illustrations

## Section 742.Table B: Tier 1 Soil Remediation Objectives[a] for Industrial/Commercial Properties

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | ClassII (mg/kg) | ADL (mg/kg) |
| 83-32-9 | Acenaphthene | 120,000[b] | -----[c] | 120,000[b] | -----[c] | 570[b] | 2,900 | * |
| 67-64-1 | Acetone | 200,000[b] | 100,000[d] | 200,000[b] | 100,000[d] | 16[b] | 16 | * |
| 15972-60-8 | Alachlor[o] | 72[e] | -----[c] | 1,600[e] | -----[c] | 0.04 | 0.2 | NA |
| 116-06-3 | Aldicarb[o] | 2,000[b] | -----[c] | 200[b] | -----[c] | 0.013 | 0.07 | NA |
| 309-00-2 | Aldrin | 0.3[e] | 6.6[e] | 6.1[b] | 9.3[e] | 0.5[e] | 2.5 | * |
| 120-12-7 | Anthracene | 610,000[b] | -----[c] | 610,000[b] | -----[c] | 12,000[b] | 59,000 | * |
| 1912-24-9 | Atrazine[o] | 72,000[b] | -----[c] | 7,100[b] | -----[c] | 0.066 | 0.33 | NA |
| 71-43-2 | Benzene | 200[e] | 1.5[e] | 4,300[e] | 2.1[e] | 0.03 | 0.17 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 56-55-3 | Benzo(*a*)anthracene | 8[e] | -----[c] | 170[e] | -----[c] | 2 | 8 | * |
| 205-99-2 | Benzo(*b*)fluoranthene | 8[e] | -----[c] | 170[e] | -----[c] | 5 | 25 | * |
| 207-08-9 | Benzo(*k*)fluroanthene | 78[e] | -----[c] | 1,700[e] | -----[c] | 49 | 250 | * |
| 50-32-8 | Benzo(*a*)pyrene | 0.8[e] | -----[c] | 17[e] | -----[c] | 8 | 82 | * |
| 111-44-4 | Bis(2-chloroethyl)ether | 5[e] | 0.47[e] | 75[e] | 0.66[e] | 0.0004[e,f] | 0.0004 | 0.66 |
| 117-81-7 | Bis(2-ethylhexyl)phthalate | 410[e] | 31,000[d] | 4,100[b] | 31,000[d] | 3,600 | 31,000[d] | * |
| 75-27-4 | Bromodichloromethane (Dichlorobromomethane) | 92[e] | 3,000[d] | 2,000[e] | 3,000[d] | 0.6 | 0.6 | * |
| 75-25-2 | Bromoform | 720[e] | 100[e] | 16,000[e] | 140[e] | 0.8 | 0.8 | * |
| 71-36-3 | Butanol | 200,000[b] | 10,000[d] | 200,000[b] | 10,000[d] | 17[b] | 17 | NA |
| 85-68-7 | Butyl benzyl phthalate | 410,000[b] | 930[d] | 410,000[b] | 930[d] | 930[d] | 930[d] | * |
| 86-74-8 | Carbazole | 290[e] | -----[c] | 6,200[e] | -----[c] | 0.6[e] | 2.8 | NA |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 1563-66-2 | Carbofuran[o] | 10,000[b] | -----[c] | 1,000[b] | -----[c] | 0.22 | 1.1 | NA |
| 75-15-0 | Carbon disulfide | 200,000[b] | 720[d] | 20,000[b] | 9.0[b] | 32[b] | 160 | * |
| 56-23-5 | Carbon tetrachloride | 44[e] | 0.64[e] | 410[b] | 0.90[e] | 0.07 | 0.33 | * |
| 57-74-9 | Chlordane | 4[e] | 38[e] | 12[b] | 53[e] | 10 | 48 | * |
| 106-47-8 | 4 - Chloroaniline (*p*-Chloroaniline) | 8,200[b] | -----[c] | 820[b] | -----[c] | 0.7[b] | 0.7 | 1.3 |
| 108-90-7 | Chlorobenzene (Monochlorobenzene) | 41,000[b] | 210[b] | 4,100[b] | 1.3[b] | 1 | 6.5 | * |
| 124-48-1 | Chlorodibromomethane (Dibromochloromethane) | 41,000[b] | 1,300[d] | 41,000[b] | 1,300[d] | 0.4 | 0.4 | * |
| 67-66-3 | Chloroform | 940[e] | 0.54[e] | 2,000[b] | 0.76[e] | 0.6 | 2.9 | * |
| 218-01-9 | Chrysene | 780[e] | -----[c] | 17,000[e] | -----[e] | 160 | 800 | * |
| 94-75-7 | 2,4-D | 20,000[b] | -----[c] | 2,000[b] | -----[c] | 1.5 | 7.7 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 75-99-0 | Dalapon | 61,000[b] | -----[c] | 6,100[b] | -----[c] | 0.85 | 8.5 | 1.2 |
| 72-54-8 | DDD | 24[e] | -----[c] | 520[e] | -----[c] | 16[e] | 80 | * |
| 72-55-9 | DDE | 17[e] | -----[c] | 370[e] | -----[c] | 54[e] | 270 | * |
| 50-29-3 | DDT | 17[e] | 1,500[e] | 100[b] | 2,100[e] | 32[e] | 160 | * |
| 53-70-3 | Dibenzo(*a,h*)anthracene | 0.8[e] | -----[c] | 17[e] | -----[c] | 2 | 7.6 | * |
| 96-12-8 | 1,2-Dibromo-3-chloropropane | 4[e] | 17[b] | 89[e] | 0.11[b] | 0.002 | 0.002 | * |
| 106-93-4 | 1,2-Dibromoethane (Ethylene dibromide) | 0.07[e] | 0.32[e] | 1.5[e] | 0.45[e] | 0.0004 | 0.004 | 0.005 |
| 84-74-2 | Di-*n*-butyl phthalate | 200,000[b] | 2,300[d] | 200,000[b] | 2,300[d] | 2,300[d] | 2,300[d] | * |
| 95-50-1 | 1,2-Dichlorobenzene (*o* - Dichlorobenzene) | 180,000[b] | 560[d] | 18,000[b] | 310[b] | 17 | 43 | * |
| 106-46-7 | 1,4-Dichlorobenzene (*p* - Dichlorobenzene) | -----[c] | 17,000[b] | -----[c] | 340[b] | 2 | 11 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 91-94-1 | 3,3'-Dichlorobenzidine | 13[e] | -----[c] | 280[e] | -----[c] | 0.007[e,f] | 0.033 | 1.3 |
| 75-34-3 | 1,1-Dichloroethane | 200,000[b] | 1,700[d] | 200,000[b] | 130[b] | 23[b] | 110 | * |
| 107-06-2 | 1,2-Dichloroethane (Ethylene dichloride) | 63[e] | 0.70[e] | 1,400[e] | 0.99[e] | 0.02 | 0.1 | * |
| 75-35-4 | 1,1-Dichloroethylene | 18,000[b] | 1,500[d] | 1,800[b] | 1,500[d] | 0.06 | 0.3 | * |
| 156-59-2 | *cis*-1,2-Dichloroethylene | 20,000[b] | 1,200[d] | 20,000[b] | 1,200[d] | 0.4 | 1.1 | * |
| 156-60-5 | *trans*-1,2-Dichloroethylene | 41,000[b] | 3,100[d] | 41,000[b] | 3,100[d] | 0.7 | 3.4 | * |
| 78-87-5 | 1,2-Dichloropropane | 84[e] | 23[b] | 1,800[e] | 0.50[b] | 0.03 | 0.15 | * |
| 542-75-6 | 1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*) | 33[e] | 0.23[e] | 610[b] | 0.33[e] | 0.004[e] | 0.02 | 0.005 |
| 60-57-1 | Dieldrin[n] | 0.4[e] | 2.2[e] | 7.8[e] | 3.1[e] | 0.004[e] | 0.02 | 0.0013 |
| 84-66-2 | Diethyl phthalate | 1,000,000[b] | 2,000[d] | 1,000,000[b] | 2,000[d] | 470[b] | 470 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 105-67-9 | 2,4-Dimethylphenol | 41,000[b] | -----[c] | 41,000[b] | -----[c] | 9[b] | 9 | * |
| 121-14-2 | 2,4-Dinitrotoluene | 8.4[e] | -----[c] | 180[e] | -----[c] | 0.0008[e,f] | 0.0008 | 0.013 |
| 606-20-2 | 2,6-Dinitrotoluene | 8.4[e] | -----[c] | 180[e] | -----[c] | 0.0007[e,f] | 0.0007 | 0.0067 |
| 117-84-0 | Di-*n*-octyl phthalate | 41,000[e] | 10,000[d] | 4,100[b] | 10,000[d] | 10,000[d] | 10,000[d] | * |
| 115-29-7 | Endosulfan | 12,000[b] | -----[c] | 1,200[b] | -----[c] | 18[b] | 90 | * |
| 145-73-3 | Endothall[o] | 41,000[c] | -----[c] | 4,100[b] | -----[c] | 0.4 | 0.4 | NA |
| 72-20-8 | Endrin | 610[b] | -----[c] | 61[b] | -----[c] | 1 | 5 | * |
| 100-41-4 | Ethylbenzene | 200,000[b] | 400[d] | 20,000[b] | 58[b] | 13 | 19 | * |
| 206-44-0 | Fluoranthene | 82,000[b] | -----[c] | 82,000[b] | -----[c] | 4,300[b] | 21,000 | * |
| 86-73-7 | Fluorene | 82,000[b] | -----[c] | 82,000[b] | -----[c] | 560[b] | 2,800 | * |
| 76-44-8 | Heptachlor | 1[e] | 11[e] | 28[e] | 16[e] | 23 | 110 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 105-67-9 | 2,4-Dimethylphenol | 41,000[b] | -----[c] | 41,000[b] | -----[c] | 9[b] | 9 | * |
| 121-14-2 | 2,4-Dinitrotoluene | 8.4[e] | -----[c] | 180[e] | -----[c] | 0.0008[e,f] | 0.0008 | 0.013 |
| 606-20-2 | 2,6-Dinitrotoluene | 8.4[e] | -----[c] | 180[e] | -----[c] | 0.0007[e,f] | 0.0007 | 0.0067 |
| 117-84-0 | Di-*n*-octyl phthalate | 41,000[e] | 10,000[d] | 4,100[b] | 10,000[d] | 10,000[d] | 10,000[d] | * |
| 115-29-7 | Endosulfan | 12,000[b] | -----[c] | 1,200[b] | -----[c] | 18[b] | 90 | * |
| 145-73-3 | Endothall[o] | 41,000[c] | -----[c] | 4,100[b] | -----[c] | 0.4 | 0.4 | NA |
| 72-20-8 | Endrin | 610[b] | -----[c] | 61[b] | -----[c] | 1 | 5 | * |
| 100-41-4 | Ethylbenzene | 200,000[b] | 400[d] | 20,000[b] | 58[b] | 13 | 19 | * |
| 206-44-0 | Fluoranthene | 82,000[b] | -----[c] | 82,000[b] | -----[c] | 4,300[b] | 21,000 | * |
| 86-73-7 | Fluorene | 82,000[b] | -----[c] | 82,000[b] | -----[c] | 560[b] | 2,800 | * |
| 76-44-8 | Heptachlor | 1[e] | 11[e] | 28[e] | 16[e] | 23 | 110 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 1024-57-3 | Heptachlor epoxide | 0.6[e] | 9.2[e] | 2.7[b] | 13[e] | 0.7 | 3.3 | * |
| 118-74-1 | Hexachlorobenzene | 4[e] | 1.8[e] | 78[e] | 2.6[e] | 2 | 11 | * |
| 319-84-6 | *alpha*-HCH (*alpha*-BHC) | 0.9[e] | 1.5[e] | 20[e] | 2.1[e] | 0.0005[e,f] | 0.003 | 0.002 |
| 58-89-9 | *gamma*-HCH (Lindane)[n] | 4[e] | -----[c] | 96[e] | -----[c] | 0.009 | 0.047 | * |
| 77-47-4 | Hexachlorocyclopentadiene | 14,000[b] | 16[b] | 14,000[b] | 1.1[b] | 400 | 2,200[d] | * |
| 67-72-1 | Hexachloroethane | 2,000[b] | -----[c] | 2,000[b] | -----[c] | 0.5[b] | 2.6 | * |
| 193-39-5 | Indeno(1,2,3-*c,d*)pyrene | 8[e] | -----[c] | 170[e] | -----[c] | 14 | 69 | * |
| 78-59-1 | Isophorone | 410,000[b] | 4,600[d] | 410,000[b] | 4,600[d] | 8[b] | 8 | * |
| 72-43-5 | Methoxychlor | 10,000[b] | -----[c] | 1,000[b] | -----[c] | 160 | 780 | * |
| 74-83-9 | Methyl bromide (Bromomethane) | 2,900[b] | 15[b] | 1,000[b] | 3.9[b] | 0.2[b] | 1.2 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 75-09-2 | Methylene chloride (Dichloromethane) | 760[e] | 24[e] | 12,000[b] | 34[e] | 0.02[e] | 0.2 | * |
| 95-48-7 | 2-Methylphenol (*o* - Cresol) | 100,000[b] | -----[c] | 100,000[b] | -----[c] | 15[b] | 15 | * |
| 86-30-6 | *N*-Nitrosodiphenylamine | 1,200[e] | -----[c] | 25,000[e] | -----[c] | 1[e] | 5.6 | 0.66 |
| 621-64-7 | *N*-Nitrosodi-*n*-propylamine | 0.8[e] | -----[c] | 18[e] | -----[c] | 0.00005[e,f] | 0.00005 | 0.66 |
| 91-20-3 | Naphthalene | 82,000[b] | -----[c] | 8,200[b] | -----[c] | 84[b] | 420 | * |
| 98-95-3 | Nitrobenzene | 1,000[b] | 140[b] | 1,000[b] | 9.4[b] | 0.1[b,f] | 0.1 | 0.26 |
| 108-95-2 | Phenol | 1,000,000[b] | -----[c] | 120,000[b] | -----[c] | 100[b] | 100 | * |
| 1918-02-1 | Picloram[o] | 140,000[b] | -----[c] | 14,000[b] | -----[c] | 2 | 20 | NA |
| 1336-36-3 | Polychlorinated biphenyls (PCBs)[n] | 1; 10; 25[h] | -----[c,h] | 1[h] | -----[c,h] | -----[h] | -----[h] | * |
| 129-00-0 | Pyrene | 61,000[b] | -----[c] | 61,000[b] | -----[c] | 4,200[b] | 21,000 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 122-34-9 | Simazine[o] | 10,000[b] | -----[c] | 1,000[b] | -----[c] | 0.04 | 0.37 | NA |
| 100-42-5 | Styrene | 410,000[b] | 1,500[d] | 41,000[b] | 430[b] | 4 | 18 | * |
| 127-18-4 | Tetrachloroethylene (Perchloroethylene) | 110[e] | 20[e] | 2,400[e] | 28[e] | 0.06 | 0.3 | * |
| 108-88-3 | Toluene | 410,000[b] | 650[d] | 410,000[b] | 42[b] | 12 | 29 | * |
| 8001-35-2 | Toxaphene[n] | 5.2[e] | 170[e] | 110[e] | 240[e] | 31 | 150 | * |
| 120-82-1 | 1,2,4-Trichlorobenzene | 20,000[b] | 3,200[d] | 2,000[b] | 920[b] | 5 | 53 | * |
| 71-55-6 | 1,1,1-Trichloroethane | -----[c] | 1,200[d] | -----[c] | 1,200[d] | 2 | 9.6 | * |
| 79-00-5 | 1,1,2-Trichloroethane | 8,200[b] | 1,800[d] | 8,200[b] | 1,800[d] | 0.02 | 0.3 | * |
| 79-01-6 | Trichloroethylene | 520[e] | 8.9[e] | 1,200[b] | 12[e] | 0.06 | 0.3 | * |
| 108-05-4 | Vinyl acetate | 1,000,000[b] | 1,600[b] | 200,000[b] | 10[b] | 170[b] | 170 | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 75-01-4 | Vinyl chloride | 3[e] | 0.06[e] | 65[e] | 0.08[e] | 0.01[f] | 0.07 | * |
| 108-38-3 | m-Xylene | 1,000,000 | 420[d] | 410,000[b] | 420[d] | 210 | 210 | * |
| 95-47-6 | o-Xylene | 1,000,000 | 410[d] | 410,000[b] | 410[d] | 190 | 190 | * |
| 106-42-3 | p-Xylene | 1,000,000 | 460[d] | 410,000[b] | 460[d] | 200 | 200 | * |
| 1330-20-7 | Xylenes (total) | 1,000,000[b] | 410[d] | 410,000[b] | 410[d] | 150 | 150 | * |
| | **Ionizable Organics** | | | | | | | |
| 65-85-0 | Benzoic Acid | 1,000,000[b] | -----[c] | 820,000[b] | -----[c] | 400[b,j] | 400[i] | * |
| 95-57-8 | 2-Chlorophenol | 10,000[b] | 53,000[d] | 10,000[b] | 53,000[d] | 4[b,j] | 20[i] | * |
| 120-83-2 | 2,4-Dichlorophenol | 6,100[b] | -----[c] | 610[b] | -----[c] | 1[b,j] | 1[i] | * |
| 51-28-5 | 2,4-Dinitrophenol | 4,100[b] | -----[c] | 410[b] | -----[c] | 0.2[b,f,i] | 0.2[i] | 3.3 |
| 88-85-7 | Dinoseb[o] | 2,000[b] | -----[c] | 200[b] | -----[c] | 0.34[b,j] | 3.4[i] | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/kg) | Class II (mg/kg) | ADL (mg/kg) |
| 87-86-5 | Pentachlorophenol | 24[e,j] | -----[c] | 520[e,j] | -----[c] | 0.03[f,j] | 0.14[i] | 2.4 |
| 93-72-1 | 2,4,5-TP (Silvex) | 16,000[b] | -----[c] | 1,600[b] | -----[c] | 11[i] | 55[i] | * |
| 95-95-4 | 2,4,5-Trichlorophenol | 200,000[b] | -----[c] | 200,000[b] | -----[c] | 270[b,j] | 1,400[i] | * |
| 88-06-2 | 2,4,6- Trichlorophenol | 520[e] | 390[e] | 11,000[e] | 540[e] | 0.2[e,f,i] | 0.77[i] | 0.43 |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/L) | Class II (mg/L) | |
| | **Inorganics** | | | | | | | |
| 7440-36-0 | Antimony | 820[b] | -----[c] | 82[b] | -----[c] | 0.006[m] | 0.024[m] | * |
| 7440-38-2 | Arsenic[l,n] | 3[e,t] | 1,200[e] | 61[b] | 25,000[e] | 0.05[m] | 0.2[m] | |
| 7440-39-3 | Barium | 140,000[b] | 910,000[b] | 14,000[b] | 870,000[b] | 2.0[m] | 2.0[m] | * |
| 7440-41-7 | Beryllium | 1[e,t] | 2,100[e] | 29[e] | 44,000[e] | 0.004[m] | 0.5[m] | * |
| 7440-42-8 | Boron | 180,000[b] | 1,000,000 | 18,000[b] | 1,000,000 | 2.0[m] | 2.0[m] | * |
| 7440-43-9 | Cadmium[l,n] | 2,000[b,r] | 2,800[e] | 200[b,r] | 59,000[e] | 0.005[m] | 0.05[m] | * |
| 16887-00-6 | Chloride | -------[c] | -----[c] | -----[c] | -----[c] | 200[m] | 200[m] | * |
| 7440-47-3 | Chromium, total | 10,000[b] | 420[e] | 4,100[b] | 8,800[e] | 0.1[m] | 1.0[m] | * |
| 16065-83-1 | Chromium, ion, trivalent | 1,000,000[b] | -----[c] | 330,000[b] | -----[c] | -----[g] | -----[g] | * |
| 18540-29-9 | Chromium, ion, hexavalent | 10,000[b] | 420[e] | 4,100[b] | 8,800[e] | ----- | ----- | * |

| CAS No. | Chemical Name | Exposure Route-Specific Values for Soils: Industrial-Commercial Ingestion (mg/kg) | Industrial-Commercial Inhalation (mg/kg) | Construction Worker Ingestion (mg/kg) | Construction Worker Inhalation (mg/kg) | Soil Component of the Groundwater Ingestion Exposure Route Values: Class I (mg/L) | Class II (mg/L) | |
|---|---|---|---|---|---|---|---|---|
| 7440-48-4 | Cobalt | 120,000[b] | -----[c] | 12,000[b] | -----[c] | 1.0[m] | 1.0[m] | * |
| 7440-50-8 | Copper[n] | 82,000[b] | -----[c] | 8,200[b] | -----[c] | 0.65[m] | 0.65[m] | * |
| 57-12-5 | Cyanide (amenable) | 41,000[b] | -----[c] | 4,100[b] | -----[c] | 0.2[q] | 0.6[q] | * |
| 7782-41-4 | Fluoride | 120,000[b] | -----[c] | 12,000[b] | -----[c] | 4.0[m] | 4.0[m] | * |
| 15438-31-0 | Iron | -----[c] | -----[c] | -----[c] | -----[c] | 5.0[m] | 5.0[m] | * |
| 7439-92-1 | Lead | 400[k] | -----[c] | 400[k] | -----[c] | 0.0075[m] | 0.1[m] | * |
| 7439-96-5 | Manganese | 96,000[b] | 91,000[b] | 9,600[b] | 8,700[b] | 0.15[m] | 10.0[m] | * |
| 7439-97-6 | Mercury[l,n] | 610[b] | 540,000[b] | 61[b,s] | 52,000[b] | 0.002[m] | 0.01[m] | * |
| 7440-02-0 | Nickel[l] | 41,000[b] | 21,000[e] | 4,100[b] | 440,000[e] | 0.1[m] | 2.0[m] | * |
| 14797-55-8 | Nitrate as N[p] | 1,000,000[b] | -----[c] | 330,000[b] | -----[c] | 10.0[q] | 100[q] | * |
| 7782-49-2 | Selenium[l,n] | 10,000[b] | -----[c] | 1,000[b] | -----[c] | 0.05[m] | 0.05[m] | * |

| | | Exposure Route-Specific Values for Soils | | | | Soil Component of the Groundwater Ingestion Exposure Route Values | | |
|---|---|---|---|---|---|---|---|---|
| | | Industrial-Commercial | | Construction Worker | | | | |
| CAS No. | Chemical Name | Ingestion (mg/kg) | Inhalation (mg/kg) | Ingestion (mg/kg) | Inhalation (mg/kg) | Class I (mg/L) | Class II (mg/L) | |
| 7440-22-4 | Silver | 10,000[b] | -----[c] | 1,000[b] | -----[c] | 0.05[m] | ----- | * |
| 14808-79-8 | Sulfate | -----[c] | -----[c] | -----[c] | -----[c] | 400[m] | 400[m] | * |
| 7440-28-0 | Thallium | 160[b,u] | -----[c] | 160[b,u] | -----[c] | 0.002[m] | 0.02[m] | * |
| 7440-62-2 | Vanadium | 14,000[b] | -----[c] | 1,400[b] | -----[c] | 0.049[m] | ----- | * |
| 7440-66-6 | Zinc[l] | 610,000[b] | -----[c] | 61,000[b] | -----[c] | 5.0[m] | 10[m] | * |

"*" indicates that the ADL is less than or equal to the specified remediation objective.

NA means Not Available; no PQL or EQL available in USEPA analytical methods.

Chemical Name and Soil Remediation Objective Notations (2nd, 5th thru 8th Columns)

[a] Soil remediation objectives based on human health criteria only.
[b] Calculated values correspond to a target hazard quotient of 1.
[c] No toxicity criteria available for this route of exposure.
[d] Soil saturation concentration ($C_{[sat]}$) = the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.
[e] Calculated values correspond to a cancer risk level of 1 in 1,000,000.
[f] Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).
[g] Chemical-specific properties are such that this route is not of concern at any soil contaminant concentration.
[h] A preliminary goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540G-90/007, and on USEPA efforts to manage PCB contamination. See 40 CFR 761.120 for USEPA "PCB Spill Cleanup Policy." This regulation goes on to say that the remediation goal for an unrestricted area is 10 ppm and 25 ppm for a restricted area, provided both have at least 10 inches of clean cover.
[i] Soil remediation objective for pH of 6.8. If soil pH is other than 6.8, refer to Appendix B, Tables C and D in this Part.
[j] Ingestion soil remediation objective adjusted by a factor of 0.5 to account for dermal route.
[k] A preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12.
[l] Potential for soil-plant-human exposure.
[m] The person conducting the remediation has the option to use: (1) TCLP or SPLP test results to compare with the remediation objectives listed in this Table; or (2) the total amount of contaminant in the soil sample results to compare with pH specific remediation objectives listed in Appendix B, Table C or D of this Part. (See Section 742.510.) If the person conducting the remediation wishes to calculate soil remediation objectives based on background concentrations, this should be done in accordance with Subpart D of this Part.
[n] The Agency reserves the right to evaluate the potential for remaining contaminant concentrations to pose significant threats to crops, livestock, or wildlife.
[o] For agrichemical facilities, remediation objectives for surficial soils which are based on field application rates may be more appropriate for currently registered pesticides. Consult the Agency for further information.
[p] For agrichemical facilities, soil remediation objectives based on site-specific background concentrations of Nitrate as N may be more appropriate. Such determinations shall be conducted in accordance with the located in Subparts D and I of this Part.
[q] The TCLP extraction must be done using water at a pH of 7.0.
r Value based on dietary Reference Dose.
s Value based on Reference Dose for Mercuric chloride (CAS No. 7487-94-7).
t Note that Table value is likely to be less than background concentration for this chemical; screening or remediation concentrations using the procedures of Subpart D of this Part.

[u] Value based on Reference Dose for thallium sulfate (CAS No. 7446-18-6).

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Section 742.Table C: pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class I Groundwater)

| Chemical (totals) (mg/kg) | pH 4.5 to 4.74 | pH 4.75 to 5.24 | pH 5.25 to 5.74 | pH 5.75 to 6.24 | pH 6.25 to 6.64 | pH 6.65 to 6.89 | pH 6.9 to 7.24 | pH 7.25 to 7.74 | pH 7.75 to 8.0 |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | | |
| Antimony | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Arsenic | 25 | 26 | 27 | 28 | 29 | 29 | 29 | 30 | 31 |
| Barium | 260 | 490 | 850 | 1,200 | 1,500 | 1,600 | 1,700 | 1,800 | 2,100 |
| Beryllium | 1.1 | 2.1 | 3.4 | 6.6 | 22 | 63 | 140 | 1,000 | 8,000 |
| Cadmium | 1.0 | 1.7 | 2.7 | 3.7 | 5.2 | 7.5 | 11 | 59 | 430 |
| Chromium (+6) | 70 | 62 | 54 | 46 | 40 | 38 | 36 | 32 | 28 |
| Copper | 330 | 580 | 2,100 | 11,000 | 59,000 | 130,000 | 200,000 | 330,000 | 330,000 |
| Cyanide | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Mercury | 0.01 | 0.01` | 0.03 | 0.15 | 0.89 | 2.1 | 3.3 | 6.4 | 8.0 |
| Nickel | 20 | 36 | 56 | 76 | 100 | 130 | 180 | 700 | 3,800 |
| Selenium | 24 | 17 | 12 | 8.8 | 6.3 | 5.2 | 4.5 | 3.3 | 2.4 |
| Silver | 0.24 | 0.33 | 0.62 | 1.5 | 4.4 | 8.5 | 13 | 39 | 110 |

| Chemical (totals) (mg/kg) | pH 4.5 to 4.74 | pH 4.75 to 5.24 | pH 5.25 to 5.74 | pH 5.75 to 6.24 | pH 6.25 to 6.64 | pH 6.65 to 6.89 | pH 6.9 to 7.24 | pH 7.25 to 7.74 | pH 7.75 to 8.0 |
|---|---|---|---|---|---|---|---|---|---|
| Thallium | 1.6 | 1.8 | 2.0 | 2.4 | 2.6 | 2.8 | 3.0 | 3.4 | 3.8 |
| Vanadium | 980 | 980 | 980 | 980 | 980 | 980 | 980 | 980 | 980 |
| Zinc | 1,000 | 1,800 | 2,600 | 3,600 | 5,100 | 6,200 | 7,500 | 16,000 | 53,000 |
| **Organics** | | | | | | | | | |
| Benzoic Acid | 440 | 420 | 410 | 400 | 400 | 400 | 400 | 400 | 400 |
| 2-Chlorophenol | 4.0 | 4.0 | 4.0 | 4.0 | 3.9 | 3.9 | 3.9 | 3.6 | 3.1 |
| 2,4-Dichlorophenol | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.86 | 0.69 |
| Dinoseb | 8.4 | 4.5 | 1.9 | 0.82 | 0.43 | 0.34 | 0.31 | 0.27 | 0.25 |
| Pentachlorophenol | 0.54 | 0.32 | 0.15 | 0.07 | 0.04 | 0.03 | 0.02 | 0.02 | 0.02 |
| 2,4,5-TP (Silvex) | 26 | 16 | 12 | 11 | 11 | 11 | 11 | 11 | 11 |
| 2,4,5-Trichlorophenol | 400 | 390 | 390 | 370 | 320 | 270 | 230 | 130 | 64 |
| 2,4,6-Trichlorophenol | 0.37 | 0.36 | 0.34 | 0.29 | 0.20 | 0.15 | 0.13 | 0.09 | 0.07 |

SOURCE: Amended at 22 Ill. Reg. 10874, effective June 8, 1998.

Section 742.APPENDIX B Tier I Tables and Illustrations

Section 742.Table D: pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class II Groundwater)

| Chemical (totals) (mg/kg) | pH 4.5 to 4.74 | pH 4.75 to 5.24 | pH 5.25 to 5.74 | pH 5.75 to 6.24 | pH 6.25 to 6.64 | pH 6.65 to 6.89 | pH 6.9 to 7.24 | pH 7.25 to 7.74 | pH 7.75 to 8.0 |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | | |
| Antimony | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Arsenic | 100 | 100 | 100 | 110 | 110 | 120 | 120 | 120 | 120 |
| Barium | 260 | 490 | 850 | 1,200 | 1,500 | 1,600 | 1,700 | 1,800 | 2,100 |
| Beryllium | 140 | 260 | 420 | 820 | 2,800 | 7,900 | 17,000 | 130,000 | 1,000,000 |
| Cadmium | 10 | 17 | 27 | 37 | 52 | 75 | 110 | 590 | 4,300 |
| Chromium (+6) | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| Copper | 330 | 580 | 2,100 | 11,000 | 59,000 | 130,000 | 200,000 | 330,000 | 330,000 |
| Cyanide | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 |
| Mercury | 0.05 | 0.06 | 0.14 | 0.75 | 4.4 | 10 | 16 | 32 | 40 |
| Nickel | 400 | 730 | 1,100 | 1,500 | 2,000 | 2,600 | 3,500 | 14,000 | 76,000 |
| Selenium | 24 | 17 | 12 | 8.8 | 6.3 | 5.2 | 4.5 | 3.3 | 2.4 |
| Thallium | 16 | 18 | 20 | 24 | 26 | 28 | 30 | 34 | 38 |
| Zinc | 2,000 | 3,600 | 5,200 | 7,200 | 10,000 | 12,000 | 15,000 | 32,000 | 110,000 |

| Chemical (totals) (mg/kg) | pH 4.5 to 4.74 | pH 4.75 to 5.24 | pH 5.25 to 5.74 | pH 5.75 to 6.24 | pH 6.25 to 6.64 | pH 6.65 to 6.89 | pH 6.9 to 7.24 | pH 7.25 to 7.74 | pH 7.75 to 8.0 |
|---|---|---|---|---|---|---|---|---|---|
| **Organics** | | | | | | | | | |
| Benzoic Acid | 440 | 420 | 410 | 400 | 400 | 400 | 400 | 400 | 400 |
| 2-Chlorophenol | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 3.6 | 3.1 |
| 2,4-Dichlorophenol | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.86 | 0.69 |
| Dinoseb | 84 | 45 | 19 | 8.2 | 4.3 | 3.4 | 3.1 | 2.7 | 2.5 |
| Pentachlorophenol | 2.7 | 1.6 | 0.75 | 0.33 | 0.18 | 0.15 | 0.12 | 0.11 | 0.10 |
| 2,4,5-TP (Silvex) | 130 | 79 | 62 | 57 | 55 | 55 | 55 | 55 | 55 |
| 2,4,5-Trichlorophenol | 2,000 | 2,000 | 1,900 | 1,800 | 1,600 | 1,400 | 1,200 | 640 | 64 |
| 2,4,6-Trichlorophenol | 1.9 | 1.8 | 1.7 | 1.4 | 1.0 | 0.77 | 0.13 | 0.09 | 0.07 |

SOURCE: Amended at 22 Ill. Reg. 10847, effective, June 8, 1998.

**Section 742.APPENDIX B**

**Section 742.Table D: pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class II Groundwater)**

| Chemical (totals) (mg/kg) | pH 4.5 to 4.74 | pH 4.75 to 5.24 | pH 5.25 to 5.74 | pH 5.75 to 6.24 | pH 6.25 to 6.64 | pH 6.65 to 6.89 | pH 6.9 to 7.24 | pH 7.25 to 7.74 | pH 7.75 to 8.0 |
|---|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | | |
| Antimony | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Arsenic | 100 | 100 | 100 | 110 | 110 | 120 | 120 | 120 | 120 |
| Barium | 260 | 490 | 850 | 1,200 | 1,500 | 1,600 | 1,700 | 1,800 | 2,100 |
| Beryllium | 140 | 260 | 420 | 820 | 2,800 | 7,900 | 17,000 | 130,000 | 1,000,000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cadmium | 10 | 17 | 27 | 37 | 52 | 75 | 110 | 590 | 4,300 |
| Chromium (+6) | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| Copper | 330 | 580 | 2,100 | 11,000 | 59,000 | 130,000 | 200,000 | 330,000 | 330,000 |
| Cyanide | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 |
| Mercury | 0.05 | 0.06 | 0.14 | 0.75 | 4.4 | 10 | 16 | 32 | 40 |
| Nickel | 400 | 730 | 1,100 | 1,500 | 2,000 | 2,600 | 3,500 | 14,000 | 76,000 |
| Selenium | 24 | 17 | 12 | 8.8 | 6.3 | 5.2 | 4.5 | 3.3 | 2.4 |
| Thallium | 16 | 18 | 20 | 24 | 26 | 28 | 30 | 34 | 38 |
| Zinc | 2,000 | 3,600 | 5,200 | 7,200 | 10,000 | 12,000 | 15,000 | 32,000 | 110,000 |

| Chemical (totals) (mg/kg) | pH 4.5 to 4.74 | pH 4.75 to 5.24 | pH 5.25 to 5.74 | pH 5.75 to 6.24 | pH 6.25 to 6.64 | pH 6.65 to 6.89 | pH 6.9 to 7.24 | pH 7.25 to 7.74 | pH 7.75 to 8.0 |
|---|---|---|---|---|---|---|---|---|---|
| **Organics** | | | | | | | | | |
| Benzoic Acid | 440 | 420 | 410 | 400 | 400 | 400 | 400 | 400 | 400 |
| 2-Chlorophenol | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 3.6 | 3.1 |
| 2,4-Dichlorophenol | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.86 | 0.69 |
| Dinoseb | 84 | 45 | 19 | 8.2 | 4.3 | 3.4 | 3.1 | 2.7 | 2.5 |
| Pentachlorophenol | 2.7 | 1.6 | 0.75 | 0.33 | 0.18 | 0.15 | 0.12 | 0.11 | 0.10 |
| 2,4,5-TP (Silvex) | 130 | 79 | 62 | 57 | 55 | 55 | 55 | 55 | 55 |
| 2,4,5-Trichlorophenol | 2,000 | 2,000 | 1,900 | 1,800 | 1,600 | 1,400 | 1,200 | 640 | 64 |
| 2,4,6-Trichlorophenol | 0.37 | 0.36 | 0.34 | 0.26 | 0.20 | 0.15 | 0.13 | 0.09 | 0.07 |

## Section 742.APPENDIX B: Tier 1 Tables and Illustrations

## Section 742.TABLE E: Tier 1 Groundwater Remediation Objectives for the Groundwater Component of the Groundwater Ingestion Route

| | | Groundwater Remediation Objective | |
|---|---|---|---|
| CAS No. | Chemical Name | Class I (mg/L) | Class II (mg/L) |
| 83-32-9 | Acenaphthene | 0.42 | 2.1 |
| 67-64-1 | Acetone | 0.7 | 0.7 |
| 15972-60-8 | Alachlor | 0.002[c] | 0.01[c] |
| 116-06-3 | Aldicarb | 0.003[c] | 0.015[c] |
| 309-00-2 | Aldrin | 0.00004[a] | 0.0002 |
| 120-12-7 | Anthracene | 2.1 | 10.5 |
| 1912-24-9 | Atrazine | 0.003[c] | 0.015[c] |
| 71-43-2 | Benzene | 0.005[c] | 0.025[c] |
| 56-55-3 | Benzo(*a*)anthracene | 0.00013[a] | 0.00065 |
| 205-99-2 | Benzo(*b*)fluoranthene | 0.00018[a] | 0.0009 |
| 207-08-9 | Benzo(*k*)fluroanthene | 0.00017[a] | 0.00085 |
| 50-32-8 | Benzo(*a*)pyrene | 0.0002[a,c] | 0.002[c] |
| 111-44-4 | Bis(2-chloroethyl)ether | 0.01[a] | 0.01 |
| 117-81-7 | Bis(2-ethylhexyl)phthalate | 0.006[a,c] | 0.06[c] |
| 75-27-4 | Bromodichloromethane (Dichlorobromomethane) | 0.00002[a] | 0.00002 |
| 75-25-2 | Bromoform | 0.0002[a] | 0.0002 |
| 71-36-3 | Butanol | 0.7 | 0.7 |
| 85-68-7 | Butyl benzyl phthalate | 1.4 | 7.0 |
| 86-74-8 | Carbazole | --- | --- |
| 1563-66-2 | Carbofuran | 0.04[c] | 0.2[c] |
| 75-15-0 | Carbon disulfide | 0.7 | 3.5 |
| 56-23-5 | Carbon tetrachloride | 0.005[c] | 0.025[c] |
| 57-74-9 | Chlordane | 0.002[c] | 0.01[c] |

| CAS No. | Chemical Name | Groundwater Remediation Objective | |
|---|---|---|---|
| | | Class I (mg/L) | Class II (mg/L) |
| 108-90-7 | Chlorobenzene (Monochlorobenzene) | 0.1[c] | 0.5[c] |
| 124-48-1 | Chlorodibromomethane (Dibromochloromethane) | 0.14 | 0.14 |
| 67-66-3 | Chloroform | 0.00002[a] | 0.0001 |
| 218-01-9 | Chrysene | 0.0015[a] | 0.0075 |
| 94-75-7 | 2,4-D | 0.07[c] | 0.35[c] |
| 75-99-0 | Dalapon | 0.2[c] | 2.0[c] |
| 72-54-8 | DDD | 0.00011[a] | 0.00055 |
| 72-55-9 | DDE | 0.00004[a] | 0.0002 |
| 50-29-3 | DDT | 0.00012[a] | 0.0006 |
| 53-70-3 | Dibenzo(*a,h*)anthracene | 0.0003[a] | 0.0015 |
| 96-12-8 | 1,2-Dibromo-3-chloropropane | 0.0002[c] | 0.0002[c] |
| 106-93-4 | 1,2-Dibromoethane (Ethylene dibromide) | 0.00005[a,c] | 0.0005[c] |
| 84-74-2 | Di-*n*-butyl phthalate | 0.7 | 3.5 |
| 95-50-1 | 1,2-Dichlorobenzene (*o* - Dichlorobenzene) | 0.6[c] | 1.5[c] |
| 106-46-7 | 1,4-Dichlorobenzene (*p* - Dichlorobenzene) | 0.075[c] | 0.375[c] |
| 91-94-1 | 3,3'-Dichlorobenzidine | 0.02[a] | 0.1 |
| 75-34-3 | 1,1-Dichloroethane | 0.7 | 3.5 |
| 107-06-2 | 1,2-Dichloroethane (Ethylene dichloride) | 0.005[c] | 0.025[c] |
| 75-35-4 | 1,1-Dichloroethylene[b] | 0.007[c] | 0.035[c] |
| 156-59-2 | *cis*-1,2-Dichloroethylene | 0.07[c] | 0.2[c] |
| 156-60-5 | *trans*-1,2-Dichloroethylene | 0.1[c] | 0.5[c] |
| 78-87-5 | 1,2-Dichloropropane | 0.005[c] | 0.025[c] |
| 542-75-6 | 1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*) | 0.001[a] | 0.005 |

| | | Groundwater Remediation Objective | |
|---|---|---|---|
| CAS No. | Chemical Name | Class I (mg/L) | Class II (mg/L) |
| 60-57-1 | Dieldrin | 0.00002[a] | 0.0001 |
| 84-66-2 | Diethyl phthalate | 5.6 | 5.6 |
| 121-14-2 | 2,4-Dinitrotoluene[a] | 0.00002 | 0.00002 |
| 606-20-2 | 2,6-Dinitrotoluene[a] | 0.0001 | 0.0001 |
| 88-85-7 | Dinoseb | 0.007[c] | 0.07[c] |
| 117-84-0 | Di-*n*-octyl phthalate | 0.14 | 0.7 |
| 115-29-7 | Endosulfan | 0.042 | 0.21 |
| 145-73-3 | Endothall | 0.1[c] | 0.1[c] |
| 72-20-8 | Endrin | 0.002[c] | 0.01[c] |
| 100-41-4 | Ethylbenzene | 0.7[c] | 1.0[c] |
| 206-44-0 | Fluoranthene | 0.28 | 1.4 |
| 86-73-7 | Fluorene | 0.28 | 1.4 |
| 76-44-8 | Heptachlor | 0.0004[c] | 0.002[c] |
| 1024-57-3 | Heptachlor epoxide | 0.0002[c] | 0.001[c] |
| 118-74-1 | Hexachlorobenzene | 0.00006[a] | 0.0003 |
| 319-84-6 | *alpha*-HCH (*alpha*-BHC) | 0.00003[a] | 0.00015 |
| 58-89-9 | *gamma*-HCH (Lindane) | 0.0002[c] | 0.001[c] |
| 77-47-4 | Hexachlorocyclopentadiene | 0.05[c] | 0.5[c] |
| 67-72-1 | Hexachloroethane | 0.007 | 0.035 |
| 193-39-5 | Indeno(1,2,3-*c,d*)pyrene | 0.00043[a] | 0.00215 |
| 78-59-1 | Isophorone | 1.4 | 1.4 |
| 72-43-5 | Methoxychlor | 0.04[c] | 0.2[c] |
| 74-83-9 | Methyl bromide (Bromomethane) | 0.0098 | 0.049 |
| 75-09-2 | Methylene chloride (Dichloromethane) | 0.005[c] | 0.05[c] |
| 91-20-3 | Naphthalene[2] | 0.025 | 0.039 |
| 98-95-3 | Nitrobenzene[2] | 0.0035 | 0.0035 |

| | | Groundwater Remediation Objective | |
|---|---|---|---|
| CAS No. | Chemical Name | Class I (mg/L) | Class II (mg/L) |
| 1918-02-1 | Picloram | 0.5[c] | 5.0[c] |
| 1336-36-3 | Polychlorinated biphenyls (PCBs)[n] | 0.0005[c] | 0.0025[c] |
| 129-00-0 | Pyrene | 0.21 | 1.05 |
| 122-34-9 | Simazine | 0.004[c] | 0.04[c] |
| 100-42-5 | Styrene | 0.1[c] | 0.5[c] |
| 93-72-1 | 2,4,5-TP (Silvex) | 0.05[c] | 0.25[c] |
| 127-18-4 | Tetrachloroethylene (Perchloroethylene) | 0.005[c] | 0.025[c] |
| 108-88-3 | Toluene | 1.0[c] | 2.5[c] |
| 8001-35-2 | Toxaphene | 0.003[c] | 0.015[c] |
| 120-82-1 | 1,2,4-Trichlorobenzene | 0.07[c] | 0.7[c] |
| 71-55-6 | 1,1,1-Trichloroethane[2] | 0.2[c] | 1.0[c] |
| 79-00-5 | 1,1,2-Trichloroethane | 0.005[c] | 0.05[c] |
| 79-01-6 | Trichloroethylene | 0.005[c] | 0.025[c] |
| 108-05-4 | Vinyl acetate | 7.0 | 7.0 |
| 75-01-4 | Vinyl chloride | 0.002[c] | 0.01[c] |
| 1330-20-7 | Xylenes (total) | 10.0[c] | 10.0[c] |
| | **Ionizable Organics** | | |
| 65-85-0 | Benzoic Acid | 28 | 28 |
| 106-47-8 | 4-Chloroaniline (*p*-Chloroaniline) | 0.028 | 0.028 |
| 95-57-8 | 2-Chlorophenol | 0.035 | 0.175 |
| 120-83-2 | 2,4-Dichlorophenol | 0.021 | 0.021 |
| 105-67-9 | 2,4-Dimethylphenol | 0.14 | 0.14 |
| 51-28-5 | 2,4-Dinitrophenol | 0.014 | 0.014 |
| 95-48-7 | 2-Methylphenol (*o* - Cresol) | 0.35 | 0.35 |
| 86-30-6 | *N*-Nitrosodiphenylamine | 0.01[a] | 0.05 |

| | | Groundwater Remediation Objective | |
|---|---|---|---|
| CAS No. | Chemical Name | Class I (mg/L) | Class II (mg/L) |
| 621-64-7 | *N*-Nitrosodi-*n*-propylamine | 0.01[a] | 0.01 |
| 87-86-5 | Pentachlorophenol | 0.001[a,c] | 0.005[c] |
| 108-95-2 | Phenol | 0.1[c] | 0.1[c] |
| 95-95-4 | 2,4,5-Trichlorophenol | 0.7 | 3.5 |
| 88-06-2 | 2,4,6 Trichlorophenol | 0.0064[a] | 0.032 |
| | **Inorganics** | | |
| 7440-36-0 | Antimony | 0.006[c] | 0.024[c] |
| 7440-38-2 | Arsenic | 0.05[c] | 0.2[c] |
| 7440-39-3 | Barium | 2.0[c] | 2.0[c] |
| 7440-41-7 | Beryllium | 0.004[c] | 0.5[c] |
| 7440-42-8 | Boron | 2.0[c] | 2.0[c] |
| 7440-43-9 | Cadmium | 0.005[c] | 0.05[c] |
| 16887-00-6 | Chloride | 200[c] | 200[c] |
| 7440-47-3 | Chromium, total | 0.1[c] | 1.0[c] |
| 18540-29-9 | Chromium, ion, hexavalent | — | — |
| 7440-48-4 | Cobalt | 1.0[c] | 1.0[c] |
| 7440-50-8 | Copper | 0.65[c] | 0.65[c] |
| 57-12-5 | Cyanide | 0.2[c] | 0.6[c] |
| 7782-41-4 | Fluoride | 4.0[c] | 4.0[c] |
| 15438-31-0 | Iron | 5.0[c] | 5.0[c] |
| 7439-92-1 | Lead | 0.0075[c] | 0.1[c] |
| 7439-96-5 | Manganese | 0.15[c] | 10.0[c] |
| 7439-97-6 | Mercury | 0.002[c] | 0.01[c] |
| 7440-02-0 | Nickel | 0.1[c] | 2.0[c] |
| 14797-55-8 | Nitrate as N | 10.0[c] | 100[c] |
| 7782-49-2 | Selenium | 0.05[c] | 0.05[c] |
| 7440-22-4 | Silver | 0.05[c] | — |
| 14808-79-8 | Sulfate | 400[c] | 400[c] |

| | | Groundwater Remediation Objective | |
|---|---|---|---|
| CAS No. | Chemical Name | Class I (mg/L) | Class II (mg/L) |
| 7440-28-0 | Thallium | 0.002[c] | 0.02[c] |
| 7440-62-2 | Vanadium[2] | 0.049 | --- |
| 7440-66-6 | Zinc | 5.0[c] | 10[c] |

Chemical Name and Groundwater Remediation Objective Notations

[a] The groundwater Health Advisory concentration is equal to ADL for carcinogens.

[b] Oral Reference Dose and/or Reference Concentration under review by USEPA. Listed values subject to change.

[c] Value listed is also the Groundwater Quality Standard for this chemical pursuant to 35 Ill. Adm. Code 620.410 for Class I Groundwater or 35 Ill. Adm. Code 620.420 for Class II Groundwater.

## Section 742.APPENDIX B: Tier 1 Tables and Illustrations

## Section 742.TABLE F: Values Used to Calculate the Tier 1 Soil Remediation Objectives for the Soil Component of the Groundwater Ingestion Route

| | | $GW_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] | |
|---|---|---|---|
| CAS No. | Chemical Name | Class I (mg/L) | Class II (mg/L) |
| 83-32-9 | Acenaphthene | 2.0[b] | 10 |
| 67-64-1 | Acetone | 4.0[b] | 4.0 |
| 15972-60-8 | Alachlor | 0.002[c] | 0.01[c] |
| 116-06-3 | Aldicarb | 0.003[c] | 0.015[c] |
| 309-00-2 | Aldrin | 5.0E-6[b] | 2.5E-5 |
| 120-12-7 | Anthracene | 10[b] | 50 |
| 1912-24-9 | Atrazine | 0.003[c] | 0.015[c] |
| 71-43-2 | Benzene | 0.005[c] | 0.025[c] |
| 56-55-3 | Benzo(*a*)anthracene | 0.0001[b] | 0.0005 |
| 205-99-2 | Benzo(*b*)fluoranthene | 0.0001[b] | 0.0005 |
| 207-08-9 | Benzo(*k*)fluroanthene | 0.001[b] | 0.005 |
| 50-32-8 | Benzo(*a*)pyrene | 0.0002[a,c] | 0.002[c] |
| 111-44-4 | Bis(2-chloroethyl)ether | 8.0E-5[b] | 8.0E-5 |
| 117-81-7 | Bis(2-ethylhexyl)phthalate | 0.006[a,c] | 0.06[c] |
| 75-27-4 | Bromodichloromethane (Dichlorobromomethane) | 0.1[b] | 0.1 |
| 75-25-2 | Bromoform | 0.1[b] | 0.01 |
| 71-36-3 | Butanol | 4.0[b] | 4.0 |
| 85-68-7 | Butyl benzyl phthalate | 7.0[b] | 35 |
| 86-74-8 | Carbazole | 0.004[b] | 0.02 |
| 1563-66-2 | Carbofuran | 0.04[c] | 0.2[c] |
| 75-15-0 | Carbon disulfide | 4.0[b] | 20 |
| 56-23-5 | Carbon tetrachloride | 0.005[c] | 0.025[c] |
| 57-74-9 | Chlordane | 0.002[c] | 0.01[c] |

| CAS No. | Chemical Name | $GW_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] | |
|---|---|---|---|
| | | Class I (mg/L) | Class II (mg/L) |
| 108-90-7 | Chlorobenzene (Monochlorobenzene) | 0.1[c] | 0.5[c] |
| 124-48-1 | Chlorodibromomethane (Dibromochloromethane) | 0.06[b] | 0.06 |
| 67-66-3 | Chloroform | 0.1[b] | 0.5 |
| 218-01-9 | Chrysene | 0.1[b] | 0.05 |
| 94-75-7 | 2,4-D | 0.07[c] | 0.35[c] |
| 75-99-0 | Dalapon | 0.2[c] | 2.0[c] |
| 72-54-8 | DDD | 0.0004[b] | 0.002 |
| 72-55-9 | DDE | 0.0003[b] | 0.0015 |
| 50-29-3 | DDT | 0.0003[b] | 0.0015 |
| 53-70-3 | Dibenzo(*a,h*)anthracene | 1.0E-5[b] | 5.0E-5 |
| 96-12-8 | 1,2-Dibromo-3-chloropropane | 0.0002[c] | 0.0002[c] |
| 106-93-4 | 1,2-Dibromoethane (Ethylene dibromide) | 0.00005[a,c] | 0.0005[c] |
| 84-74-2 | Di-*n*-butyl phthalate | 4.0[b] | 20 |
| 95-50-1 | 1,2-Dichlorobenzene (*o* - Dichlorobenzene) | 0.6[c] | 1.5[c] |
| 106-46-7 | 1,4-Dichlorobenzene (*p* - Dichlorobenzene) | 0.075[c] | 0.375[c] |
| 91-94-1 | 3,3'-Dichlorobenzidine | 0.0002[b] | 0.001 |
| 75-34-3 | 1,1-Dichloroethane | 4.0[b] | 20 |
| 107-06-2 | 1,2-Dichloroethane (Ethylene dichloride) | 0.005[c] | 0.025[c] |
| 75-35-4 | 1,1-Dichloroethylene | 0.007[c] | 0.035[c] |
| 156-59-2 | *cis*-1,2-Dichloroethylene | 0.07[c] | 0.2[c] |
| 156-60-5 | *trans*-1,2-Dichloroethylene | 0.1[c] | 0.5[c] |
| 78-97-5 | 1,2-Dichloropropane | 0.005[c] | 0.025[c] |
| 542-75-6 | 1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*) | 0.0005[b] | 0.0025 |

| CAS No. | Chemical Name | $GW_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] | |
|---|---|---|---|
| | | Class I (mg/L) | Class II (mg/L) |
| 60-57-1 | Dieldrin | 5.0E-6[b] | 2.5E-5 |
| 84-66-2 | Diethyl phthalate | 30[b] | 30 |
| 121-14-2 | 2,4-Dinitrotoluene | 0.0001[b] | 0.0001 |
| 606-20-2 | 2,6-Dinitrotoluene | 0.0001 | 0.0001 |
| 88-85-7 | Dinoseb | 0.007[c] | 0.07[c] |
| 117-84-0 | Di-*n*-octyl phthalate | 0.7[b] | 3.5 |
| 115-29-7 | Endosulfan | 0.2[b] | 1.0 |
| 145-73-3 | Endothall | 0.1[c] | 0.1[c] |
| 72-20-8 | Endrin | 0.002[c] | 0.01[c] |
| 100-41-4 | Ethylbenzene | 0.7[c] | 1.0[c] |
| 206-44-0 | Fluoranthene | 1.0[b] | 5.0 |
| 86-73-7 | Fluorene | 1.0[b] | 5.0 |
| 76-44-8 | Heptachlor | 0.0004[c] | 0.002[c] |
| 1024-57-3 | Heptachlor epoxide | 0.0002[c] | 0.001[c] |
| 118-74-1 | Hexachlorobenzene | 0.001[b] | 0.005 |
| 319-84-6 | *alpha*-HCH (*alpha*-BHC) | 1.0E-5[b] | 5.0E-5 |
| 58-89-9 | *gamma*-HCH (Lindane) | 0.0002[c] | 0.001[c] |
| 77-47-4 | Hexachlorocyclopentadiene | 0.05[c] | 0.5[c] |
| 67-72-1 | Hexachloroethane | 0.007 | 0.035 |
| 193-39-5 | Indeno(1,2,3-*c,d*)pyrene | 0.0001[b] | 0.0005 |
| 78-59-1 | Isophorone | 1.4 | 1.4 |
| 72-43-5 | Methoxychlor | 0.04[c] | 0.2[c] |
| 74-83-9 | Methyl bromide (Bromomethane) | 0.05[b] | 0.25 |
| 75-09-2 | Methylene chloride (Dichloromethane) | 0.005[c] | 0.05[c] |
| 91-20-3 | Naphthalene | 1.0[b] | 5.0 |
| 98-95-3 | Nitrobenzene | 0.02[b] | 0.02 |

| CAS No. | Chemical Name | $GW_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] | |
|---|---|---|---|
| | | Class I (mg/L) | Class II (mg/L) |
| 1918-02-1 | Picloram | 0.5[c] | 5.0[c] |
| 1336-36-3 | Polychlorinated biphenyls (PCBs) | --- | --- |
| 129-00-0 | Pyrene | 1.0[b] | 5.0 |
| 122-34-9 | Simazine | 0.004[c] | 0.04[c] |
| 100-42-5 | Styrene | 0.1[c] | 0.5[c] |
| 93-72-1 | 2,4,5-TP (Silvex) | 0.05[c] | 0.25[c] |
| 127-18-4 | Tetrachloroethylene (Perchloroethylene) | 0.005[c] | 0.025[c] |
| 108-88-3 | Toluene | 1.0[c] | 2.5[c] |
| 8001-35-2 | Toxaphene | 0.003[c] | 0.015[c] |
| 120-82-1 | 1,2,4-Trichlorobenzene | 0.07[c] | 0.7[c] |
| 71-55-6 | 1,1,1-Trichloroethane[2] | 0.2[c] | 1.0[c] |
| 79-00-5 | 1,1,2-Trichloroethane | 0.005[c] | 0.05[c] |
| 79-01-6 | Trichloroethylene | 0.005[c] | 0.025[c] |
| 108-05-4 | Vinyl acetate | 40[b] | 40 |
| 75-01-4 | Vinyl chloride | 0.002[c] | 0.01[c] |
| 1330-20-7 | Xylenes (total) | 10.0[c] | 10.0[c] |
| | **Ionizable Organics** | | |
| 65-85-0 | Benzoic Acid | 100[b] | 100 |
| 106-47-8 | 4-Chloroaniline (*p*-Chloroaniline) | 0.1[b] | 0.1 |
| 95-57-8 | 2-Chlorophenol | 0.2[b] | 1.0 |
| 120-83-2 | 2,4-Dichlorophenol | 0.1[b] | 0.1 |
| 105-67-9 | 2,4-Dimethylphenol | 0.7[b] | 0.7 |
| 51-28-5 | 2,4-Dinitrophenol | 0.04[b] | 0.04 |
| 95-48-7 | 2-Methylphenol (*o* - Cresol) | 2.0[b] | 2.0 |
| 86-30-6 | *N*-Nitrosodiphenylamine | 0.02[b] | 0.1 |

| CAS No. | Chemical Name | $GW_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] | |
|---|---|---|---|
| | | Class I (mg/L) | Class II (mg/L) |
| 621-64-7 | *N*-Nitrosodi-*n*-propylamine | 1.0E-5[b] | 1.0E-5 |
| 87-86-5 | Pentachlorophenol | 0.001[a,c] | 0.005[c] |
| 108-95-2 | Phenol | 0.1[c] | 0.1[c] |
| 95-95-4 | 2,4,5-Trichlorophenol | 4.0[b] | 20 |
| 88-06-2 | 2,4,6-Trichlorophenol | 0.008[b] | 0.04 |
| | **Inorganics** | | |
| 7440-36-0 | Antimony | 0.006[c] | 0.024[c] |
| 7440-38-2 | Arsenic | 0.05[c] | 0.2[c] |
| 7440-39-3 | Barium | 2.0[c] | 2.0[c] |
| 7440-41-7 | Beryllium | 0.004[c] | 0.5[c] |
| 7440-42-8 | Boron | 2.0[c] | 2.0[c] |
| 7440-43-9 | Cadmium | 0.005[c] | 0.05[c] |
| 16887-00-6 | Chloride | 200[c] | 200[c] |
| 7440-47-3 | Chromium, total | 0.1[c] | 1.0[c] |
| 18540-29-9 | Chromium, ion, hexavalent | --- | --- |
| 7440-48-4 | Cobalt | 1.0[c] | 1.0[c] |
| 7440-50-8 | Copper | 0.65[c] | 0.65[c] |
| 57-12-5 | Cyanide | 0.2[c] | 0.6[c] |
| 7782-41-4 | Fluoride | 4.0[c] | 4.0[c] |
| 15438-31-0 | Iron | 5.0[c] | 5.0[c] |
| 7439-92-1 | Lead | 0.0075[c] | 0.1[c] |
| 7439-96-5 | Manganese | 0.15[c] | 10.0[c] |
| 7439-97-6 | Mercury | 0.002[c] | 0.01[c] |
| 7440-02-0 | Nickel | 0.1[c] | 2.0[c] |
| 14797-55-8 | Nitrate as N | 10.0[c] | 100[c] |
| 7782-49-2 | Selenium | 0.05[c] | 0.05[c] |
| 7440-22-4 | Silver | 0.05[c] | --- |
| 14808-79-8 | Sulfate | 400[c] | 400[c] |

| | | $GW_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] | |
|---|---|---|---|
| CAS No. | Chemical Name | Class I (mg/L) | Class II (mg/L) |
| 7440-28-0 | Thallium | 0.002[c] | 0.02[c] |
| 7440-62-2 | Vanadium | 0.049 | — |
| 7440-66-6 | Zinc | 5.0[c] | 10[c] |

Chemical Name and Groundwater Remediation Objective Notations

[a] The Equation S17 is used to calculate the Soil Remediation Objective for the Soil Component of the Groundwater Ingestion Route; this equation requires calculation of the Target Soil Leachate Concentration ($C_w$) from Equation S18: $C_w = DF \times GW_{obj}$.

[b] Value listed is the Water Health Based Limit (HBL) for this chemical from Soil Screening Guidance: User's Guide, incorporated by reference at Section 742.210; for carcinogens, the HBL is equal to a cancer risk of 1.0E-6, and for noncarcinogens is equal to a Hazard Quotient of 1.0. NOTE: These $GW_{obj}$ concentrations are not equal to the Tier 1 Groundwater Remediation Objectives for the Direct Ingestion of Groundwater Component of the Groundwater Ingestion Route, listed in Section 742.Appendix B, Table E.

[c] Value listed is also the Groundwater Quality Standard for this chemical pursuant to 35 Ill. Adm. Code 620.410 for Class I Groundwater or 35 Ill. Adm. Code 620.420 for Class II Groundwater.

# APPENDIX C

# USEPA REGION 9 PRELIMINARY REMEDIATION GOALS

Key: i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 8.7E-03 | i | 4.0E-03 | i | 8.7E-03 | r | 4.0E-03 | r | 0 | 0.10 | 30560-19-1 | | Acephate | 5.6E+01 | ca** | 2.8E+02 | ca* | 7.7E-01 | ca* | 7.7E+00 | ca* | | |
| | | | | 7.7E-03 | i | 2.6E-03 | i | 1 | | 75-07-0 | | Acetaldehyde | 1.1E+01 | ca** | 2.3E+01 | ca** | 8.7E-01 | ca* | 1.7E+00 | ca | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 34256-82-1 | | Acetochlor | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 1 | | 67-64-1 | | Acetone | 1.6E+03 | nc | 6.2E+03 | nc | 3.7E+02 | nc | 6.1E+02 | nc | 2E+01 | 8E-01 |
| | | 8.0E-04 | h | | | 8.0E-04 | r | 0 | 0.10 | 75-86-5 | | Acetone cyanohydrin | 4.9E+01 | nc | 7.0E+02 | nc | 2.9E+00 | nc | 2.9E+01 | nc | | |
| | | 6.0E-03 | x | | | 1.7E-02 | i | 1 | | 75-05-8 | | **Acetonitrile** | 2.7E+02 | nc | 1.7E+03 | nc | 6.2E+01 | nc | 7.9E+01 | nc | | |
| | | 1.0E-01 | i | | | 5.7E-06 | x | 1 | | 98-86-2 | | Acetophenone | 4.9E-01 | nc | 1.6E+00 | nc | 2.1E-02 | nc | 4.2E-02 | nc | | |
| 1.1E-01 | o | 1.3E-02 | i | 1.1E-01 | r | 1.3E-02 | r | 0 | 0.10 | 50594-66-6 | | Acifluorfen | 4.4E+00 | ca | 2.2E+01 | ca | 6.1E-02 | ca | 6.1E-01 | ca | | |
| | | 2.0E-02 | h | | | 5.7E-06 | i | 1 | | 107-02-8 | | Acrolein | 1.0E-01 | nc | 3.4E-01 | nc | 2.1E-02 | nc | 4.2E-02 | nc | | |
| 4.6E+00 | i | 2.0E-04 | i | 4.6E+00 | i | 2.0E-04 | r | 0 | 0.10 | 79-06-1 | | Acrylamide | 1.1E-01 | ca | 5.4E-01 | ca | 1.5E-03 | ca | 1.5E-02 | ca | | |
| | | 5.0E-01 | i | | | 2.9E-04 | i | 0 | 0.10 | 79-10-7 | | Acrylic acid | 2.9E+04 | nc | 1.0E+05 | max | 1.0E+00 | nc | 1.8E+04 | nc | | |
| 5.4E-01 | i | 1.0E-03 | h | 2.4E-01 | i | 5.7E-04 | i | 1 | | 107-13-1 | | Acrylonitrile | 2.1E-01 | ca* | 5.1E-01 | ca* | 2.8E-02 | ca* | 3.9E-02 | ca* | | |
| 8.1E-02 | h | 1.0E-02 | i | 8.0E-02 | r | 1.0E-02 | r | 0 | 0.10 | 15972-60-8 | | Alachlor | 6.0E+00 | ca | 3.1E+01 | ca | 8.4E-02 | ca | 8.4E-01 | ca | | |
| | | 1.5E-01 | i | | | 1.5E-01 | r | 0 | 0.10 | 1596-84-5 | | Alar | 9.2E+03 | nc | 1.0E+05 | max | 5.5E+02 | nc | 5.5E+03 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 116-06-3 | | Aldicarb | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 1646-88-4 | | Aldicarb sulfone | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| 1.7E+01 | i | 3.0E-05 | i | 1.7E+01 | i | 3.0E-05 | r | 0 | 0.10 | 309-00-2 | | Aldrin | 2.9E-02 | ca* | 1.5E-01 | ca | 3.9E-04 | ca | 4.0E-03 | ca | 1.2E+04 | 6E+02 |
| | | 2.5E-01 | i | | | 2.6E-01 | r | 0 | 0.10 | 5585-64-8 | | Ally | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 107-18-6 | | Allyl alcohol | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 5.0E-02 | h | | | 2.9E-04 | i | 0 | 0.10 | 107-05-1 | | Allyl chloride | 3.0E+03 | nc | 4.3E+04 | nc | 1.0E+00 | nc | 1.8E+03 | nc | | |
| | | 1.0E+00 | n | | | 1.4E-03 | n | 0 | | 7429-90-5 | | **Aluminum** | 7.6E+04 | nc | 1.0E+05 | max | 5.1E+00 | nc | 3.6E+04 | nc | | |
| | | 4.0E-04 | i | | | | | 0 | | 20859-73-8 | | Aluminum phosphide | 3.1E+01 | nc | 8.2E+02 | nc | | | 1.5E+01 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0 | 0.10 | 67485-29-4 | | Amdro | 1.8E+01 | nc | 2.6E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| | | 9.0E-03 | i | | | 9.0E-03 | r | 0 | 0.10 | 834-12-8 | | Ametryn | 5.5E+02 | nc | 7.9E+03 | nc | 3.3E+01 | nc | 3.3E+02 | nc | | |
| | | 7.0E-02 | h | | | 7.0E-02 | r | 0 | 0.10 | 591-27-5 | | m-Aminophenol | 4.3E+03 | nc | 6.2E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| | | 2.0E-05 | h | | | 2.0E-05 | r | 0 | 0.10 | 504-24-5 | | 4-Aminopyridine | 1.2E+00 | nc | 1.8E+01 | nc | 7.3E-02 | nc | 7.3E-01 | nc | | |
| | | 2.5E-03 | i | | | 2.5E-03 | r | 0 | 0.10 | 33089-61-1 | | Amitraz | 1.5E+02 | nc | 2.2E+03 | nc | 9.1E+00 | nc | 9.1E+01 | nc | | |
| | | | | | | 2.9E-02 | i | | | 7664-41-7 | | Ammonia | | | | | 1.0E+02 | nc | | | | |
| | | 2.0E-01 | i | | | | | 0 | 0.10 | 7773-06-0 | | Ammonium sulfamate | 1.2E+04 | nc | 1.0E+05 | max | | | 7.3E+03 | nc | | |
| 5.7E-03 | i | 7.0E-03 | n | 5.7E-03 | r | 2.9E-04 | i | 0 | 0.10 | 62-53-3 | | Aniline | 8.5E+01 | ca** | 4.3E+02 | ca* | 1.0E+00 | nc | 1.2E+01 | ca* | | |
| | | 4.0E-04 | i | | | | | 0 | | 7440-36-0 | | Antimony and compounds | 3.1E+01 | nc | 8.2E+02 | nc | | | 1.5E+01 | nc | 5.0E+00 | 3E-01 |
| | | 5.0E-04 | h | | | | | 0 | | 1314-60-9 | | Antimony pentoxide | 3.9E+01 | nc | 1.0E+03 | nc | | | 1.8E+01 | nc | | |
| | | 9.0E-04 | h | | | | | 0 | | 28300-74-5 | | Antimony potassium tartrate | 7.0E+01 | nc | 1.8E+03 | nc | | | 3.3E+01 | nc | | |
| | | 4.0E-04 | h | | | | | 0 | | 1332-81-6 | | Antimony tetroxide | 3.1E+01 | nc | 8.2E+02 | nc | | | 1.5E+01 | nc | | |
| | | 4.0E-04 | h | | | 5.7E-05 | i | 0 | | 1309-64-4 | | **Antimony trioxide** | 3.1E+01 | nc | 8.2E+02 | nc | 2.1E-01 | nc | 1.5E+01 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 74115-24-5 | | Apollo | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| 2.5E-02 | i | 5.0E-02 | h | 2.5E-02 | i | 5.0E-02 | r | 0 | 0.10 | 140-57-8 | | Aramite | 1.9E+01 | ca | 9.9E+01 | ca | 2.7E-01 | ca | 2.7E+00 | ca | | |
| | | 3.0E-04 | i | | | | | 0 | 0.03 | 7440-38-2 | | Arsenic (noncancer endpoint) | 2.2E+01 | nc | 4.4E+02 | nc | | | | | | |
| 1.5E+00 | i | 3.0E-04 | i | 1.5E+01 | i | | | 0 | 0.03 | 7440-38-2 | | Arsenic (cancer endpoint) | 3.9E-01 | ca* | 2.7E+00 | ca | 4.5E-04 | ca | 4.5E-02 | ca | 2.9E+01 | 1E+00 |
| | | | | | | 1.4E-05 | i | | | 7784-42-1 | | Arsine (see arsenic for cancer endpoint) | | | | | 5.2E-02 | nc | | | | |
| | | 9.0E-03 | i | | | 9.0E-03 | r | 0 | 0.10 | 76578-12-6 | | Assure | 5.5E+02 | nc | 7.9E+03 | nc | 3.3E+01 | nc | 3.3E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 3337-71-1 | | Asulam | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| 2.2E-01 | h | 3.5E-02 | h | 2.2E-01 | r | 3.5E-02 | r | 0 | 0.10 | 1912-24-9 | | Atrazine | 2.2E+00 | ca | 1.1E+01 | ca | 3.1E-02 | ca | 3.0E-01 | ca | | |
| | | 4.0E-04 | i | | | 4.0E-04 | r | 0 | 0.10 | 71751-41-2 | | Avermectin B1 | 2.4E+01 | nc | 3.5E+02 | nc | 1.5E+00 | nc | 1.5E+01 | nc | | |
| 1.1E-01 | i | | | 1.1E-01 | i | | | 0 | 0.10 | 103-33-3 | | Azobenzene | 4.4E+00 | ca | 2.2E+01 | ca | 6.2E-02 | ca | 6.1E-01 | ca | | |
| | | 7.0E-02 | i | | | 1.4E-04 | h | 0 | | 7440-39-3 | | Barium and compounds | 5.4E+03 | nc | 1.0E+05 | max | 5.2E-01 | nc | 2.6E+03 | nc | 1.6E+03 | 8E+01 |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0 | 0.10 | 114-26-1 | | Baygon | 2.4E+02 | nc | 3.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 43121-43-3 | | Bayleton | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 68359-37-5 | | Baythroid | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 3.0E-01 | i | | | 3.0E-01 | r | 0 | 0.10 | 1861-40-1 | | Benefin | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 17804-35-2 | | Benomyl | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 25057-89-0 | | Benlazon | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 100-52-7 | | Benzaldehyde | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| 2.9E-02 | i | 3.0E-03 | n | 2.7E-02 | i | 1.7E-03 | n | 1 | | 71-43-2 | | Benzene | 6.7E-01 | ca* | 1.5E+00 | ca* | 2.5E-01 | ca* | 4.1E-01 | ca* | 3.0E-02 | 2E-03 |
| 2.3E+02 | i | 3.0E-03 | i | 2.3E+02 | i | 3.0E-03 | r | 0 | 0.10 | 92-87-5 | | Benzidine | 2.1E-03 | ca | 1.1E-02 | ca | 2.9E-05 | ca | 2.9E-04 | ca | | |
| | | 4.0E+00 | i | | | 4.0E+00 | r | 0 | 0.10 | 65-85-0 | | Benzoic acid | 1.0E+05 | max | 1.0E+05 | max | 1.5E+04 | nc | 1.5E+05 | nc | 4.0E+02 | 2E+01 |
| 1.3E+01 | i | | | 1.3E+01 | r | | | 0 | 0.10 | 98-07-7 | | Benzotrichloride | 3.7E-02 | ca | 1.9E-01 | ca | 5.2E-04 | ca | 5.2E-03 | ca | | |
| | | 3.0E-01 | h | | | 3.0E-01 | r | 0 | 0.10 | 100-51-6 | | Benzyl alcohol | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |

Key: i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | Migration to Ground Water | |
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 1.7E-01 | i | | | 1.7E-01 | r | | | 1 | | 100-44-7 | Benzyl chloride | 8.9E-01 | ca | 2.3E+00 | ca | 4.0E-02 | ca | 6.6E-02 | ca | | |
| | | 2.0E-03 | i | 8.4E+00 | i | 5.7E-06 | i | 0 | | 7440-41-7 | Beryllium and compounds | 1.5E+02 | nc | 2.2E+03 | ca** | 8.0E-04 | ca* | 7.3E+01 | nc | 6.3E+01 | 3E+00 |
| | | 1.0E-04 | i | | | 1.0E-04 | r | 0 | 0.10 | 141-66-2 | Bidrin | 6.1E+00 | nc | 8.8E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 1.5E-02 | i | | | 1.5E-02 | r | 0 | 0.10 | 82657-04-3 | Biphenthrin (Talstar) | 9.2E+02 | nc | 1.3E+04 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 1 | | 92-52-4 | 1,1-Biphenyl | 3.5E+02 | sat | 3.5E+02 | sat | 1.8E+02 | nc | 3.0E+02 | nc | | |
| 1.1E+00 | i | | | 1.2E+00 | i | | | 1 | | 111-44-4 | Bis(2-chloroethyl)ether | 2.1E-01 | ca | 6.2E-01 | ca | 5.8E-03 | ca | 9.8E-03 | ca | 4.0E-04 | 2E-05 |
| 7.0E-02 | h | 4.0E-02 | i | 3.5E-02 | h | 4.0E-02 | r | 1 | | 108-60-1 | Bis(2-chloroisopropyl)ether | 2.9E+00 | ca | 8.1E+00 | ca | 1.9E-01 | ca | 2.7E-01 | ca | | |
| 2.2E+02 | i | | | 2.2E+02 | i | | | 1 | | 542-88-1 | Bis(chloromethyl)ether | 1.9E-04 | ca | 4.4E-04 | ca | 3.1E-05 | ca | 5.2E-05 | ca | | |
| 7.0E-02 | h | | | 3.5E-02 | h | | | 0 | 0.10 | 108-60-1 | Bis(2-chloro-1-methylethyl)ether | 6.9E+00 | ca | 3.5E+01 | ca | 1.9E-01 | ca | 9.6E-01 | ca | | |
| 1.4E-02 | i | 2.0E-02 | i | 1.4E-02 | r | 2.2E-02 | r | 0 | 0.10 | 117-81-7 | Bis(2-ethylhexyl)phthalate (DEHP) | 3.5E+01 | ca* | 1.8E+02 | ca | 4.8E-01 | ca | 4.8E+00 | ca | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 80-05-7 | Bisphenol A | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 9.0E-02 | i | | | 5.7E-03 | h | 0 | 0.10 | 7440-42-8 | Boron | 5.5E+03 | nc | 7.9E+04 | nc | 2.1E+01 | nc | 3.3E+03 | nc | | |
| | | | | | | 2.0E-04 | h | 0 | 0.10 | 7637-07-2 | Boron trifluoride | | | | | 7.3E-01 | nc | | | | |
| | | 2.0E-02 | n | | | 2.9E-03 | n | 1 | | 108-86-1 | Bromobenzene | 2.8E+01 | nc | 9.2E+01 | nc | 1.0E+01 | nc | 2.0E+01 | nc | | |
| 6.2E-02 | i | 2.0E-02 | i | 6.2E-02 | r | 2.0E-02 | r | 1 | | 75-27-4 | Bromodichloromethane | 1.0E+00 | ca | 2.4E+00 | ca | 1.1E-01 | ca | 1.8E-01 | ca | 6E-01 | 3E-02 |
| 7.9E-03 | i | 2.0E-02 | i | 3.9E-03 | i | 2.0E-02 | r | 0 | 0.10 | 75-25-2 | Bromoform (tribromomethane) | 6.2E+01 | ca* | 3.1E+02 | ca* | 1.7E+00 | ca* | 8.5E+00 | ca* | 8E-01 | 4E-02 |
| | | 1.4E-03 | i | | | 1.4E-03 | i | 1 | | 74-83-9 | Bromomethane (Methyl bromide) | 3.9E+00 | nc | 1.3E+01 | nc | 5.2E+00 | nc | 8.7E+00 | nc | 2E-01 | 1E-02 |
| | | | | | | | | 0 | 0.10 | 101-55-3 | 4-Bromophenyl phenyl ether | | | | | | | | | | |
| | | 5.0E-03 | h | | | 5.0E-03 | r | 0 | 0.10 | 2104-96-3 | Bromophos | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 1689-84-5 | Bromoxynil | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 1689-99-2 | Bromoxynil octanoate | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| 1.8E+00 | r | | | 1.8E+00 | i | | | 1 | | 106-99-0 | 1,3-Butadiene | 3.5E-03 | ca | 7.6E-03 | ca | 3.7E-03 | ca | 6.2E-03 | ca | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 71-36-3 | 1-Butanol | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | 2E+01 | 9E-01 |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 2008-41-5 | Butylate | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 1.0E-02 | n | | | 1.0E-02 | r | 1 | | 104-51-8 | n-Butylbenzene | 1.4E+02 | nc | 2.4E+02 | sat | 3.7E+01 | nc | 6.1E+01 | nc | | |
| | | 1.0E-02 | n | | | 1.0E-02 | r | 1 | | 135-9-88 | sec-Butylbenzene | 1.1E+02 | nc | 2.2E+02 | sat | 3.7E+01 | nc | 6.1E+01 | nc | | |
| | | 1.0E-02 | n | | | 1.0E-02 | r | 1 | | 98-06-6 | tert-Butylbenzene | 1.3E+02 | nc | 3.9E+02 | sat | 3.7E+01 | nc | 6.1E+01 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0 | 0.10 | 85-68-7 | Butyl benzyl phthalate | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | 9E+02 | 8E+02 |
| | | 1.0E+00 | i | | | 1.0E+00 | r | 0 | 0.10 | 85-70-1 | Butylphthalyl butylglycolate | 6.1E+04 | nc | 1.0E+05 | max | 3.7E+03 | nc | 3.6E+04 | nc | | |
| | | 3.0E-03 | h | | | 3.0E-03 | r | 0 | 0.10 | 75-60-5 | Cacodylic acid | 1.8E+02 | nc | 2.6E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 5.0E-04 | i | 6.3E+00 | i | | | 0 | 0.001 | 7440-43-9 | Cadmium and compounds | 3.7E+01 | nc | 8.1E+02 | nc | 1.1E-03 | ca | 1.8E+01 | nc | 8E+00 | 4E-01 |
| | | | | | | | | | | | **"CAL-Modified PRG" (PEA, 1994)** | 9.0E+00 | | | | | | | | | |
| | | 5.0E-01 | i | | | 5.0E-01 | r | 0 | 0.10 | 105-60-2 | Caprolactam | 3.1E+04 | nc | 1.0E+05 | max | 1.8E+03 | nc | 1.8E+04 | nc | | |
| 8.6E-03 | h | 2.0E-03 | i | 8.6E-03 | r | 2.0E-03 | r | 0 | 0.10 | 2425-06-1 | Captafol | 5.7E+01 | ca** | 2.9E+02 | ca** | 7.8E-01 | ca** | 7.8E+00 | ca** | | |
| 3.5E-03 | h | 1.3E-01 | i | 3.5E-03 | r | 1.3E-01 | r | 0 | 0.10 | 133-06-2 | Captan | 1.4E+02 | ca* | 7.0E+02 | ca | 1.9E+00 | ca | 1.9E+01 | ca | | |
| | | 1.0E-01 | i | | | 1.1E-01 | r | 0 | 0.10 | 63-25-2 | Carbaryl | 6.1E+03 | nc | 8.8E+04 | nc | 4.0E+02 | nc | 3.6E+03 | nc | | |
| 2.0E-02 | h | | | 2.0E-02 | r | | | 0 | 0.10 | 86-74-8 | Carbazole | 2.4E+01 | ca | 1.2E+02 | ca | 3.4E-01 | ca | 3.4E+00 | ca | 6E-01 | 3E-02 |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 1563-66-2 | Carbofuran | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 1.0E-01 | i | | | 2.0E-01 | i | 1 | | 75-15-0 | Carbon disulfide | 3.6E+02 | nc | 7.2E+02 | sat | 7.3E+02 | nc | 1.0E+03 | nc | 3E+01 | 2E+00 |
| 1.3E-01 | i | 7.0E-04 | i | 5.3E-02 | i | 7.0E-04 | r | 1 | | 56-23-5 | Carbon tetrachloride | 2.4E-01 | ca** | 5.3E-01 | ca* | 1.3E-01 | ca* | 1.7E-01 | ca* | 7E-02 | 3E-03 |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 55285-14-8 | Carbosulfan | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 5234-68-4 | Carboxin | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 302-17-0 | Chloral | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 1.5E-02 | i | | | 1.5E-02 | r | 0 | 0.10 | 133-90-4 | Chloramben | 9.2E+02 | nc | 1.3E+04 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| 4.0E-01 | h | | | 4.0E-01 | r | | | 0 | 0.10 | 118-75-2 | Chloranil | 1.2E+00 | ca | 6.1E+00 | ca | 1.7E-02 | ca | 1.7E-01 | ca | | |
| 3.5E-01 | i | 5.0E-04 | i | 3.5E-01 | i | 2.0E-04 | i | 0 | 0.04 | 12789-03-6 | **Chlordane** | 1.6E+00 | ca* | 1.1E+01 | ca* | 1.9E-02 | ca* | 1.9E-01 | ca* | 1E+01 | 5E-01 |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 90982-32-4 | Chlorimuron-ethyl | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.0E-01 | i | | | | | | | 7782-50-5 | Chlorine | | | | | | | 3.6E+03 | nc | | |
| | | | | | | 5.7E-05 | i | | | 10049-04-4 | Chlorine dioxide | | | | | 2.1E-01 | nc | | | | |
| | | | | | | | | 1 | | 107-20-0 | Chloroacetaldehyde | | | | | | | | | | |
| | | 2.0E-03 | h | | | 2.0E-03 | r | 0 | 0.10 | 79-11-8 | Chloroacetic acid | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 8.6E-06 | r | | | 8.6E-06 | i | 1 | | 532-27-4 | 2-Chloroacetophenone | 3.3E-02 | nc | 1.1E-01 | nc | 3.1E-02 | nc | 5.2E-02 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0 | 0.10 | 106-47-8 | 4-Chloroaniline | 2.4E+02 | nc | 3.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | 7E-01 | 3E-02 |
| | | 2.0E-02 | i | | | 1.7E-02 | n | 1 | | 108-90-7 | **Chlorobenzene** | 1.5E+02 | nc | 5.4E+02 | nc | 6.2E+01 | nc | 1.1E+02 | nc | 1E+00 | 7E-02 |
| 2.7E-01 | h | 2.0E-02 | i | 2.7E-01 | h | 2.0E-02 | r | 0 | 0.10 | 510-15-6 | Chlorobenzilate | 1.8E+00 | ca | 9.1E+00 | ca | 2.5E-02 | ca | 2.5E-01 | ca | | |
| | | 2.0E-01 | h | | | 2.0E-01 | r | 0 | 0.10 | 74-11-3 | p-Chlorobenzoic acid | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-02 | r | 0 | 0.10 | 98-56-6 | 4-Chlorobenzotrifluoride | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-03 | h | 1 | | 126-99-8 | 2-Chloro-1,3-butadiene | 3.6E+00 | nc | 1.2E+01 | nc | 7.3E+00 | nc | 1.4E+01 | nc | | |

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where nc < 100X ca) **(where nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 4.0E-01 | h | | | 4.0E-01 | r | 1 | | 109-69-3 | | 1-Chlorobutane | 4.8E+02 | sat | 4.8E+02 | sat | 1.5E+03 | nc | 2.4E+03 | nc | | |
| | | 1.4E+01 | r | | | 1.4E+01 | i | 1 | | 75-68-3 | | 1-Chloro-1,1-difluoroethane (HCFC-142b) | 3.4E+02 | sat | 3.4E+02 | sat | 5.2E+04 | nc | 8.7E+04 | nc | | |
| | | 1.4E+01 | r | | | 1.4E+01 | i | 1 | | 75-45-6 | | Chlorodifluoromethane | 3.4E+02 | sat | 3.4E+02 | sat | 5.1E+04 | nc | 8.5E+04 | nc | | |
| 2.9E-03 | n | 4.0E-01 | n | 2.9E-03 | r | 2.9E+00 | i | 1 | | 75-00-3 | | Chloroethane | 3.0E+00 | ca | 6.5E+00 | ca | 2.3E+00 | ca | 4.6E+00 | ca | | |
| | | | | | | | | 1 | | 110-75-8 | | 2-Chloroethyl vinyl ether | | | | | | | | | | |
| 6.1E-03 | i | 1.0E-02 | i | 8.1E-02 | i | 8.6E-05 | n | 1 | | 67-66-3 | | Chloroform | 2.4E-01 | ca** | 5.2E-01 | ca** | 8.4E-02 | ca** | 1.6E-01 | ca** | 6E-01 | 3E-02 |
| 1.3E-02 | h | | | 6.3E-03 | h | 8.6E-02 | n | 1 | | 74-87-3 | | Chloromethane | 1.2E+00 | ca | 2.7E+00 | ca | 1.1E+00 | ca | 1.5E+00 | ca | | |
| 5.8E-01 | h | | | 5.8E-01 | r | | | 0 | 0.10 | 95-69-2 | | 4-Chloro-2-methylaniline | 8.4E-01 | ca | 4.3E+00 | ca | 1.2E-02 | ca | 1.2E-01 | ca | | |
| 4.6E-01 | h | | | 4.6E-01 | r | | | 0 | 0.10 | 3165-93-3 | | 4-Chloro-2-methylaniline hydrochloride | 1.1E+00 | ca | 5.4E+00 | ca | 1.5E-02 | ca | 1.5E-01 | ca | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 1 | | 91-58-7 | | beta-Chloronaphthalene | 4.9E+03 | nc | 2.7E+04 | nc | 2.9E+02 | nc | 4.9E+02 | nc | | |
| 2.5E-02 | h | | | 2.5E-02 | r | | r | 1 | | 88-73-3 | | o-Chloronitrobenzene | 8.1E+00 | ca | 2.3E+01 | ca | 2.7E-01 | ca | 4.5E-01 | ca | | |
| 1.8E-02 | h | | | 1.8E-02 | r | | r | 1 | | 100-00-5 | | p-Chloronitrobenzene | 1.1E+01 | ca | 3.2E+01 | ca | 3.7E-01 | ca | 6.2E-01 | ca | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 1 | | 95-57-8 | | 2-Chlorophenol | 6.3E+01 | nc | 2.4E+02 | nc | 1.8E+01 | nc | 3.0E+01 | nc | 4E+00 | 2E-01 |
| | | 2.9E-02 | r | | | 2.9E-02 | h | 1 | | 75-29-6 | | 2-Chloropropane | 1.7E+02 | nc | 5.9E+02 | nc | 1.0E+02 | nc | 1.7E+02 | nc | | |
| 1.1E-02 | h | 1.5E-02 | i | 1.1E-02 | r | 1.5E-02 | r | 0 | 0.10 | 1897-45-6 | | Chlorothalonil | 4.4E+01 | ca* | 2.2E+02 | ca* | 6.1E-01 | ca* | 6.1E+00 | ca* | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 1 | | 95-49-8 | | o-Chlorotoluene | 1.6E+02 | nc | 5.7E+02 | nc | 7.3E+01 | nc | 1.2E+02 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0 | 0.10 | 101-21-3 | | Chlorpropham | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0 | 0.10 | 2921-88-2 | | Chlorpyrifos | 1.8E+02 | nc | 2.6E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 0 | 0.10 | 5598-13-0 | | Chlorpyrifos-methyl | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 64902-72-3 | | Chlorsulfuron | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 8.0E-04 | h | | | 8.0E-04 | r | 0 | 0.10 | 60238-56-4 | | Chlorthiophos | 4.9E+01 | nc | 7.0E+02 | nc | 2.9E+00 | nc | 2.9E+01 | nc | | |
| | | | | 4.2E+01 | i | | | 0 | | | | Total Chromium (1:6 ratio Cr VI:Cr III) | 2.1E+02 | ca | 4.5E+02 | ca | 1.6E-04 | ca | | | 4E+01 | 2E+00 |
| | | 1.5E+00 | i | | | | | | | 16065-83-1 | | Chromium III | 1.0E+05 | max | 1.0E+05 | max | | | 5.5E+04 | nc | | |
| | | 3.0E-03 | i | 2.9E+02 | i | | | 0 | | 18540-29-9 | | Chromium VI | 3.0E+01 | ca** | 6.4E+01 | ca | 2.3E-05 | ca | 1.1E+02 | nc | 4E+01 | 2E+00 |
| | | | | | | | | | | | | "CAL-Modified PRG" (PEA, 1994) | 2.0E-01 | | | | | | 2E-01 | | | |
| | | 6.0E-02 | n | | | | | | | 7440-48-4 | | Cobalt | 4.7E+03 | nc | 1.0E+05 | max | | | 2.2E+03 | nc | | |
| | | | | 2.2E+00 | i | | | 0 | | 8007-45-2 | | Coke Oven Emissions | | | | | 3.1E-03 | ca | | | | |
| | | 3.7E-02 | h | | | | | 0 | | 7440-50-8 | | Copper and compounds | 2.9E+03 | nc | 7.6E+04 | nc | | | 1.4E+03 | nc | | |
| 1.9E+00 | h | | | 1.9E+00 | r | | | 1 | | 123-73-9 | | Crotonaldehyde | 5.3E-03 | ca | 1.1E-02 | ca | 3.5E-03 | ca | 5.9E-03 | ca | | |
| | | 1.0E-01 | i | | | 1.1E-01 | i | 1 | | 98-82-8 | | Cumene (isopropylbenzene) | 1.6E+02 | nc | 5.2E+02 | nc | 4.0E+02 | nc | 6.6E+02 | nc | | |
| 8.4E-01 | h | 2.0E-03 | h | 8.4E-01 | r | 2.0E-03 | r | 0 | 0.10 | 21725-46-2 | | Cyanazine | 5.8E-01 | ca | 2.9E+00 | ca | 8.0E-03 | ca | 8.0E-02 | ca | | |
| | | | | | | | | | | n/a | | Cyanides | | | | | | | | | | |
| | | 1.0E-01 | h | | | | | 0 | 0.10 | 542-62-1 | | Barium cyanide | 6.1E+03 | nc | 1.0E+05 | max | | | 3.6E+03 | nc | | |
| | | 4.0E-02 | i | | | | | 0 | 0.10 | 592-01-8 | | Calcium cyanide | 2.4E+03 | nc | 3.5E+04 | nc | | | 1.5E+03 | nc | | |
| | | 5.0E-03 | i | | | | | 0 | 0.10 | 544-92-3 | | Copper cyanide | 3.1E+02 | nc | 4.4E+03 | nc | | | 1.8E+02 | nc | | |
| | | 2.0E-02 | i | | | | | 0 | 0.10 | 57-12-5 | | Free cyanide | 1.2E+03 | nc | 1.8E+04 | nc | | | 7.3E+02 | nc | 4E+01 | 2E+00 |
| | | 2.0E-02 | i | | | 8.6E-04 | i | 1 | | 74-90-8 | | Hydrogen cyanide | 1.1E+01 | nc | 3.5E+01 | nc | 3.1E+00 | nc | 6.2E+00 | nc | | |
| | | 5.0E-02 | i | | | | | 0 | 0.10 | 151-50-8 | | Potassium cyanide | 3.1E+03 | nc | 4.4E+04 | nc | | | 1.8E+03 | nc | | |
| | | 2.0E-01 | i | | | | | 0 | 0.10 | 506-61-6 | | Potassium silver cyanide | 1.2E+04 | nc | 1.0E+05 | max | | | 7.3E+03 | nc | | |
| | | 1.0E-01 | i | | | | | 0 | 0.10 | 506-64-9 | | Silver cyanide | 6.1E+03 | nc | 8.8E+04 | nc | | | 3.6E+03 | nc | | |
| | | 4.0E-02 | i | | | | | 0 | 0.10 | 143-33-9 | | Sodium cyanide | 2.4E+03 | nc | 3.5E+04 | nc | | | 1.5E+03 | nc | | |
| | | 5.0E-02 | i | | | | | 0 | 0.10 | 557-21-1 | | Zinc cyanide | 3.1E+03 | nc | 4.4E+04 | nc | | | 1.8E+03 | nc | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 1 | | 460-19-5 | | Cyanogen | 1.3E+02 | nc | 4.3E+02 | nc | 1.5E+02 | nc | 2.4E+02 | nc | | |
| | | 9.0E-02 | i | | | 9.0E-02 | r | 1 | | 506-68-3 | | Cyanogen bromide | 2.9E+02 | nc | 9.7E+02 | nc | 3.3E+02 | nc | 5.5E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 1 | | 506-77-4 | | Cyanogen chloride | 1.6E+02 | nc | 5.4E+02 | nc | 1.8E+02 | nc | 3.0E+02 | nc | | |
| | | 5.0E+00 | i | | | 5.0E+00 | r | 0 | 0.10 | 108-94-1 | | Cyclohexanone | 1.0E+05 | max | 1.0E+05 | max | 1.8E+04 | nc | 1.8E+05 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0 | 0.10 | 108-91-8 | | Cyclohexylamine | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 68085-85-8 | | Cyhalothrin/Karate | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 52315-07-8 | | Cypermethrin | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 7.5E-03 | i | | | 7.5E-03 | r | 0 | 0.10 | 66215-27-8 | | Cyromazine | 4.6E+02 | nc | 6.6E+03 | nc | 2.7E+01 | nc | 2.7E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 1861-32-1 | | Dacthal | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 75-99-0 | | Dalapon | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 39515-41-8 | | Danitol | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| 2.4E-01 | i | | | 2.4E-01 | r | | | 0 | 0.03 | 72-54-8 | | DDD | 2.4E+00 | ca | 1.7E+01 | ca | 2.8E-02 | ca | 2.8E-01 | ca | 2E+01 | 8E-01 |
| 3.4E-01 | i | | | 3.4E-01 | r | | | 0 | 0.03 | 72-55-9 | | DDE | 1.7E+00 | ca | 1.2E+01 | ca | 2.0E-02 | ca | 2.0E-01 | ca | 5E+01 | 3E+00 |
| 3.4E-01 | i | 5.0E-04 | i | 3.4E-01 | i | 5.0E-04 | r | 0 | 0.03 | 50-29-3 | | DDT | 1.7E+00 | ca* | 1.2E+01 | ca* | 2.0E-02 | ca* | 2.0E-01 | ca* | 3E+01 | 2E+00 |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 1163-19-5 | | Decabromodiphenyl ether | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 4.0E-05 | i | | | 4.0E-05 | r | 0 | 0.10 | 8065-48-3 | | Demeton | 2.4E+00 | nc | 3.5E+01 | nc | 1.5E-01 | nc | 1.5E+00 | nc | | |

Key : I=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 6.1E-02 | h | | | 6.1E-02 | r | | | 0 | 0.10 | 2303-16-4 | | Diallate | 8.0E+00 | ca | 4.0E+01 | ca | 1.1E-01 | ca | 1.1E+00 | ca | | |
| | | 9.0E-04 | h | | | 9.0E-04 | r | 0 | 0.10 | 333-41-5 | | Diazinon | 5.5E+01 | nc | 7.9E+02 | nc | 3.3E+00 | nc | 3.3E+01 | nc | | |
| | | 4.0E-03 | x | | | 4.0E-03 | r | 1 | | 132-64-9 | | Dibenzofuran | 2.9E+02 | nc | 5.1E+03 | nc | 1.5E+01 | nc | 2.4E+01 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 106-37-6 | | 1,4-Dibromobenzene | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 8.4E-02 | i | 2.0E-02 | i | 8.4E-02 | r | 2.0E-02 | r | 1 | | 124-48-1 | | **Dibromochloromethane** | 1.1E+00 | ca | 2.7E+00 | ca | 8.0E-02 | ca | 1.3E-01 | ca | 4E-01 | 2E-02 |
| 1.4E+00 | h | 5.7E-05 | r | 2.4E-03 | h | 5.7E-05 | i | 1 | | 96-12-8 | | **1,2-Dibromo-3-chloropropane** | 4.5E-01 | ca** | 4.0E+00 | ca** | 2.1E-01 | nc | 4.8E-02 | ca** | | |
| | | | | | | | | | | | | **"CAL-Modified PRG" (PEA, 1994)** | 6.0E-02 | | | | 9.6E-04 | | 4.7E-03 | | | |
| 8.5E+01 | i | 5.7E-05 | r | 7.7E-01 | i | 5.7E-05 | h | 1 | | 106-93-4 | | 1,2-Dibromoethane | 6.9E-03 | ca | 4.8E-02 | ca* | 8.7E-03 | ca* | 7.6E-04 | ca | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 84-74-2 | | Dibutyl phthalate | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | 2E+03 | 3E+02 |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 1918-00-9 | | Dicamba | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 9.0E-02 | i | | | 5.7E-02 | h | 1 | | 95-50-1 | | 1,2-Dichlorobenzene | 3.7E+02 | sat | 3.7E+02 | sat | 2.1E+02 | nc | 3.7E+02 | nc | 2E+01 | 9E-01 |
| | | **9.00E-04** | n | | | **9.00E-04** | r | 1 | | 541-73-1 | | **1,3-Dichlorobenzene** | 1.3E+01 | nc | 5.2E+01 | nc | 3.3E+00 | nc | 5.5E+00 | nc | | |
| 2.4E-02 | h | **3.00E-02** | n | 2.2E-02 | n | 3.00E-02 | i | 1 | | 106-46-7 | | **1,4-Dichlorobenzene** | 3.4E+00 | ca | 8.1E+00 | ca | 3.1E-01 | ca | 5.0E-01 | ca | 2E+00 | 1E-01 |
| 4.5E-01 | i | | | 4.5E-01 | r | | | 0 | 0.10 | 91-94-1 | | 3,3-Dichlorobenzidine | 1.1E+00 | ca | 5.5E+00 | ca | 1.5E-02 | ca | 1.5E-01 | ca | 7E-03 | 3E-04 |
| 9.3E+00 | r | | | 9.3E+00 | h | | | 1 | | 764-41-0 | | 1,4-Dichloro-2-butene | 7.9E-03 | ca | 1.8E-02 | ca | 7.2E-04 | ca | 1.2E-03 | ca | | |
| | | 2.0E-01 | i | | | 5.7E-02 | h | 1 | | 75-71-8 | | Dichlorodifluoromethane | 9.4E+01 | nc | 3.1E+02 | nc | 2.1E+02 | nc | 3.9E+02 | nc | | |
| | | 1.0E-01 | h | | | 1.4E-01 | h | 1 | | 75-34-3 | | 1,1-Dichloroethane | 5.9E+02 | nc | 2.1E+03 | nc | 5.2E+02 | nc | 8.1E+02 | nc | 2E+01 | 1E+00 |
| 9.1E-02 | i | 3.0E-02 | n | 9.1E-02 | i | 1.4E-03 | n | 1 | | 107-06-2 | | 1,2-Dichloroethane (EDC) | 3.5E-01 | ca* | 7.6E-01 | ca* | 7.4E-02 | ca* | 1.2E-01 | ca* | 2E-02 | 1E-03 |
| 6.0E-01 | i | 9.0E-03 | i | 1.8E-01 | i | 9.0E-03 | r | 1 | | 75-35-4 | | 1,1-Dichloroethylene | 5.4E-02 | ca | 1.2E-01 | ca | 3.8E-02 | ca | 4.6E-02 | ca | 6E-02 | 3E-03 |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 1 | | 156-59-2 | | 1,2-Dichloroethylene (cis) | 4.3E+01 | nc | 1.5E+02 | nc | 3.7E+01 | nc | 6.1E+01 | nc | 4E-01 | 2E-02 |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 1 | | 156-60-5 | | 1,2-Dichloroethylene (trans) | 6.3E+01 | nc | 2.1E+02 | nc | 7.3E+01 | nc | 1.2E+02 | nc | 7E-01 | 3E-02 |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0 | 0.10 | 120-83-2 | | 2,4-Dichlorophenol | 1.8E+02 | nc | 2.6E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | 1E+00 | 5E-02 |
| | | 8.0E-03 | i | | | 8.0E-03 | r | 0 | 0.10 | 94-82-6 | | 4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB) | 4.9E+02 | nc | 7.0E+03 | nc | 2.9E+01 | nc | 2.9E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.05 | 94-75-7 | | 2,4-Dichlorophenoxyacetic Acid (2,4-D) | 6.9E+02 | nc | 1.2E+04 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 6.8E-02 | h | 1.1E-03 | r | 6.8E-02 | r | 1.1E-03 | i | 1 | | 78-87-5 | | 1,2-Dichloropropane | 3.5E-01 | ca* | 7.7E-01 | ca* | 9.9E-02 | ca* | 1.6E-01 | ca* | 3E-02 | 1E-03 |
| 1.8E-01 | h | 3.0E-04 | i | 1.3E-01 | h | 5.7E-03 | i | 1 | | 542-75-6 | | 1,3-Dichloropropene | 8.2E-02 | ca | 1.8E-01 | ca | 5.2E-02 | ca | 8.1E-02 | ca | 4E-03 | 2E-04 |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0 | 0.10 | 616-23-9 | | 2,3-Dichloropropanol | 1.8E+02 | nc | 2.6E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| 2.9E-01 | i | 5.0E-04 | i | 2.9E-01 | r | 1.4E-04 | i | 0 | 0.10 | 62-73-7 | | Dichlorvos | 1.7E+00 | ca* | 8.5E+00 | ca* | 2.3E-02 | ca* | 2.3E-01 | ca* | | |
| 4.4E-01 | x | | | 4.4E-01 | r | | | 0 | 0.10 | 115-32-2 | | Dicofol | 1.1E+00 | ca | 5.6E+00 | ca | 1.5E-02 | ca | 1.5E-01 | ca | | |
| | | 3.0E-02 | h | | | 5.7E-05 | h | 1 | | 77-73-6 | | Dicyclopentadiene | 5.4E-01 | nc | 1.8E+00 | nc | 2.1E-01 | nc | 4.2E-01 | nc | | |
| 1.6E+01 | i | 5.0E-05 | i | 1.6E+01 | i | 5.0E-05 | r | 0 | 0.10 | 60-57-1 | | Dieldrin | 3.0E-02 | ca | 1.5E-01 | ca | 4.2E-04 | ca | 4.2E-03 | ca | 4E-03 | 2E-04 |
| | | 5.7E-03 | r | | | 5.7E-03 | h | 0 | 0.10 | 112-34-5 | | Diethylene glycol, monobutyl ether | 3.5E+02 | nc | 5.0E+03 | nc | 2.1E+01 | nc | 2.1E+02 | nc | | |
| | | 2.0E+00 | h | | | 2.0E+00 | r | 0 | 0.10 | 111-90-0 | | Diethylene glycol, monoethyl ether | 1.0E+05 | max | 1.0E+05 | max | 7.3E+03 | nc | 7.3E+04 | nc | | |
| | | 1.1E-02 | h | | | 1.1E-02 | r | 0 | 0.10 | 617-84-5 | | Diethylformamide | 6.7E+02 | nc | 9.7E+03 | nc | 4.0E+01 | nc | 4.0E+02 | nc | | |
| 1.2E-03 | i | 6.0E-01 | i | 1.2E-03 | r | 6.0E-01 | r | 0 | 0.10 | 103-23-1 | | Di(2-ethylhexyl)adipate | 4.1E+02 | ca | 2.1E+03 | ca | 5.6E+00 | ca | 5.6E+01 | ca | | |
| | | 8.0E-01 | i | | | 8.0E-01 | r | 0 | 0.10 | 84-66-2 | | Diethyl phthalate | 4.9E+04 | nc | 1.0E+05 | max | 2.9E+03 | nc | 2.9E+04 | nc | | |
| 4.7E+03 | h | | | 4.7E+03 | r | | | 0 | 0.10 | 56-53-1 | | Diethylstilbestrol | 1.0E-04 | ca | 5.2E-04 | ca | 1.4E-06 | ca | 1.4E-05 | ca | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 0 | 0.10 | 43222-48-6 | | Difenzoquat (Avenge) | 4.9E+03 | nc | 7.0E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 35367-38-5 | | Diflubenzuron | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.1E+01 | r | | | 1.1E+01 | i | 1 | | 75-37-6 | | 1,1-Difluoroethane | | | | | 4.2E+04 | nc | 6.9E+04 | nc | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 0 | 0.10 | 1445-75-6 | | Diisopropyl methylphosphonate | 4.9E+03 | nc | 7.0E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 55290-64-7 | | Dimethipin | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-04 | i | | | 2.0E-04 | r | 0 | 0.10 | 60-51-5 | | Dimethoate | 1.2E+01 | nc | 1.8E+02 | nc | 7.3E-01 | nc | 7.3E+00 | nc | | |
| 1.4E-02 | h | | | 1.4E-02 | r | | | 0 | 0.10 | 119-90-4 | | 3,3'-Dimethoxybenzidine | 3.5E+01 | ca | 1.8E+02 | ca | 4.8E-01 | ca | 4.8E+00 | ca | | |
| | | 5.7E-06 | r | | | 5.7E-06 | x | 1 | | 124-40-3 | | Dimethylamine | 6.7E-02 | nc | 2.5E-01 | nc | 2.1E-02 | nc | 3.5E-02 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 121-69-7 | | N-N-Dimethylaniline | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| 7.5E-01 | h | | | 7.5E-01 | r | | | 0 | 0.10 | 95-68-1 | | 2,4-Dimethylaniline | 6.5E-01 | ca | 3.3E+00 | ca | 9.0E-03 | ca | 9.0E-02 | ca | | |
| 5.8E-01 | h | | | 5.8E-01 | r | | | 0 | 0.10 | 21436-96-4 | | 2,4-Dimethylaniline hydrochloride | 8.4E-01 | ca | 4.3E+00 | ca | 1.2E-02 | ca | 1.2E-01 | ca | | |
| 9.2E+00 | h | | | 9.2E+00 | r | | | 0 | 0.10 | 119-93-7 | | 3,3'-Dimethylbenzidine | 5.3E-02 | ca | 2.7E-01 | ca | 7.3E-04 | ca | 7.3E-03 | ca | | |
| 2.6E+00 | x | | | 3.5E+00 | x | | | 0 | 0.10 | 57-14-7 | | 1,1-Dimethylhydrazine | 1.9E-01 | ca | 9.5E-01 | ca | 1.9E-03 | ca | 2.6E-02 | ca | | |
| 3.7E+01 | x | | | 3.7E+01 | x | | | 0 | 0.10 | 540-73-8 | | 1,2-Dimethylhydrazine | 1.3E-02 | ca | 6.7E-02 | ca | 1.8E-04 | ca | 1.8E-03 | ca | | |
| | | 1.0E-01 | h | | | 8.6E-03 | i | 0 | 0.10 | 68-12-2 | | N,N-Dimethylformamide | 6.1E+03 | nc | 8.8E+04 | nc | 3.1E+01 | nc | 3.6E+03 | nc | | |
| | | 1.0E-03 | n | | | 1.0E-03 | r | 0 | 0.10 | 122-09-8 | | Dimethylphenethylamine | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 105-67-9 | | 2,4-Dimethylphenol | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | 9E+00 | 4E-01 |
| | | 8.0E-04 | i | | | 6.0E-04 | r | 0 | 0.10 | 576-26-1 | | 2,6-Dimethylphenol | 3.7E+01 | nc | 5.3E+02 | nc | 2.2E+00 | nc | 2.2E+01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 95-65-8 | | 3,4-Dimethylphenol | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 1.0E+01 | h | | | 1.0E+01 | r | 0 | 0.10 | 131-11-3 | | Dimethyl phthalate | 1.0E+05 | max | 1.0E+05 | max | 3.7E+04 | nc | 3.6E+05 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 120-61-6 | | Dimethyl terephthalate | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |

Key : I=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 131-89-5 | 4,6-Dinitro-o-cyclohexyl phenol | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+01 | nc | 7.3E+01 | nc | | |
| | | 4.0E-04 | h | | | 4.0E-04 | r | 0 | 0.10 | 528-29-0 | 1,2-Dinitrobenzene | 2.4E+01 | nc | 3.5E+02 | nc | 1.5E+00 | nc | 1.5E+01 | nc | | |
| | | 1.0E-04 | i | | | 1.0E-04 | r | 0 | 0.10 | 99-65-0 | 1,3-Dinitrobenzene | 6.1E+00 | nc | 8.8E+01 | nc | 3.7E-01 | nc | 3.6E+00 | nc | | |
| | | 4.0E-04 | h | | | 4.0E-04 | r | 0 | 0.10 | 100-25-4 | 1,4-Dinitrobenzene | 2.4E+01 | nc | 3.5E+02 | nc | 1.5E+00 | nc | 1.5E+01 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 51-28-5 | 2,4-Dinitrophenol | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | 3E-01 | 1E-02 |
| 6.8E-01 | i | | | 6.8E-01 | r | | | 0 | 0.10 | 25321-14-6 | Dinitrotoluene mixture | 7.2E-01 | ca | 3.6E+00 | ca | 9.9E-03 | ca | 9.9E-02 | ca | 8E-04 | 4E-05 |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 121-14-2 | 2,4-Dinitrotoluene (also see Dinitrotoluene mixture) | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | 8E-04 | 4E-05 |
| | | 1.0E-03 | h | | | 1.0E-03 | r | 0 | 0.10 | 606-20-2 | 2,6-Dinitrotoluene (also see Dinitrotoluene mixture) | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | 7E-04 | 3E-05 |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 88-85-7 | Dinoseb | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-02 | r | 0 | 0.10 | 117-84-0 | di-n-Octyl phthalate | 1.2E+03 | nc | 1.0E+04 | sat | 7.3E+01 | nc | 7.3E+02 | nc | 1E+04 | 1E+04 |
| 1.1E-02 | i | | | 1.1E-02 | r | | | 0 | 0.10 | 123-91-1 | 1,4-Dioxane | 4.4E+01 | ca | 2.2E+02 | ca | 6.1E-01 | ca | 6.1E+00 | ca | | |
| 1.5E+05 | h | | | 1.5E+05 | h | | | 0 | 0.03 | 1746-01-6 | Dioxin (2,3,7,8-TCDD) | 3.9E-06 | ca | 2.7E-05 | ca | 4.5E-08 | ca | 4.5E-07 | ca | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 957-51-7 | Diphenamid | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 122-39-4 | Diphenylamine | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| 8.0E-01 | i | | | 7.7E-01 | i | | | 0 | 0.10 | 122-66-7 | 1,2-Diphenylhydrazine | 6.1E-01 | ca | 3.1E+00 | ca | 8.7E-03 | ca | 8.4E-02 | ca | | |
| | | 9.0E-03 | n | | | 9.0E-03 | r | 0 | 0.10 | 127-63-9 | Diphenyl sulfone | 5.5E+02 | nc | 7.9E+03 | nc | 3.3E+01 | nc | 3.3E+02 | nc | | |
| | | 2.2E-03 | i | | | 2.2E-03 | r | 0 | 0.10 | 85-00-7 | Diquat | 1.3E+02 | nc | 1.9E+03 | nc | 8.0E+00 | nc | 8.0E+01 | nc | | |
| 8.6E+00 | h | | | 8.6E+00 | r | | | 0 | 0.10 | 1937-37-7 | Direct black 38 | 5.7E-02 | ca | 2.9E-01 | ca | 7.8E-04 | ca | 7.8E-03 | ca | | |
| 8.1E+00 | h | | | 8.1E+00 | r | | | 0 | 0.10 | 2602-46-2 | Direct blue 6 | 6.0E-02 | ca | 3.0E-01 | ca | 8.3E-04 | ca | 8.3E-03 | ca | | |
| 9.3E+00 | h | | | 9.3E+00 | r | | | 0 | 0.10 | 16071-86-6 | Direct brown 95 | 5.2E-02 | ca | 2.7E-01 | ca | 7.2E-04 | ca | 7.2E-03 | ca | | |
| | | 4.0E-05 | i | | | 4.0E-05 | r | 0 | 0.10 | 298-04-4 | Disulfoton | 2.4E+00 | nc | 3.5E+01 | nc | 1.5E+01 | nc | 1.5E+00 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 505-29-3 | 1,4-Dithiane | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 330-54-1 | Diuron | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0 | 0.10 | 2439-10-3 | Dodine | 2.4E+02 | nc | 3.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 6.0E-03 | i | | | 6.0E-03 | r | 0 | 0.10 | 115-29-7 | Endosulfan | 3.7E+02 | nc | 5.3E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | 2E+01 | 9E-01 |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 145-73-3 | Endothall | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0 | 0.10 | 72-20-8 | Endrin | 1.8E+01 | nc | 2.6E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | 1E+00 | 5E-02 |
| 9.9E-03 | i | 2.0E-03 | h | 4.2E-03 | i | 2.9E-04 | i | 1 | | 106-89-8 | Epichlorohydrin | 7.6E+00 | nc | 2.6E+01 | nc | 1.0E+00 | nc | 2.0E+00 | nc | | |
| | | 5.7E-03 | r | | | 5.7E-03 | i | 0 | 0.10 | 106-88-7 | 1,2-Epoxybutane | 3.5E+02 | nc | 5.0E+03 | nc | 2.1E+01 | nc | 2.1E+02 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 759-94-4 | EPTC (S-Ethyl dipropylthiocarbamate) | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 16672-87-0 | Ethephon (2-chloroethyl phosphonic acid) | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r | 0 | 0.10 | 563-12-2 | Ethion | 3.1E+01 | nc | 4.4E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| | | 4.0E-01 | h | | | 5.7E-02 | i | 0 | 0.10 | 110-80-5 | 2-Ethoxyethanol | 2.4E+04 | nc | 1.0E+05 | max | 2.1E+02 | nc | 1.5E+04 | nc | | |
| | | 3.0E-01 | h | | | 3.0E-01 | r | 0 | 0.10 | 111-15-9 | 2-Ethoxyethanol acetate | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |
| | | 9.0E-01 | i | | | 9.0E-01 | r | 1 | | 141-78-6 | Ethyl acetate | 1.9E+04 | nc | 3.7E+04 | sat | 3.3E+03 | nc | 5.5E+03 | nc | | |
| 4.8E-02 | h | | | 4.8E-02 | r | | | 1 | | 140-88-5 | Ethyl acrylate | 2.1E-01 | ca | 4.5E-01 | ca | 1.4E-01 | ca | 2.3E-01 | ca | | |
| | | 1.0E-01 | i | | | 2.9E-01 | i | 1 | | 100-41-4 | Ethylbenzene | 2.3E+02 | sat | 2.3E+02 | sat | 1.1E+03 | nc | 1.3E+03 | nc | 1E+01 | 7E-01 |
| 2.9E-03 | n | 4.0E-01 | n | 2.9E-03 | r | 2.9E+00 | i | 1 | | 75-00-3 | Ethyl chloride | 3.0E+00 | ca | 6.5E+00 | ca | 2.3E+00 | ca | 4.6E+00 | ca | | |
| | | 3.0E-01 | h | | | 3.0E-01 | r | 0 | 0.10 | 109-78-4 | Ethylene cyanohydrin | 1.8E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.1E+04 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-02 | r | 0 | 0.10 | 107-15-3 | Ethylene diamine | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E+00 | i | | | 2.0E+00 | r | 0 | 0.10 | 107-21-1 | Ethylene glycol | 1.0E+05 | max | 1.0E+05 | max | 7.3E+03 | nc | 7.3E+04 | nc | | |
| | | 5.7E-03 | r | | | 5.7E-03 | h | 0 | 0.10 | 111-76-2 | Ethylene glycol, monobutyl ether | 3.5E+02 | nc | 5.0E+03 | nc | 2.1E+01 | nc | 2.1E+02 | nc | | |
| 1.0E+00 | h | | | 3.5E-01 | h | | | 1 | | 75-21-8 | Ethylene oxide | 1.4E-01 | ca | 3.6E-01 | ca | 1.9E-02 | ca | 2.4E-02 | ca | | |
| 1.1E-01 | h | 8.0E-05 | i | 1.1E-01 | r | 8.0E-05 | r | 0 | 0.10 | 96-45-7 | Ethylene thiourea (ETU) | 4.4E+00 | ca** | 2.2E+01 | ca** | 6.1E-02 | ca** | 6.1E-01 | ca** | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 1 | | 60-29-7 | Ethyl ether | 1.8E+03 | sat | 1.8E+03 | sat | 7.3E+02 | nc | 1.2E+03 | nc | | |
| | | 9.0E-02 | h | | | 9.0E-02 | r | 1 | | 97-63-2 | Ethyl methacrylate | 1.4E+02 | sat | 1.4E+02 | sat | 3.3E+02 | nc | 5.5E+02 | nc | | |
| | | 1.0E-05 | i | | | 1.0E-05 | r | 0 | 0.10 | 2104-64-5 | Ethyl p-nitrophenyl phenylphosphorothioate | 6.1E-01 | nc | 8.8E+00 | nc | 3.7E-02 | nc | 3.6E-01 | nc | | |
| | | 3.0E+00 | i | | | 3.0E+00 | r | 0 | 0.10 | 84-72-0 | Ethylphthalyl ethyl glycolate | 1.0E+05 | max | 1.0E+05 | max | 1.1E+04 | nc | 1.1E+05 | nc | | |
| | | 8.0E-03 | i | | | 8.0E-03 | r | 0 | 0.10 | 101200-48-0 | Express | 4.9E+02 | nc | 7.0E+03 | nc | 2.9E+01 | nc | 2.9E+02 | nc | | |
| | | 2.5E-04 | i | | | 2.5E-04 | r | 0 | 0.10 | 22224-92-6 | Fenamiphos | 1.5E+01 | nc | 2.2E+02 | nc | 9.1E-01 | nc | 9.1E+00 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 2164-17-2 | Fluometuron | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 6.0E-02 | i | | | | | 0 | 0.10 | 16984-48-8 | Fluoride | 3.7E+03 | nc | 5.3E+04 | nc | | | 2.2E+03 | nc | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 0 | 0.10 | 59756-60-4 | Fluoridone | 4.9E+03 | nc | 7.0E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 56425-91-3 | Flurprimidol | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 6.0E-02 | i | | | 6.0E-02 | r | 0 | 0.10 | 66332-96-5 | Flutolanil | 3.7E+03 | nc | 5.3E+04 | nc | 2.2E+02 | nc | 2.2E+03 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 69409-94-5 | Fluvalinate | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 3.5E-03 | i | 1.0E-01 | i | 3.5E-03 | r | 1.0E-01 | r | 0 | 0.10 | 133-07-3 | Folpel | 1.4E+02 | ca | 7.0E+02 | ca | 1.9E+00 | ca | 1.9E+01 | ca | | |
| 1.9E-01 | i | | | 1.9E-01 | r | | | 0 | 0.10 | 72178-02-0 | Fomesafen | 2.6E+00 | ca | 1.3E+01 | ca | 3.5E-02 | ca | 3.5E-01 | ca | | |

Key: i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 944-22-9 | | Fonofos | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 1.5E-01 | i | 4.6E-02 | i | | | 0 | 0.10 | 50-00-0 | | Formaldehyde | 9.2E+03 | nc | 1.0E+05 | nc | 1.5E-01 | ca | 5.5E+03 | nc | | |
| | | 2.0E+00 | h | | | 2.0E+00 | r | 0 | 0.10 | 64-18-6 | | Formic Acid | 1.0E+05 | max | 1.0E+05 | max | 7.3E+03 | nc | 7.3E+04 | nc | | |
| | | 3.0E+00 | i | | | 3.0E+00 | r | 0 | 0.10 | 39148-24-8 | | Fosetyl-al | 1.0E+05 | max | 1.0E+05 | max | 1.1E+04 | nc | 1.1E+05 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 1 | | 110-00-9 | | Furan | 2.5E+00 | nc | 8.5E+00 | nc | 3.7E+00 | nc | 6.1E+00 | nc | | |
| 3.8E+00 | h | | | 3.8E+00 | r | | | 0 | 0.10 | 67-45-8 | | Furazolidone | 1.3E-01 | ca | 6.5E-01 | ca | 1.8E-03 | ca | 1.8E-02 | ca | | |
| | | 3.0E-03 | i | | | 1.4E-02 | h | 0 | 0.10 | 98-01-1 | | Furfural | 1.8E+02 | nc | 2.6E+03 | nc | 5.2E+01 | nc | 1.1E+02 | nc | | |
| 5.0E+01 | h | | | 5.0E+01 | r | | | 0 | 0.10 | 531-82-8 | | Furium | 9.7E-03 | ca | 4.9E-02 | ca | 1.3E-04 | ca | 1.3E-03 | ca | | |
| 3.0E-02 | i | | | 3.0E-02 | r | | | 0 | 0.10 | 60568-05-0 | | Furmecyclox | 1.6E+01 | ca | 8.2E+01 | ca | 2.2E-01 | ca | 2.2E+00 | ca | | |
| | | 4.0E-04 | i | | | 4.0E-04 | r | 0 | 0.10 | 77182-82-2 | | Glufosinate-ammonium | 2.4E+01 | nc | 3.5E+02 | nc | 1.5E+00 | nc | 1.5E+01 | nc | | |
| | | 4.0E-04 | i | | | 2.9E-04 | h | 0 | 0.10 | 765-34-4 | | Glycidaldehyde | 2.4E+01 | nc | 3.5E+02 | nc | 1.0E+00 | nc | 1.5E+01 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 1071-83-6 | | Glyphosate | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 5.0E-05 | i | | | 5.0E-05 | r | 0 | 0.10 | 69806-40-2 | | Haloxyfop-methyl | 3.1E+00 | nc | 4.4E+01 | nc | 1.8E-01 | nc | 1.8E+00 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 79277-27-3 | | Harmony | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| 4.5E+00 | i | 5.0E-04 | i | 4.6E+00 | i | 5.0E-04 | r | 0 | 0.10 | 76-44-8 | | Heptachlor | 1.1E-01 | ca | 5.5E-01 | ca | 1.5E-03 | ca | 1.5E-02 | ca | 2E+01 | 1E+00 |
| 9.1E+00 | i | 1.3E-05 | i | 9.1E+00 | i | 1.3E-05 | r | 0 | 0.10 | 1024-57-3 | | Heptachlor epoxide | 5.3E-02 | ca* | 2.7E-01 | ca* | 7.4E-04 | ca* | 7.4E-03 | ca* | 7E-01 | 3E-02 |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 87-82-1 | | Hexabromobenzene | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| 1.6E+00 | i | 8.0E-04 | i | 1.6E+00 | i | 8.0E-04 | r | 0 | 0.10 | 118-74-1 | | Hexachlorobenzene | 3.0E-01 | ca | 1.5E+00 | ca | 4.2E-03 | ca | 4.2E-02 | ca | 2E+00 | 1E-01 |
| 7.8E-02 | i | 2.0E-04 | h | 7.8E-02 | i | 2.0E-04 | r | 0 | 0.10 | 87-68-3 | | Hexachlorobutadiene | 6.2E+00 | ca** | 3.2E+01 | ca** | 8.6E-02 | ca** | 8.6E-01 | ca** | 2E+00 | 1E-01 |
| 6.3E+00 | i | | | 6.3E+00 | i | | | 0 | 0.04 | 319-84-6 | | HCH (alpha) | 9.0E-02 | ca | 5.9E-01 | ca | 1.1E-03 | ca | 1.1E-02 | ca | 5E-04 | 3E-05 |
| 1.8E+00 | i | | | 1.8E+00 | i | | | 0 | 0.04 | 319-85-7 | | HCH (beta) | 3.2E-01 | ca | 2.1E+00 | ca | 3.7E-03 | ca | 3.7E-02 | ca | 3E-03 | 1E-04 |
| 1.3E+00 | h | 3.0E-04 | i | 1.3E+00 | r | 3.0E-04 | r | 0 | 0.04 | 58-89-9 | | HCH (gamma) Lindane | 4.4E-01 | ca* | 2.9E+00 | ca | 5.2E-03 | ca | 5.2E-02 | ca | 9E-03 | 5E-04 |
| 1.8E+00 | i | | | 1.8E+00 | i | | | 0 | 0.04 | 608-73-1 | | HCH-technical | 3.2E-01 | ca | 2.1E+00 | ca | 3.8E-03 | ca | 3.7E-02 | ca | 3E-03 | 1E-04 |
| | | 7.0E-03 | i | | | 2.0E-05 | h | 0 | 0.10 | 77-47-4 | | Hexachlorocyclopentadiene | 4.2E+02 | nc | 5.9E+03 | nc | 7.3E-02 | nc | 2.6E+02 | nc | 4E+02 | 2E+01 |
| 6.2E+03 | i | | | 4.6E+03 | i | | | 0 | 0.10 | 19408-74-3 | | Hexachlorodibenzo-p-dioxin mixture (HxCDD) | 7.8E-05 | ca | 4.0E-04 | ca | 1.5E-06 | ca | 1.1E-05 | ca | | |
| 1.4E-02 | i | 1.0E-03 | i | 1.4E-02 | i | 1.0E-03 | r | 0 | 0.10 | 67-72-1 | | Hexachloroethane | 3.5E+01 | ca** | 1.8E+02 | ca** | 4.8E-01 | ca** | 4.8E+00 | ca** | 5E-01 | 2E-02 |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0 | 0.10 | 70-30-4 | | Hexachlorophene | 1.8E+01 | nc | 2.6E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| 1.1E-01 | i | 3.0E-03 | i | 1.1E-01 | r | 3.0E-03 | r | 0 | 0.10 | 121-82-4 | | Hexahydro-1,3,5-trinitro-1,3,5-triazine | 4.4E+00 | ca* | 2.2E+01 | ca | 6.1E-02 | ca | 6.1E-01 | ca | | |
| | | 2.9E-06 | r | | | 2.9E-06 | i | 0 | 0.10 | 822-06-0 | | 1,6-Hexamethylene diisocyanate | 1.7E-01 | nc | 2.5E+00 | nc | 1.0E-02 | nc | 1.0E-01 | nc | | |
| | | 6.0E-02 | h | | | 5.7E-02 | i | 1 | | 110-54-3 | | n-Hexane | 1.1E+02 | sat | 1.1E+02 | sat | 2.1E+02 | nc | 3.5E+02 | nc | | |
| | | 3.3E-02 | i | | | 3.3E-02 | r | 0 | 0.10 | 51235-04-2 | | Hexazinone | 2.0E+03 | nc | 2.9E+04 | nc | 1.2E+02 | nc | 1.2E+03 | nc | | |
| 3.0E+00 | i | | | 1.7E+01 | i | | | 0 | 0.10 | 302-01-2 | | Hydrazine, hydrazine sulfate | 1.6E-01 | ca | 8.2E-01 | ca | 3.9E-04 | ca | 2.2E-02 | ca | | |
| | | | | | | 5.7E-03 | i | | | 7647-01-0 | | Hydrogen chloride | | | | | 2.1E+01 | nc | | | | |
| | | 3.0E-03 | i | | | 2.9E-04 | i | | | 7783-06-4 | | Hydrogen sulfide | | | | | 1.0E+00 | nc | 1.1E+02 | nc | | |
| | | 4.0E-02 | h | | | 4.0E-02 | r | 0 | 0.10 | 123-31-9 | | p-Hydroquinone | 2.4E+03 | nc | 3.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 35554-44-0 | | Imazalil | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 2.5E-01 | i | | | 2.5E-01 | r | 0 | 0.10 | 81335-37-7 | | Imazaquin | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 0 | 0.10 | 36734-19-7 | | Iprodione | 2.4E+03 | nc | 3.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | | |
| | | 3.0E-01 | n | | | | | 0 | | 7439-89-6 | | Iron | 2.3E+04 | nc | 1.0E+05 | max | | | 1.1E+04 | nc | | |
| | | 3.0E-01 | i | | | 3.0E-01 | r | 1 | | 78-83-1 | | Isobutanol | 1.3E+04 | nc | 4.0E+04 | sat | 1.1E+03 | nc | 1.8E+03 | nc | | |
| 9.5E-04 | i | 2.0E-01 | i | 9.5E-04 | r | 2.0E-01 | r | 0 | 0.10 | 78-59-1 | | Isophorone | 5.1E+02 | ca* | 2.6E+03 | ca* | 7.1E+00 | ca | 7.1E+01 | ca | 5E-01 | 3E-02 |
| | | 1.5E-02 | i | | | 1.5E-02 | r | 0 | 0.10 | 33820-53-0 | | Isopropalin | 9.2E+02 | nc | 1.3E+04 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.1E-01 | r | 0 | 0.10 | 1832-54-8 | | Isopropyl methyl phosphonic acid | 6.1E+03 | nc | 8.8E+04 | nc | 4.0E+02 | nc | 3.6E+03 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 82558-50-7 | | Isoxaben | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| 1.8E+01 | n | | | 1.8E+01 | r | | | 0 | 0.10 | 143-50-0 | | Kepone | 2.7E-02 | ca | 1.4E-01 | ca | 3.7E-04 | ca | 3.7E-03 | ca | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 77501-63-4 | | Lactofen | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| PRGs Based on EPA Models, IEUBK (1994) and TRW (1996) | | | | | | | | | | 7439-92-1 | | Lead | 4.0E+02 | nc | 1.0E+03 | nc | | | | | | |
| | | 1.0E-07 | i | | | | | 0 | 0.10 | 78-00-2 | | Lead (tetraethyl) | 6.1E-03 | nc | 8.8E-02 | nc | | | 3.6E-03 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 330-55-2 | | Linuron | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 2.0E-02 | x | | | | | 0 | | 7439-93-2 | | Lithium | 1.6E+03 | nc | 4.1E+04 | nc | | | 7.3E+02 | nc | | |
| | | 2.0E-01 | i | | | 2.0E-01 | r | 0 | 0.10 | 83055-99-6 | | Londax | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 121-75-5 | | Malathion | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 108-31-6 | | Maleic anhydride | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 5.0E-01 | i | | | 5.0E-01 | r | 1 | | 123-33-1 | | Maleic hydrazide | 1.7E+03 | nc | 2.4E+03 | sat | 1.8E+03 | nc | 3.0E+03 | nc | | |
| | | 2.0E-05 | h | | | 2.0E-05 | r | 0 | 0.10 | 109-77-3 | | Malononitrile | 1.2E+00 | nc | 1.8E+01 | nc | 7.3E-02 | nc | 7.3E-01 | nc | | |
| | | 3.0E-02 | h | | | 3.0E-02 | r | 0 | 0.10 | 8018-01-7 | | Mancozeb | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| 6.0E-02 | o | 5.0E-03 | i | 6.0E-02 | r | 5.0E-03 | r | 0 | 0.10 | 12427-38-2 | | Maneb | 8.1E+00 | ca* | 4.1E+01 | ca | 1.1E-01 | ca | 1.1E+00 | ca | | |
| | | 2.4E-02 | i | | | 1.4E-05 | i | 0 | | 7439-96-5 | | **Manganese and compounds** | 1.8E+03 | nc | 3.2E+04 | nc | 5.1E-02 | nc | 8.8E+02 | nc | | |

Key : I=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | | | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 9.0E-05 | h | | | 9.0E-05 | r | 0 | 0.10 | 950-10-7 | | | | Mephosfolan | 5.5E+00 | nc | 7.9E+01 | nc | 3.3E-01 | nc | 3.3E+00 | nc | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 24307-26-4 | | | | Mepiquat | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| 2.9E-02 | n | 1.0E-01 | n | 2.9E-02 | r | 1.0E-01 | r | 0 | 0.10 | 149-30-4 | | | | 2-Mercaptobenzothiazole | 1.7E+01 | ca | 8.5E+01 | ca | 2.3E-01 | ca | 2.3E+00 | ca | | |
| | | 3.0E-04 | i | | | | | 0 | | 7487-94-7 | | | | Mercury and compounds | 2.3E+01 | nc | 6.1E+02 | nc | | | 1.1E+01 | nc | | |
| | | | | | | 8.6E-05 | i | | | 7439-97-6 | | | | Mercury (elemental) | | | | | 3.1E-01 | nc | | | | |
| | | 1.0E-04 | i | | | | | 0 | 0.10 | 22967-92-6 | | | | Mercury (methyl) | 6.1E+00 | nc | 8.8E+01 | nc | | | 3.6E+00 | nc | | |
| | | 3.0E-05 | i | | | 3.0E-05 | r | 0 | 0.10 | 150-50-5 | | | | Merphos | 1.8E+00 | nc | 2.6E+01 | nc | 1.1E-01 | nc | 1.1E+00 | nc | | |
| | | 3.0E-05 | i | | | 3.0E-05 | r | 0 | 0.10 | 78-48-8 | | | | Merphos oxide | 1.8E+00 | nc | 2.6E+01 | nc | 1.1E-01 | nc | 1.1E+00 | nc | | |
| | | 6.0E-02 | i | | | 6.0E-02 | r | 0 | 0.10 | 57837-19-1 | | | | Metalaxyl | 3.7E+03 | nc | 5.3E+04 | nc | 2.2E+02 | nc | 2.2E+03 | nc | | |
| | | 1.0E-04 | i | | | 2.0E-04 | h | 1 | | 126-98-7 | | | | Methacrylonitrile | 2.1E+00 | nc | 8.8E+00 | nc | 7.3E-01 | nc | 1.0E+00 | nc | | |
| | | 5.0E-05 | i | | | 5.0E-05 | r | 0 | 0.10 | 10265-92-6 | | | | Methamidophos | 3.1E+00 | nc | 4.4E+01 | nc | 1.8E-01 | nc | 1.8E+00 | nc | | |
| | | 5.0E-01 | i | | | 5.0E-01 | r | 0 | 0.10 | 67-56-1 | | | | Methanol | 3.1E+04 | nc | 1.0E+05 | max | 1.8E+03 | nc | 1.8E+04 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 950-37-8 | | | | Methidathion | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 1 | | 16752-77-5 | | | | Methomyl | 4.4E+01 | nc | 1.5E+02 | nc | 9.1E+01 | nc | 1.5E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 72-43-5 | | | | Methoxychlor | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | 2E+02 | 8E+00 |
| | | 1.0E-03 | h | | | 5.7E-03 | i | 0 | 0.10 | 109-86-4 | | | | 2-Methoxyethanol | 6.1E+01 | nc | 8.8E+02 | nc | 2.1E+01 | nc | 3.6E+01 | nc | | |
| | | 2.0E-03 | h | | | 2.0E-03 | r | 0 | 0.10 | 110-49-6 | | | | 2-Methoxyethanol acetate | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| 4.6E-02 | h | | | 4.6E-02 | r | | | 0 | 0.10 | 99-59-2 | | | | 2-Methoxy-5-nitroaniline | 1.1E+01 | ca | 5.4E+01 | ca | 1.5E-01 | ca | 1.5E+00 | ca | | |
| | | 1.0E+00 | h | | | 1.0E+00 | r | 1 | | 79-20-9 | | | | Methyl acetate | 2.2E+04 | nc | 9.6E+04 | nc | 3.7E+03 | nc | 6.1E+03 | nc | | |
| | | 3.0E-02 | h | | | 3.0E-02 | r | 1 | | 96-33-3 | | | | Methyl acrylate | 7.0E+01 | nc | 2.3E+02 | nc | 1.1E+02 | nc | 1.8E+02 | nc | | |
| 2.4E-01 | h | | | 2.4E-01 | r | | | 0 | 0.10 | 95-53-4 | | | | 2-Methylaniline (o-toluidine) | 2.0E+00 | ca | 1.0E+01 | ca | 2.8E-02 | ca | 2.8E-01 | ca | | |
| 1.8E-01 | h | | | 1.8E-01 | r | | | 0 | 0.10 | 636-21-5 | | | | 2-Methylaniline hydrochloride | 2.7E+00 | ca | 1.4E+01 | ca | 3.7E-02 | ca | 3.7E-01 | ca | | |
| | | 1.0E+00 | x | | | 1.0E+00 | r | 0 | 0.10 | 79-22-1 | | | | Methyl chlorocarbonate | 6.1E+04 | nc | 1.0E+05 | max | 3.7E+03 | nc | 3.6E+04 | nc | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r | 0 | 0.10 | 94-74-6 | | | | 2-Methyl-4-chlorophenoxyacetic acid | 3.1E+01 | nc | 4.4E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 94-81-5 | | | | 4-(2-Methyl-4-chlorophenoxy) butyric acid | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 93-65-2 | | | | 2-(2-Methyl-4-chlorophenoxy) propionic acid | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 16484-77-8 | | | | 2-(2-Methyl-1,4-chlorophenoxy) propionic acid | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 8.6E-01 | r | | | 8.6E-01 | h | 1 | | 108-87-2 | | | | Methylcyclohexane | 2.6E+03 | nc | 8.8E+03 | nc | 3.1E+03 | nc | 5.2E+03 | nc | | |
| 2.5E-01 | h | | | 2.5E-01 | r | | | 0 | 0.10 | 101-77-9 | | | | 4,4'-Methylenebisbenzeneamine | 1.9E+00 | ca | 9.9E+00 | ca | 2.7E-02 | ca | 2.7E-01 | ca | | |
| 1.3E-01 | h | 7.0E-04 | h | 1.3E-01 | h | 7.0E-04 | r | 0 | 0.10 | 101-14-4 | | | | 4,4'-Methylene bis(2-chloroaniline) | 3.7E+00 | ca* | 1.9E+01 | ca* | 5.2E-02 | ca* | 5.2E-01 | ca* | | |
| 4.6E-02 | i | | | 4.6E-02 | r | | | 0 | 0.10 | 101-61-1 | | | | 4,4'-Methylene bis(N,N'-dimethyl)aniline | 1.1E+01 | ca | 5.4E+01 | ca | 1.5E-01 | ca | 1.5E+00 | ca | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 1 | | 74-95-3 | | | | Methylene bromide | 6.7E+01 | nc | 2.4E+02 | nc | 3.7E+01 | nc | 6.1E+01 | nc | | |
| 7.5E-03 | i | 6.0E-02 | i | 1.6E-03 | i | 8.6E-01 | h | 1 | | 75-09-2 | | | | Methylene chloride | 8.9E+00 | ca | 2.1E+01 | ca | 4.1E+00 | ca | 4.3E+00 | ca | 2E-02 | 1E-03 |
| | | 1.7E-04 | r | | | 1.7E-04 | i | 0 | 0.10 | 101-68-8 | | | | 4,4'-Methylene diphenyl diisocyanate | 1.0E+01 | nc | 1.5E+02 | nc | 6.2E-01 | nc | 6.2E+00 | nc | | |
| | | 6.0E-01 | i | | | 2.9E-01 | i | 1 | | 78-93-3 | | | | Methyl ethyl ketone | 7.3E+03 | nc | 2.8E+04 | nc | 1.0E+03 | nc | 1.9E+03 | nc | | |
| 1.1E+00 | h | | | 1.1E+00 | r | | | 0 | 0.10 | 60-34-4 | | | | Methyl hydrazine | 4.4E-01 | ca | 2.2E+00 | ca | 6.1E-03 | ca | 6.1E-02 | ca | | |
| | | 8.0E-02 | h | | | 2.3E-02 | h | 1 | | 108-10-1 | | | | Methyl isobutyl ketone | 7.9E+02 | nc | 2.9E+03 | nc | 8.3E+01 | nc | 1.6E+02 | nc | | |
| | | 5.7E-04 | r | | | 5.7E-04 | n | 0 | 0.10 | 74-93-1 | | | | Methyl Mercaptan | 3.5E+01 | nc | 5.0E+02 | nc | 2.1E+00 | nc | 2.1E+01 | nc | | |
| | | 1.4E+00 | i | | | 2.0E-01 | i | 1 | | 80-62-6 | | | | Methyl methacrylate | 2.2E+03 | nc | 2.7E+03 | sat | 7.3E+02 | nc | 1.4E+03 | nc | | |
| 3.3E-02 | h | | | 3.3E-02 | r | | | 0 | 0.10 | 99-55-8 | | | | 2-Methyl-5-nitroaniline | 1.5E+01 | ca | 7.5E+01 | ca | 2.0E-01 | ca | 2.0E+00 | ca | | |
| | | 2.5E-04 | i | | | 2.5E-04 | r | 0 | 0.10 | 298-00-0 | | | | Methyl parathion | 1.5E+01 | nc | 2.2E+02 | nc | 9.1E-01 | nc | 9.1E+00 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 95-48-7 | | | | 2-Methylphenol | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | 2E+01 | 8E-01 |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 108-39-4 | | | | 3-Methylphenol | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 5.0E-03 | h | | | 5.0E-03 | r | 0 | 0.10 | 106-44-5 | | | | 4-Methylphenol | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.0E-02 | n | | | 2.0E-02 | r | 0 | 0.10 | 993-13-5 | | | | Methyl phosphonic acid | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 6.0E-03 | h | | | 1.1E-02 | h | 1 | | 25013-15-4 | | | | Methyl styrene (mixture) | 1.3E+02 | nc | 5.6E+02 | nc | 4.2E+01 | nc | 6.0E+01 | nc | | |
| | | 7.0E-02 | h | | | 7.0E-02 | r | 1 | | 98-83-9 | | | | Methyl styrene (alpha) | 6.8E+02 | sat | 6.8E+02 | sat | 2.6E+02 | nc | 4.3E+02 | nc | | |
| | | | | | | 8.6E-01 | i | 1 | | 1634-04-4 | | | | Methyl tertbutyl ether (MTBE) | | | | | 3.1E+03 | nc | 2.0E+01 | nc/ca | | |
| | | 1.5E-01 | i | | | 1.5E-01 | r | 0 | 0.10 | 51218-45-2 | | | | Metolachlor (Dual) | 9.2E+03 | nc | 1.0E+05 | max | 5.5E+02 | nc | 5.5E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 21087-64-9 | | | | Metribuzin | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| 1.6E+00 | x | 2.0E-04 | i | 1.6E+00 | r | 2.0E-04 | r | 0 | 0.10 | 2385-85-5 | | | | Mirex | 2.7E-01 | ca* | 1.4E+00 | ca | 3.7E-03 | ca | 3.7E-02 | ca | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 2212-67-1 | | | | Molinate | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 5.0E-03 | h | | | | | 0 | | 7439-98-7 | | | | Molybdenum | 3.9E+02 | nc | 1.0E+04 | nc | | | 1.8E+02 | nc | | |
| | | 1.0E-01 | h | | | 1.0E-01 | h | 0 | 0.10 | 10599-90-3 | | | | Monochloramine | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 300-76-5 | | | | Naled | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 15299-99-7 | | | | Napropamide | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 2.0E-02 | i | | | | | 0 | | 7440-02-0 | | | | Nickel (soluble salts) | 1.6E+03 | nc | 4.1E+04 | nc | | | 7.3E+02 | nc | 1E+02 | 7E+00 |
| | | | | | | | | | | | | | | "CAL-Modified PRG" (PEA, 1994) | 1.5E+02 | | | | | | | | | |

Key: I=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | | | 8.4E-01 | i | | | 0 | | | Nickel refinery dust | | | | | 8.0E-03 | ca | | | | |
| | | | | 1.7E+00 | i | | | 0 | | 12035-72-2 | Nickel subsulfide | | | 1.1E+04 | ca | 4.0E-03 | ca | | | | |
| | | 1.5E-03 | x | | | 1.5E-03 | r | 0 | 0.10 | 1929-82-4 | Nitrapyrin | 9.2E+01 | nc | 1.3E+03 | nc | 5.5E+00 | nc | 5.5E+01 | nc | | |
| Tap Water PRG Based on Infant NOAEL (see IRIS) | | | | | | | | | | 14797-55-8 | Nitrate | | | | | | | 1.0E+04 | nc | | |
| | | 1.0E-01 | x | | | | | | | 10102-43-9 | Nitric Oxide | 7.8E+03 | nc | 1.0E+05 | max | | | 3.6E+03 | nc | | |
| Tap Water PRG Based on Infant NOAEL (see IRIS) | | | | | | | | | | 14797-65-0 | Nitrite | | | | | | | 1.0E+03 | nc | | |
| | | 5.7E-05 | r | | | 5.7E-05 | h | 0 | 0.10 | 88-74-4 | 2-Nitroaniline | 3.5E+00 | nc | 5.0E+01 | nc | 2.1E-01 | nc | 2.1E+00 | nc | | |
| | | 5.0E-04 | i | | | 5.7E-04 | h | 1 | | 98-95-3 | Nitrobenzene | 2.0E+01 | nc | 1.1E+02 | nc | 2.1E+00 | nc | 3.4E+00 | nc | 1E-01 | 7E-03 |
| | | 7.0E-02 | h | | | 7.0E-02 | r | 0 | 0.10 | 67-20-9 | Nitrofurantoin | 4.3E+03 | nc | 6.2E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| 1.5E+00 | h | | | 9.4E+00 | h | | | 0 | 0.10 | 59-87-0 | Nitrofurazone | 3.2E-01 | ca | 1.6E+00 | ca | 7.2E-04 | ca | 4.5E-02 | ca | | |
| 1.4E-02 | n | | | 1.4E-02 | r | | | 0 | 0.10 | 55-63-0 | Nitroglycerin | 3.5E+01 | ca | 1.8E+02 | ca | 4.8E-01 | ca | 4.8E+00 | ca | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 556-88-7 | Nitroguanidine | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 8.0E-03 | n | | | 8.00E-03 | r | 0 | 0.10 | 100-02-7 | 4-Nitrophenol | 4.9E+02 | nc | 7.0E+03 | nc | 2.9E+01 | nc | 2.9E+02 | nc | | |
| 9.4E+00 | r | 5.7E-03 | r | 9.4E+00 | h | 5.7E-03 | i | 1 | | 79-46-9 | 2-Nitropropane | | | | | 7.2E-04 | ca | 1.2E-03 | ca | | |
| 5.4E+00 | i | | | 5.6E+00 | i | | | 1 | | 924-16-3 | N-Nitrosodi-n-butylamine | 2.4E-02 | ca | 6.1E-02 | ca | 1.2E-03 | ca | 2.0E-03 | ca | | |
| 2.8E+00 | i | | | 2.8E+00 | r | | | 0 | 0.10 | 1116-54-7 | N-Nitrosodiethanolamine | 1.7E-01 | ca | 8.8E-01 | ca | 2.4E-03 | ca | 2.4E-02 | ca | | |
| 1.5E+02 | i | | | 1.5E+02 | i | | | 0 | 0.10 | 55-18-5 | N-Nitrosodiethylamine | 3.2E-03 | ca | 1.6E-02 | ca | 4.5E-05 | ca | 4.5E-04 | ca | | |
| 5.1E+01 | i | | | 4.9E+01 | i | | | 0 | 0.10 | 62-75-9 | N-Nitrosodimethylamine | 9.5E-03 | ca | 4.8E-02 | ca | 1.4E-04 | ca | 1.3E-03 | ca | | |
| 4.9E-03 | i | | | 4.9E-03 | r | | | 0 | 0.10 | 86-30-6 | N-Nitrosodiphenylamine | 9.9E+01 | ca | 5.0E+02 | ca | 1.4E+00 | ca | 1.4E+01 | ca | 1E+00 | 6E-02 |
| 7.0E+00 | i | | | 7.0E+00 | r | | | 0 | 0.10 | 621-64-7 | N-Nitroso di-n-propylamine | 6.9E-02 | ca | 3.5E-01 | ca | 9.6E-04 | ca | 9.6E-03 | ca | 5E-05 | 2E-06 |
| 2.2E+01 | i | | | 2.2E+01 | r | | | 0 | 0.10 | 10595-95-6 | N-Nitroso-N-methylethylamine | 2.2E-02 | ca | 1.1E-01 | ca | 3.1E-04 | ca | 3.1E-03 | ca | | |
| 2.1E+00 | i | | | 2.1E+00 | i | | | 0 | 0.10 | 930-55-2 | N-Nitrosopyrrolidine | 2.3E-01 | ca | 1.2E+00 | ca | 3.1E-03 | ca | 3.2E-02 | ca | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 1 | | 99-08-1 | m-Nitrotoluene | 3.7E+02 | nc | 1.00E+03 | sat | 3.7E+01 | nc | 6.1E+01 | nc | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 1 | | 99-08-1 | o-Nitrotoluene | 3.7E+02 | nc | 1.00E+03 | sat | 3.7E+01 | nc | 6.1E+01 | nc | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 1 | | 99-99-0 | p-Nitrotoluene | 3.7E+02 | nc | 1.00E+03 | sat | 3.7E+01 | nc | 6.1E+01 | nc | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 0 | 0.10 | 27314-13-2 | Norflurazon | 2.4E+03 | nc | 3.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | | |
| | | 7.0E-04 | i | | | 7.0E-04 | r | 0 | 0.10 | 85509-19-9 | NuStar | 4.3E+01 | nc | 6.2E+02 | nc | 2.6E+00 | nc | 2.6E+01 | nc | | |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0 | 0.10 | 32536-52-0 | Octabromodiphenyl ether | 1.8E+02 | nc | 2.6E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 2691-41-0 | Octahydro-1357-tetranitro-1357- tetrazocine (HMX) | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 2.0E-03 | h | | | 2.0E-03 | r | 0 | 0.10 | 152-16-9 | Octamethylpyrophosphoramide | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 19044-88-3 | Oryzalin | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 19666-30-9 | Oxadiazon | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 23135-22-0 | Oxamyl | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0 | 0.10 | 42874-03-3 | Oxyfluorfen | 1.8E+02 | nc | 2.6E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 76738-62-0 | Paclobutrazol | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 4.5E-03 | i | | | 4.5E-03 | r | 0 | 0.10 | 4685-14-7 | Paraquat | 2.7E+02 | nc | 4.0E+03 | nc | 1.6E+01 | nc | 1.6E+02 | nc | | |
| | | 6.0E-03 | h | | | 6.0E-03 | r | 0 | 0.10 | 56-38-2 | Parathion | 3.7E+02 | nc | 5.3E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | | |
| | | 5.0E-02 | h | | | 5.0E-02 | r | 0 | 0.10 | 1114-71-2 | Pebulate | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 0 | 0.10 | 40487-42-1 | Pendimethalin | 2.4E+03 | nc | 3.5E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | | |
| 2.3E-02 | h | | | 2.3E-02 | r | | | 0 | 0.10 | 87-84-3 | Pentabromo-6-chloro cyclohexane | 2.1E+01 | ca | 1.1E+02 | ca | 2.9E-01 | ca | 2.9E+00 | ca | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 32534-81-9 | Pentabromodiphenyl ether | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 8.0E-04 | i | | | 8.0E-04 | r | 0 | 0.10 | 608-93-5 | Pentachlorobenzene | 4.9E+01 | nc | 7.0E+02 | nc | 2.9E+00 | nc | 2.9E+01 | nc | | |
| 2.6E-01 | h | 3.0E-03 | i | 2.6E-01 | r | 3.0E-03 | r | 0 | 0.10 | 82-68-8 | Pentachloronitrobenzene | 1.9E+00 | ca* | 9.5E+00 | ca | 2.6E-02 | ca | 2.6E-01 | ca | | |
| 1.2E-01 | i | 3.0E-02 | i | 1.2E-01 | r | 3.0E-02 | r | 0 | 0.25 | 87-86-5 | Pentachlorophenol | 3.0E+00 | ca | 1.1E+01 | ca | 5.6E-02 | ca | 5.6E-01 | ca | 3E-02 | 1E-03 |
| | | 5.0E-04 | x | | | | | 0 | | 7601-90-3 | Perchlorate | 3.9E+01 | nc | 1.0E+03 | nc | | | 1.8E+01 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 52645-53-1 | Permethrin | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 2.5E-01 | i | | | 2.5E-01 | r | 0 | 0.10 | 13684-63-4 | Phenmedipham | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 6.0E-01 | i | | | 6.0E-01 | r | 0 | 0.10 | 108-95-2 | Phenol | 3.7E+04 | nc | 1.0E+05 | max | 2.2E+03 | nc | 2.2E+04 | nc | 1E+02 | 5E+00 |
| | | 2.0E-03 | n | | | 2.0E-03 | r | 0 | 0.10 | 92-84-2 | Phenothiazine | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 6.0E-03 | i | | | 6.0E-03 | r | 0 | 0.10 | 108-45-2 | m-Phenylenediamine | 3.7E+02 | nc | 5.3E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | | |
| | | 1.9E-01 | h | | | 1.9E-01 | r | 0 | 0.10 | 106-50-3 | p-Phenylenediamine | 1.2E+04 | nc | 1.0E+05 | max | 6.9E+02 | nc | 6.9E+03 | nc | | |
| | | 8.0E-05 | i | | | 8.0E-05 | r | 0 | 0.10 | 62-38-4 | Phenylmercuric acetate | 4.9E+00 | nc | 7.0E+01 | nc | 2.9E-01 | nc | 2.9E+00 | nc | | |
| 1.9E-03 | h | | | 1.9E-03 | r | | | 0 | 0.10 | 90-43-7 | 2-Phenylphenol | 2.5E+02 | ca | 1.3E+03 | ca | 3.5E+00 | ca | 3.5E+01 | ca | | |
| | | 2.0E-04 | h | | | 2.0E-04 | r | 0 | 0.10 | 298-02-2 | Phorate | 1.2E+01 | nc | 1.8E+02 | nc | 7.3E-01 | nc | 7.3E+00 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 732-11-6 | Phosmet | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 3.0E-04 | h | | | 8.6E-05 | i | 0 | 0.10 | 7803-51-2 | Phosphine | 1.8E+01 | nc | 2.6E+02 | nc | 3.1E-01 | nc | 1.1E+01 | nc | | |
| | | | | | | 2.9E-03 | i | | | 7664-38-2 | Phosphoric acid | | | | | 1.0E+01 | nc | | | | |
| | | 2.0E-05 | i | | | | | 0 | | 7723-14-0 | Phosphorus (white) | 1.6E+00 | nc | 4.1E+01 | nc | | | 7.3E-01 | nc | | |

Key: i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFI 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 1.0E+00 | h | | | 1.0E+00 | r | 0 | 0.10 | 100-21-0 | p-Phthalic acid | 6.1E+04 | nc | 1.0E+05 | max | 3.7E+03 | nc | 3.6E+04 | nc | | |
| | | 2.0E+00 | i | | | 3.4E-02 | h | 0 | 0.10 | 85-44-9 | Phthalic anhydride | 1.0E+05 | max | 1.0E+05 | max | 1.2E+02 | nc | 7.3E+04 | nc | | |
| | | 7.0E-02 | i | | | 7.0E-02 | r | 0 | 0.10 | 1918-02-1 | Picloram | 4.3E+03 | nc | 6.2E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 23505-41-1 | Pirimiphos-methyl | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 8.9E+00 | h | 7.0E-06 | h | 8.9E+00 | r | 7.0E-06 | r | 0 | 0.10 | | Polybrominated biphenyls | 5.5E-02 | ca** | 2.8E-01 | ca* | 7.6E-04 | ca* | 7.6E-03 | ca* | | |
| 2.0E+00 | i | | | 2.0E+00 | i | | | 0 | 0.14 | 1336-36-3 | Polychlorinated biphenyls (PCBs) | 2.2E-01 | ca | 1.0E+00 | ca | 3.4E-03 | ca | 3.4E-02 | ca | | |
| 7.0E-02 | i | 7.0E-05 | i | 7.0E-02 | i | 7.0E-05 | r | 0 | 0.14 | 12674-11-2 | **Aroclor 1016** | 3.9E+00 | nc | 2.9E+01 | ca** | 9.6E-02 | ca** | 9.6E-01 | ca** | | |
| 2.0E+00 | i | | | 2.0E+00 | i | | | 0 | 0.14 | 11104-28-2 | **Aroclor 1221** | 2.2E-01 | ca | 1.0E+00 | ca | 3.4E-03 | ca | 3.4E-02 | ca | | |
| 2.0E+00 | i | | | 2.0E+00 | i | | | 0 | 0.14 | 11141-16-5 | **Aroclor 1232** | 2.2E-01 | ca | 1.0E+00 | ca | 3.4E-03 | ca | 3.4E-02 | ca | | |
| 2.0E+00 | i | | | 2.0E+00 | i | | | 0 | 0.14 | 53469-21-9 | **Aroclor 1242** | 2.2E-01 | ca | 1.0E+00 | ca | 3.4E-03 | ca | 3.4E-02 | ca | | |
| 2.0E+00 | i | | | 2.0E+00 | i | | | 0 | 0.14 | 12672-29-6 | **Aroclor 1248** | 2.2E-01 | ca | 1.0E+00 | ca | 3.4E-03 | ca | 3.4E-02 | ca | | |
| 2.0E+00 | i | 2.0E-05 | i | 2.0E+00 | i | 2.0E-05 | r | 0 | 0.14 | 11097-69-1 | **Aroclor 1254** | 2.2E-01 | ca** | 1.0E+00 | ca* | 3.4E-03 | ca* | 3.4E-02 | ca* | | |
| 2.0E+00 | i | | | 2.0E+00 | i | | | 0 | 0.14 | 11096-82-5 | **Aroclor 1260** | 2.2E-01 | ca | 1.0E+00 | ca | 3.4E-03 | ca | 3.4E-02 | ca | | |
| | | | | | | | | | 0.13 | | Polynuclear aromatic hydrocarbons (PAHs) | | | | | | | | | | |
| | | 6.0E-02 | i | | | 6.0E-02 | r | 1 | | 83-32-9 | Acenaphthene | 3.7E+03 | nc | 3.8E+04 | nc | 2.2E+02 | nc | 3.7E+02 | nc | 6E+02 | 3E+01 |
| | | 3.0E-01 | i | | | 3.0E-01 | r | 1 | | 120-12-7 | Anthracene | 2.2E+04 | nc | 1.0E+05 | max | 1.1E+03 | nc | 1.8E+03 | nc | 1E+04 | 6E+02 |
| 7.3E-01 | n | | | 3.1E-01 | n | | | 0 | 0.13 | 56-55-3 | Benz[a]anthracene | 6.2E-01 | ca | 2.9E+00 | ca | 2.2E-02 | ca | 9.2E-02 | ca | 2E+00 | 8E-02 |
| 7.3E-01 | n | | | 3.1E-01 | n | | | 0 | 0.13 | 205-99-2 | Benzo[b]fluoranthene | 6.2E-01 | ca | 2.9E+00 | ca | 2.2E-02 | ca | 9.2E-02 | ca | 5E+00 | 2E-01 |
| 7.3E-02 | n | | | 3.1E-02 | n | | | 0 | 0.13 | 207-08-9 | Benzo[k]fluoranthene | 6.2E+00 | ca | 2.9E+01 | ca | 2.2E-01 | ca | 9.2E-01 | ca | 5E+01 | 2E+00 |
| | | | | | | | | | | | **"CAL-Modified PRG" (PEA, 1994)** | 6.1E-01 | | | | | | | | | |
| 7.3E+00 | i | | | 3.1E+00 | n | | | 0 | 0.13 | 50-32-8 | Benzo[a]pyrene | 6.2E-02 | ca | 2.9E-01 | ca | 2.2E-03 | ca | 9.2E-03 | ca | 8E+00 | 4E-01 |
| | | | | | | | | | | | **"CAL-Modified PRG" (PEA, 1994)** | | | | | | | 1.5E-03 | | | |
| 7.3E-03 | n | | | 3.1E-03 | n | | | 0 | 0.13 | 218-01-9 | Chrysene | 6.2E+01 | ca | 2.9E+02 | ca | 2.2E+00 | ca | 9.2E+00 | ca | 2E+02 | 8E+00 |
| | | | | | | | | | | | **"CAL-Modified PRG" (PEA, 1994)** | 6.1E+00 | | | | | | | | | |
| 7.3E+00 | n | | | 3.1E+00 | n | | | 0 | 0.13 | 53-70-3 | Dibenz[ah]anthracene | 6.2E-02 | ca | 2.9E-01 | ca | 2.2E-03 | ca | 9.2E-03 | ca | 2E+00 | 8E-02 |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 0 | 0.13 | 206-44-0 | Fluoranthene | 2.3E+03 | nc | 3.0E+04 | nc | 1.5E+02 | nc | 1.5E+03 | nc | 4E+03 | 2E+02 |
| | | 4.0E-02 | i | | | 4.0E-02 | r | 1 | | 86-73-7 | Fluorene | 2.6E+03 | nc | 3.3E+04 | nc | 1.5E+02 | nc | 2.4E+02 | nc | 6E+02 | 3E+01 |
| 7.3E-01 | n | | | 3.1E-01 | n | | | 0 | 0.13 | 193-39-5 | Indeno[1,2,3-cd]pyrene | 6.2E-01 | ca | 2.9E+00 | ca | 2.2E-02 | ca | 9.2E-02 | ca | 1E+01 | 7E-01 |
| | | 2.0E-02 | i | | | 8.6E-04 | i | 1 | | 91-20-3 | Naphthalene | 5.6E+01 | nc | 1.9E+02 | nc | 3.1E+00 | nc | 6.2E+00 | nc | 8E+01 | 4E+00 |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 1 | | 129-00-0 | Pyrene | 2.3E+03 | nc | 5.4E+04 | nc | 1.1E+02 | nc | 1.8E+02 | nc | 4E+03 | 2E+02 |
| 1.5E-01 | i | 9.0E-03 | i | 1.5E-01 | r | 9.0E-03 | r | 0 | 0.10 | 67747-09-5 | Prochloraz | 3.2E+00 | ca | 1.6E+01 | ca | 4.5E-02 | ca | 4.5E-01 | ca | | |
| | | 6.0E-03 | h | | | 6.0E-03 | r | 0 | 0.10 | 26399-36-0 | Profluralin | 3.7E+02 | nc | 5.3E+03 | nc | 2.2E+01 | nc | 2.2E+02 | nc | | |
| | | 1.5E-02 | i | | | 1.5E-02 | r | 0 | 0.10 | 1610-18-0 | Prometon | 9.2E+02 | nc | 1.3E+04 | nc | 5.5E+01 | nc | 5.5E+02 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0 | 0.10 | 7287-19-6 | Prometryn | 2.4E+02 | nc | 3.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 7.5E-02 | i | | | 7.5E-02 | r | 0 | 0.10 | 23950-58-5 | Pronamide | 4.6E+03 | nc | 6.6E+04 | nc | 2.7E+02 | nc | 2.7E+03 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 1918-16-7 | Propachlor | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 709-98-8 | Propanil | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 2312-35-8 | Propargite | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-03 | i | | | 2.0E-03 | r | 0 | 0.10 | 107-19-7 | Propargyl alcohol | 1.2E+02 | nc | 1.8E+03 | nc | 7.3E+00 | nc | 7.3E+01 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 139-40-2 | Propazine | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 2.0E-02 | i | | | 2.0E-02 | r | 0 | 0.10 | 122-42-9 | Propham | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 60207-90-1 | Propiconazole | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 1.0E-01 | i | | | 1.1E-01 | i | 1 | | 98-82-8 | Isopropylbenzene (Cumene) | 1.6E+02 | nc | 5.2E+02 | nc | 4.0E+02 | nc | 6.6E+02 | nc | | |
| | | 1.0E-02 | n | | | 1.0E-02 | r | 1 | | 103-65-1 | n-Propylbenzene | 1.4E+02 | nc | 2.4E+02 | sat | 3.7E+01 | nc | 6.1E+01 | nc | | |
| | | 2.0E+01 | h | | | 2.0E+01 | r | 0 | 0.10 | 57-55-6 | Propylene glycol | 1.0E+05 | max | 1.0E+05 | max | 7.3E+04 | nc | 7.3E+05 | nc | | |
| | | 7.0E-01 | h | | | 7.0E-01 | r | 0 | 0.10 | 111-35-3 | Propylene glycol, monoethyl ether | 4.3E+04 | nc | 1.0E+05 | max | 2.6E+03 | nc | 2.6E+04 | nc | | |
| | | 7.0E-01 | h | | | 5.7E-01 | i | 0 | 0.10 | 107-98-2 | Propylene glycol, monomethyl ether | 4.3E+04 | nc | 1.0E+05 | max | 2.1E+03 | nc | 2.6E+04 | nc | | |
| 2.4E-01 | i | 8.6E-03 | r | 1.3E-02 | i | 8.6E-03 | i | 1 | | 75-56-9 | Propylene oxide | 1.9E+00 | ca* | 9.1E+00 | ca* | 5.2E-01 | ca* | 2.2E-01 | ca | | |
| | | 2.5E-01 | i | | | 2.5E-01 | r | 0 | 0.10 | 81335-77-5 | Pursuit | 1.5E+04 | nc | 1.0E+05 | max | 9.1E+02 | nc | 9.1E+03 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 51630-58-1 | Pydrin | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 110-86-1 | Pyridine | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r | 0 | 0.10 | 13593-03-8 | Quinalphos | 3.1E+01 | nc | 4.4E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| 1.2E+01 | h | | | 1.2E+01 | r | | | 0 | 0.10 | 91-22-5 | Quinoline | 4.1E-02 | ca | 2.1E-01 | ca | 5.6E-04 | ca | 5.6E-03 | ca | | |
| 1.1E-01 | i | 3.0E-03 | i | 1.1E-01 | r | 3.0E-03 | r | 0 | 0.10 | 121-82-4 | RDX (Cyclonite) | 4.4E+00 | ca* | 2.2E+01 | ca | 6.1E-02 | ca | 6.1E-01 | ca | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 10453-86-8 | Resmethrin | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 5.0E-02 | h | | | 5.0E-02 | r | 0 | 0.10 | 299-84-3 | Ronnel | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0 | 0.10 | 83-79-4 | Rotenone | 2.4E+02 | nc | 3.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 78587-05-0 | Savey | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |

Key : I=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFI 1/(mg/kg-d) | | RfDI (mg/kg-d) | | V O C | skin abs: soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | Migration to Ground Water DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| | | 5.0E-03 | i | | | | | 0 | 0.10 | 7783-00-8 | Selenious Acid | 3.1E+02 | nc | 4.4E+03 | nc | | | 1.8E+02 | nc | | |
| | | 5.0E-03 | i | | | | | 0 | | 7782-49-2 | Selenium | 3.9E+02 | nc | 1.0E+04 | nc | | | 1.8E+02 | nc | 5E+00 | 3E-01 |
| | | 5.0E-03 | h | | | | | 0 | 0.10 | 630-10-4 | Selenourea | 3.1E+02 | nc | 4.4E+03 | nc | | | 1.8E+02 | nc | | |
| | | 9.0E-02 | i | | | 9.0E-02 | r | 0 | 0.10 | 74051-80-2 | Sethoxydim | 5.5E+03 | nc | 7.9E+04 | nc | 3.3E+02 | nc | 3.3E+03 | nc | | |
| | | 5.0E-03 | i | | | | | 0 | | 7440-22-4 | Silver and compounds | 3.9E+02 | nc | 1.0E+04 | nc | | | 1.8E+02 | nc | 3E+01 | 2E+00 |
| 1.2E-01 | h | 5.0E-03 | i | 1.2E-01 | r | 2.0E-03 | r | 0 | 0.10 | 122-34-9 | Simazine | 4.1E+00 | ca* | 2.1E+01 | ca | 5.6E-02 | ca | 5.6E-01 | ca | | |
| | | 4.0E-03 | i | | | 4.0E-03 | r | 0 | 0.10 | 26628-22-8 | Sodium azide | 2.4E+02 | nc | 3.5E+03 | nc | 1.5E+01 | nc | 1.5E+02 | nc | | |
| 2.7E-01 | h | 3.0E-02 | i | 2.7E-01 | r | 3.0E-02 | r | 0 | 0.10 | 148-18-5 | Sodium diethyldithiocarbamate | 1.8E+00 | ca | 9.1E+00 | ca | 2.5E-02 | ca | 2.5E-01 | ca | | |
| | | 2.0E-05 | i | | | 2.0E-05 | r | 0 | 0.10 | 62-74-8 | Sodium fluoroacetate | 1.2E+00 | nc | 1.8E+01 | nc | 7.3E-02 | nc | 7.3E-01 | nc | | |
| | | 1.0E-03 | h | | | 1.0E-03 | r | 0 | 0.10 | 13718-26-8 | Sodium metavanadate | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 6.0E-01 | i | | | | | 0 | | 7440-24-6 | Strontium, stable | 4.7E+04 | nc | 1.0E+05 | max | | | 2.2E+04 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0 | 0.10 | 57-24-9 | Strychnine | 1.6E+01 | nc | 2.6E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| | | 2.0E-01 | i | | | 2.9E-01 | i | 1 | | 100-42-5 | Styrene | 1.7E+03 | sat | 1.7E+03 | sat | 1.1E+03 | nc | 1.6E+03 | nc | 4E+00 | 2E-01 |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 88671-89-0 | Systhane | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| 1.5E+05 | h | | | 1.5E+05 | h | | | 0 | 0.03 | 1746-01-6 | 2,3,7,8-TCDD (dioxin) | 3.9E-06 | ca | 2.7E-05 | ca | 4.5E-08 | ca | 4.5E-07 | ca | | |
| | | 7.0E-02 | i | | | 7.0E-02 | r | 0 | 0.10 | 34014-18-1 | Tebuthiuron | 4.3E+03 | nc | 6.2E+04 | nc | 2.6E+02 | nc | 2.6E+03 | nc | | |
| | | 2.0E-02 | h | | | 2.0E-02 | r | 0 | 0.10 | 3383-96-8 | Temephos | 1.2E+03 | nc | 1.8E+04 | nc | 7.3E+01 | nc | 7.3E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 5902-51-2 | Terbacil | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 2.5E-05 | h | | | 2.5E-05 | r | 0 | 0.10 | 13071-79-9 | Terbufos | 1.5E+00 | nc | 2.2E+01 | nc | 9.1E-02 | nc | 9.1E-01 | nc | | |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 886-50-0 | Terbutryn | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0 | 0.10 | 95-94-3 | 1,2,4,5-Tetrachlorobenzene | 1.8E+01 | nc | 2.6E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| 2.6E-02 | i | 3.0E-02 | i | 2.6E-02 | i | 3.0E-02 | r | 1 | | 630-20-6 | 1,1,1,2-Tetrachloroethane | 3.0E+00 | ca | 7.0E+00 | ca | 2.6E-01 | ca | 4.3E-01 | ca | | |
| 2.0E-01 | i | 6.00E-02 | n | 2.0E-01 | i | 6.00E-02 | r | 1 | | 79-34-5 | 1,1,2,2-Tetrachloroethane | 3.8E-01 | ca | 9.0E-01 | ca | 3.3E-02 | ca | 5.5E-02 | ca | 3E-03 | 2E-04 |
| 5.2E-02 | n | 1.0E-02 | i | 2.0E-03 | n | 1.1E-01 | n | 1 | | 127-18-4 | Tetrachloroethylene (PCE) | 5.7E+00 | ca* | 1.9E+01 | ca* | 3.3E+00 | ca | 1.1E+00 | ca | 6E-02 | 3E-03 |
| | | | | | | | | | | | "CAL-Modified PRG" (PEA, 1994) | | | | | 3.2E-01 | | | | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 58-90-2 | 2,3,4,6-Tetrachlorophenol | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| 2.0E+01 | h | | | 2.0E+01 | r | | | 0 | 0.10 | 5216-25-1 | p,a,a,a-Tetrachlorotoluene | 2.4E-02 | ca | 1.2E-01 | ca | 3.4E-04 | ca | 3.4E-03 | ca | | |
| 2.4E-02 | h | 3.0E-02 | i | 2.4E-02 | r | 3.0E-02 | r | 0 | 0.10 | 961-11-5 | Tetrachlorovinphos | 2.0E+01 | ca* | 1.0E+02 | ca | 2.8E-01 | ca | 2.8E+00 | ca | | |
| | | 5.0E-04 | i | | | 5.0E-04 | r | 0 | 0.10 | 3689-24-5 | Tetraethyldithiopyrophosphate | 3.1E+01 | nc | 4.4E+02 | nc | 1.8E+00 | nc | 1.8E+01 | nc | | |
| 7.6E-03 | n | 2.1E-01 | n | 6.6E-03 | n | 8.6E-02 | n | 0 | 0.10 | 109-99-9 | Tetrahydrofuran | 6.4E+01 | ca | 3.2E+02 | ca | 9.9E-01 | ca | 8.8E+00 | ca | | |
| | | 7.0E-05 | x | | | | | 0 | | 1314-32-5 | Thallic oxide | 5.5E+00 | nc | 1.4E+02 | nc | | | 2.6E+00 | nc | | |
| | | 9.0E-05 | i | | | | | 0 | | 563-68-8 | Thallium acetate | 7.0E+00 | nc | 1.8E+02 | nc | | | 3.3E+00 | nc | 7E-01 | 4E-01 |
| | | 8.0E-05 | i | | | | | 0 | | 6533-73-9 | Thallium carbonate | 6.3E+00 | nc | 1.6E+02 | nc | | | 2.9E+00 | nc | 7E-01 | 4E-01 |
| | | 8.0E-05 | i | | | | | 0 | | 7791-12-0 | Thallium chloride | 6.3E+00 | nc | 1.6E+02 | nc | | | 2.9E+00 | nc | 7E-01 | 4E-01 |
| | | 9.0E-05 | i | | | | | 0 | | 10102-45-1 | Thallium nitrate | 7.0E+00 | nc | 1.8E+02 | nc | | | 3.3E+00 | nc | 7E-01 | 4E-01 |
| | | 9.0E-05 | x | | | | | 0 | | 12039-52-0 | Thallium selenite | 7.0E+00 | nc | 1.8E+02 | nc | | | 3.3E+00 | nc | 7E-01 | 4E-01 |
| | | 8.0E-05 | i | | | | | 0 | | 7446-18-6 | Thallium sulfate | 6.3E+00 | nc | 1.6E+02 | nc | | | 2.9E+00 | nc | 7E-01 | 4E-01 |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 28249-77-6 | Thiobencarb | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 1.0E-01 | n | | | 1.0E-01 | r | 0 | 0.10 | N/A | Thiocyanate | 6.1E+03 | nc | 1.0E+05 | max | 3.7E+02 | nc | 3.6E+03 | nc | | |
| | | 3.0E-04 | h | | | 3.0E-04 | r | 0 | 0.10 | 39196-18-4 | Thiofanox | 1.8E+01 | nc | 2.6E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| | | 8.0E-02 | i | | | 8.0E-02 | r | 0 | 0.10 | 23564-05-8 | Thiophanate-methyl | 4.9E+03 | nc | 7.0E+04 | nc | 2.9E+02 | nc | 2.9E+03 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 137-26-8 | Thiram | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 6.0E-01 | h | | | | | 0 | | | Tin (inorganic, see tributyltin oxide for organic tin) | 4.7E+04 | nc | 1.0E+05 | max | | | 2.2E+04 | nc | | |
| | | 2.0E-01 | i | | | 1.1E-01 | h | 1 | | 108-88-3 | Toluene | 5.2E+02 | sat | 5.2E+02 | sat | 4.0E+02 | nc | 7.2E+02 | nc | 1E+01 | 6E-01 |
| 3.2E+00 | h | | | 3.2E+00 | r | | | 0 | 0.10 | 95-80-7 | Toluene-2,4-diamine | 1.5E-01 | ca | 7.7E-01 | ca | 2.1E-03 | ca | 2.1E-02 | ca | | |
| | | 6.0E-01 | h | | | 6.0E-01 | r | 0 | 0.10 | 95-70-5 | Toluene-2,5-diamine | 3.7E+04 | nc | 1.0E+05 | max | 2.2E+03 | nc | 2.2E+04 | nc | | |
| | | 2.0E-01 | h | | | 2.0E-01 | r | 0 | 0.10 | 823-40-5 | Toluene-2,6-diamine | 1.2E+04 | nc | 1.0E+05 | max | 7.3E+02 | nc | 7.3E+03 | nc | | |
| 2E-01 | i | | | 2E-01 | r | | | 0 | 0.10 | 106-49-0 | p-Toluidine | 2.6E+00 | ca | 1.3E+01 | ca | 3.5E-02 | ca | 3.5E-01 | ca | | |
| 1.1E+00 | i | | | 1.1E+00 | i | | | 0 | 0.10 | 8001-35-2 | Toxaphene | 4.4E-01 | ca | 2.2E+00 | ca | 6.0E-03 | ca | 6.1E-02 | ca | 3E+01 | 2E+00 |
| | | 7.5E-03 | i | | | 7.5E-03 | r | 0 | 0.10 | 66841-25-6 | Tralomethrin | 4.6E+02 | nc | 6.6E+03 | nc | 2.7E+01 | nc | 2.7E+02 | nc | | |
| | | 1.3E-02 | i | | | 1.3E-02 | r | 0 | 0.10 | 2303-17-5 | Triallate | 7.9E+02 | nc | 1.1E+04 | nc | 4.7E+01 | nc | 4.7E+02 | nc | | |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 82097-50-5 | Triasulfuron | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 0 | 0.10 | 615-54-3 | 1,2,4-Tribromobenzene | 3.1E+02 | nc | 4.4E+03 | nc | 1.8E+01 | nc | 1.8E+02 | nc | | |
| | | 3.0E-04 | i | | | | | 0 | 0.10 | 56-35-9 | Tributyltin oxide (TBTO) | 1.8E+01 | nc | 2.6E+02 | nc | | | 1.1E+01 | nc | | |
| 3.4E-02 | h | | | 3.4E-02 | r | | | 0 | 0.10 | 634-93-5 | 2,4,6-Trichloroaniline | 1.4E+01 | ca | 7.3E+01 | ca | 2.0E-01 | ca | 2.0E+00 | ca | | |
| 2.9E-02 | h | | | 2.9E-02 | r | | | 0 | 0.10 | 33663-50-2 | 2,4,6-Trichloroaniline hydrochloride | 1.7E+01 | ca | 8.5E+01 | ca | 2.3E-01 | ca | 2.3E+00 | ca | | |
| | | 1.0E-02 | i | | | 5.7E-02 | h | 1 | | 120-82-1 | 1,2,4-Trichlorobenzene | 6.5E+02 | nc | 3.00E+03 | sat | 2.1E+02 | nc | 1.9E+02 | nc | 5E+00 | 3E-01 |
| | | 3.5E-02 | n | | | 2.9E-01 | n | 1 | | 71-55-6 | 1,1,1-Trichloroethane | 7.7E+02 | nc | 1.4E+03 | sat | 1.0E+03 | nc | 7.9E+02 | nc | 2E+00 | 1E-01 |

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

# FOR PLANNING PURPOSES

| TOXICITY INFORMATION | | | | | | | | | | | | CONTAMINANT | PRELIMINARY REMEDIATION GOALS (PRGs) | | | | | | | | SOIL SCREENING LEVELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | Migration to Ground Water | |
| SFo 1/(mg/kg-d) | | RfDo (mg/kg-d) | | SFi 1/(mg/kg-d) | | RfDi (mg/kg-d) | | V O C | skin abs. soils | CAS No. | | Residential Soil (mg/kg) | | Industrial Soil (mg/kg) | | Ambient Air (ug/m^3) | | Tap Water (ug/l) | | DAF 20 (mg/kg) | DAF 1 (mg/kg) |
| 5.7E-02 | i | 4.0E-03 | i | 5.6E-02 | i | 4.0E-03 | r | 1 | | 79-00-5 | 1,1,2-Trichloroethane | 8.4E-01 | ca* | 1.9E+00 | ca* | 1.2E-01 | ca | 2.0E-01 | ca | 2E-02 | 9E-04 |
| 1.1E-02 | n | 6.0E-03 | x | 6.0E-03 | n | 6.0E-03 | r | 1 | | 79-01-6 | Trichloroethylene (TCE) | 2.8E+00 | ca** | 6.1E+00 | ca* | 1.1E+00 | ca* | 1.6E+00 | ca* | 6E-02 | 3E-03 |
| | | 3.0E-01 | i | | | 2.0E-01 | h | 1 | | 75-69-4 | Trichlorofluoromethane | 3.9E+02 | nc | 2.00E+03 | sat | 7.3E+02 | nc | 1.3E+03 | nc | | |
| | | 1.0E-01 | i | | | 1.0E-01 | r | 0 | 0.10 | 95-95-4 | 2,4,5-Trichlorophenol | 6.1E+03 | nc | 8.8E+04 | nc | 3.7E+02 | nc | 3.6E+03 | nc | 3E+02 | 1E+01 |
| 1.1E-02 | i | | | 1.1E-02 | i | | | 0 | 0.10 | 88-06-2 | 2,4,6-Trichlorophenol | 4.4E+01 | ca | 2.2E+02 | ca | 6.2E-01 | ca | 6.1E+00 | ca | 2E-01 | 8E-03 |
| | | 1.0E-02 | i | | | 1.0E-02 | r | 0 | 0.10 | 93-76-5 | 2,4,5-Trichlorophenoxyacetic Acid | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| | | 8.0E-03 | i | | | 8.0E-03 | r | 0 | 0.10 | 93-72-1 | 2-(2,4,5-Trichlorophenoxy) propionic acid | 4.9E+02 | nc | 7.0E+03 | nc | 2.9E+01 | nc | 2.9E+02 | nc | | |
| | | 5.0E-03 | i | | | 5.0E-03 | r | 1 | | 598-77-6 | 1,1,2-Trichloropropane | 1.5E+01 | nc | 5.1E+01 | nc | 1.8E+01 | nc | 3.0E+01 | nc | | |
| 7.0E+00 | h | 6.0E-03 | i | 7.0E+00 | r | 5.0E-03 | r | 1 | | 96-18-4 | 1,2,3-Trichloropropane | 1.4E-03 | ca | 3.1E-03 | ca | 9.6E-04 | ca | 1.6E-03 | ca | | |
| | | 5.0E-03 | h | | | 5.0E-03 | r | 1 | | 96-19-5 | 1,2,3-Trichloropropene | 1.2E+01 | nc | 3.9E+01 | nc | 1.8E+01 | nc | 3.0E+01 | nc | | |
| | | 3.0E+01 | i | | | 8.6E+00 | h | 1 | | 76-13-1 | 1,1,2-Trichloro-1,2,2-trifluoroethane | 5.6E+03 | sat | 5.6E+03 | sat | 3.1E+04 | nc | 5.9E+04 | nc | | |
| | | 3.0E-03 | i | | | 3.0E-03 | r | 0 | 0.10 | 58138-08-2 | Tridiphane | 1.8E+02 | nc | 2.6E+03 | nc | 1.1E+01 | nc | 1.1E+02 | nc | | |
| | | 2.0E-03 | r | | | 2.0E-03 | i | 1 | | 121-44-8 | Triethylamine | 2.3E+01 | nc | 8.8E+01 | nc | 7.3E+00 | nc | 1.2E+01 | nc | | |
| 7.7E-03 | i | 7.5E-03 | i | 7.7E-03 | r | 7.5E-03 | r | 0 | 0.10 | 1582-09-8 | Trifluralin | 6.3E+01 | ca** | 3.2E+02 | ca* | 8.7E-01 | ca* | 8.7E+00 | ca* | | |
| | | 5.0E-02 | n | | | 1.7E-03 | n | 1 | | 95-63-6 | 1,2,4-Trimethylbenzene | 5.7E+00 | sat | 5.7E+00 | sat | 6.2E+00 | nc | 1.2E+01 | nc | | |
| | | 5.0E-02 | n | | | 1.7E-03 | n | 1 | | 108-67-8 | 1,3,5-Trimethylbenzene | 2.1E+01 | nc | 7.0E+01 | nc | 6.2E+00 | nc | 1.2E+01 | nc | | |
| 3.7E-02 | h | | | 3.7E-02 | r | | | 0 | 0.10 | 512-56-1 | Trimethyl phosphate | 1.3E+01 | ca | 6.7E+01 | ca | 1.8E-01 | ca | 1.8E+00 | ca | | |
| | | 3.0E-02 | i | | | 3.0E-02 | r | 0 | 0.10 | 99-35-4 | 1,3,5-Trinitrobenzene | 1.8E+03 | nc | 2.6E+04 | nc | 1.1E+02 | nc | 1.1E+03 | nc | | |
| | | 1.0E-02 | h | | | 1.0E-02 | r | 0 | 0.10 | 479-45-8 | Trinitrophenylmethylnitramine | 6.1E+02 | nc | 8.8E+03 | nc | 3.7E+01 | nc | 3.6E+02 | nc | | |
| 3E-02 | i | 5.0E-04 | i | 3E-02 | r | 5.0E-04 | r | 0 | 0.10 | 118-96-7 | 2,4,6-Trinitrotoluene | 1.6E+01 | ca** | 8.2E+01 | ca** | 2.2E-01 | ca** | 2.2E+00 | ca** | | |
| | | 7.0E-03 | h | | | | | 0 | | 7440-62-2 | Vanadium | 5.5E+02 | nc | 1.4E+04 | nc | | | 2.6E+02 | nc | 6E+03 | 3E+02 |
| | | 9.0E-03 | i | | | | | 0 | | 1314-62-1 | Vanadium pentoxide | 7.0E+02 | nc | 1.8E+04 | nc | | | 3.3E+02 | nc | 6E+03 | 3E+02 |
| | | 2.0E-02 | h | | | | | 0 | | 13701-70-7 | Vanadium sulfate | 1.6E+03 | nc | 4.1E+04 | nc | | | 7.3E+02 | nc | 6E+03 | 3E+02 |
| | | 1.0E-03 | i | | | 1.0E-03 | r | 0 | 0.10 | 1929-77-7 | Vernam | 6.1E+01 | nc | 8.8E+02 | nc | 3.7E+00 | nc | 3.6E+01 | nc | | |
| | | 2.5E-02 | i | | | 2.5E-02 | r | 0 | 0.10 | 50471-44-8 | Vinclozolin | 1.5E+03 | nc | 2.2E+04 | nc | 9.1E+01 | nc | 9.1E+02 | nc | | |
| | | 1.0E+00 | h | | | 5.7E-02 | i | 1 | | 108-05-4 | Vinyl acetate | 4.3E+02 | nc | 1.4E+03 | nc | 2.1E+02 | nc | 4.1E+02 | nc | 2E+02 | 8E+00 |
| 1.1E-01 | r | 8.6E-04 | r | 1.1E-01 | h | 8.6E-04 | i | 1 | | 593-60-2 | Vinyl bromide (bromoethene) | 1.9E-01 | ca* | 4.2E-01 | ca* | 6.1E-02 | ca* | 1.0E-01 | ca* | | |
| 1.9E+00 | h | | | 3.0E-01 | h | | | 1 | | 75-01-4 | Vinyl chloride | 2.2E-02 | ca | 4.9E-02 | ca | 2.2E-02 | ca | 2.0E-02 | ca | 1E-02 | 7E-04 |
| | | 3.0E-04 | i | | | 3.0E-04 | r | 0 | 0.10 | 81-81-2 | Warfarin | 1.8E+01 | nc | 2.6E+02 | nc | 1.1E+00 | nc | 1.1E+01 | nc | | |
| | | 2.0E+00 | i | | | 2.0E-01 | x | 1 | 0.10 | 1330-20-7 | Xylenes | 2.1E+02 | sat | 2.1E+02 | sat | 7.3E+02 | nc | 1.4E+03 | nc | 2E+02 | 1E+01 |
| | | 3.0E-01 | i | | | | | 0 | | 7440-66-6 | Zinc | 2.3E+04 | nc | 1.0E+05 | max | | | 1.1E+04 | nc | 1E+04 | 6E+02 |
| | | 3.0E-04 | i | | | | | 0 | | 1314-84-7 | Zinc phosphide | 2.3E+01 | nc | 6.1E+02 | nc | | | 1.1E+01 | nc | | |
| | | 5.0E-02 | i | | | 5.0E-02 | r | 0 | 0.10 | 12122-67-7 | Zineb | 3.1E+03 | nc | 4.4E+04 | nc | 1.8E+02 | nc | 1.8E+03 | nc | | |

# APPENDIX D

# USEPA REGION 3 RISK-BASED CONCENTRATIONS

Sources: I = IRIS, H = HEAST, A = HEAST Alternate, W = Withdrawn from IRIS or HEAST, E = EPA NCEA provisional value, O = other

Basis: C = Carcinogenic effects, N = Noncarcinogenic effects, I = RBC at HI of 0.1, < RBC-c

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil industrial mg/kg | Residential mg/kg | Region III SSLs: Soil, for groundwater migration: DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ACETALDEHYDE | 75070 | | | 2.57E-003 I | 7.7E-003 I | y | 1.6E+000 C | 8.1E-001 C | | | | 3.8E-004 | 7.7E-003 C |
| ACETOCHLOR | 34256821 | 2E-002 I | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | | |
| ACETONE | 67641 | 1.00E-001 I | | | | y | 6.1E+002 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 1.2E-001 | 2.5E+000 N |
| ACETONITRILE | 75058 | | | 1.7E-002 I | | y | 1.2E+002 N | 6.2E+001 N | | | | 2.9E-002 | 5.8E-001 N |
| ACETOPHENONE | 98862 | 1.00E-001 I | | 5.70E-006 W | | y | 4.2E-002 N | 2.1E-002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 1.1E-005 | 2.2E-004 N |
| ACROLEIN | 107028 | 2.00E-002 H | | 5.70E-006 I | | y | 4.2E-002 N | 2.1E-002 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 1.0E-005 | 2.0E-004 N |
| ACRYLAMIDE | 79061 | 2.00E-004 I | 4.50E+000 I | | 4.50E+000 I | | 1.5E-002 C | 1.4E-003 C | 7.0E-004 C | 1.3E+000 C | 1.4E-001 C | 3.7E-006 | 7.4E-005 C |
| ACRYLONITRILE | 107131 | 1.00E-003 H | 5.40E-001 I | 5.70E-004 I | 2.40E-001 I | y | 3.7E-002 C | 2.6E-002 C | 5.8E-003 C | 1.1E+001 C | 1.2E+000 C | 7.4E-006 | 1.5E-004 C |
| ALACHLOR | 15972608 | 1.00E-002 I | 8.00E-002 H | | | | 8.4E-001 C | 7.8E-002 C | 3.9E-002 C | 7.2E+001 C | 8.0E+000 C | 3.5E-004 | 7.0E-003 C |
| ALAR | 1596845 | 1.50E-001 I | | | | | 5.5E+003 N | 5.5E+002 N | 2.0E+002 N | 3.1E+005 N | 1.2E+004 N | | |
| ALDICARB | 116063 | 1.00E-003 I | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | 1.0E-002 | 2.1E-001 N |
| ALDICARB SULFONE | 1646884 | 1.00E-003 I | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | 7.5E-003 | 1.5E-001 N |
| ALDRIN | 309002 | 3.00E-005 I | 1.70E+001 I | | 1.70E+001 I | | 3.9E-003 C | 3.7E-004 C | 1.9E-004 C | 3.4E-001 C | 3.8E-002 C | 3.8E-004 | 7.7E-003 C |
| ALUMINUM | 7429905 | 1.00E+000 E | | 1.00E-003 E | | | 3.7E+004 N | 3.7E+000 N | 1.4E+003 N | 2.0E+006 N | 7.8E+004 N | | |
| AMINODINITROTOLUENES | | 6.00E-005 E | | | | | 2.2E+000 N | 2.2E-001 N | 8.1E-002 N | 1.2E+002 N | 4.7E+000 N | | |
| 4-AMINOPYRIDINE | 504245 | 2.00E-005 H | | | | | 7.3E-001 N | 7.3E-002 N | 2.7E-002 N | 4.1E+001 N | 1.6E+000 N | | |
| AMMONIA | 7664417 | | | 2.86E-002 I | | y | 2.1E+002 N | 1.0E+002 N | | | | | |
| ANILINE | 62533 | 7.00E-003 E | 5.70E-003 I | 2.90E-004 I | | | 1.2E+001 C | 1.1E+000 N | 5.5E-001 C | 1.0E+003 C | 1.1E+002 C I | 6.8E-003 | 1.4E-001 C |
| ANTIMONY | 7440360 | 4.00E-004 I | | | | | 1.5E+001 N | 1.5E+000 N | 5.4E-001 N | 8.2E+002 N | 3.1E+001 N | 6.8E-001 | 1.3E+001 N |
| ANTIMONY PENTOXIDE | 1314609 | 5.00E-004 H | | | | | 1.8E+001 N | 1.8E+000 N | 6.8E-001 N | 1.0E+003 N | 3.9E+001 N | | |
| ANTIMONY TETROXIDE | 1332816 | 4.00E-004 H | | | | | 1.5E+001 N | 1.5E+000 N | 5.4E-001 N | 8.2E+002 N | 3.1E+001 N | | |
| ANTIMONY TRIOXIDE | 1309644 | 4.00E-004 H | | 5.70E-005 I | | | 1.5E+001 N | 2.1E-001 N | 5.4E-001 N | 8.2E+002 N | 3.1E+001 N | | |
| ARSENIC | 7440382 | 3.00E-004 I | 1.50E+000 I | | 1.51E+001 I | | 4.5E-002 C | 4.1E-004 C | 2.1E-003 C | 3.8E+000 C | 4.3E-001 C | 1.3E-003 | 2.6E-002 C |
| ARSINE | 7784421 | | | 1.40E-005 I | | y | 1.0E-001 N | 5.1E-002 N | | | | | |
| ASSURE | 76578148 | 9.00E-003 I | | | | | 3.3E+002 N | 3.3E+001 N | 1.2E+001 N | 1.8E+004 N | 7.0E+002 N | | |
| ATRAZINE | 1912249 | 3.50E-002 I | 2.20E-001 H | | | | 3.0E-001 C | 2.8E-002 C | 1.4E-002 C | 2.6E+001 C | 2.9E+000 C | 4.4E-004 | 8.8E-003 C |
| AZOBENZENE | 103333 | | 1.10E-001 I | | 1.10E-001 I | | 6.1E-001 C | 5.7E-002 C | 2.9E-002 C | 5.2E+001 C | 5.8E+000 C | 1.8E-003 | 3.5E-002 C |
| BARIUM | 7440393 | 7.00E-002 I | | 1.40E-004 A | | | 2.6E+003 N | 5.1E-001 N | 9.5E+001 N | 1.4E+005 N | 5.5E+003 N | 1.1E+002 | 2.1E+003 N |
| BAYGON | 114261 | 4.00E-003 I | | | | | 1.5E+002 N | 1.5E+001 N | 5.4E+000 N | 8.2E+003 N | 3.1E+002 N | | |
| BAYTHROID | 68359375 | 2.50E-002 I | | | | | 9.1E+002 N | 9.1E+001 N | 3.4E+001 N | 5.1E+004 N | 2.0E+003 N | | |
| BENTAZON | 25057890 | 3.00E-002 I | | | | | 1.1E+003 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | | |
| BENZALDEHYDE | 100527 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| BENZENE | 71432 | 3.00E-003 E | 5.5E-002 I | 1.70E-003 E | 2.90E-002 I | y | 3.2E-001 C | 2.2E-001 C | 5.7E-002 C | 1.0E+002 C | 1.2E+001 C | 9.0E-005 | 1.8E-003 C |
| BENZENETHIOL | 108985 | 1.00E-005 H | | | | y | 6.1E-002 N | 3.7E-002 N | 1.4E-002 N | 2.0E+001 N | 7.8E-001 N | | |
| BENZIDINE | 92875 | 3.00E-003 I | 2.30E+002 I | | 2.30E+002 I | | 2.9E-004 C | 2.7E-005 C | 1.4E-005 C | 2.5E-002 C | 2.8E-003 C | | |
| BENZOIC ACID | 65850 | 4.00E+000 I | | | | | 1.5E+005 N | 1.5E+004 N | 5.4E+003 N | 8.2E+006 N | 3.1E+005 N | | |
| BENZYL ALCOHOL | 100516 | 3.00E-001 H | | | | | 1.1E+004 N | 1.1E+003 N | 4.1E+002 N | 6.1E+005 N | 2.3E+004 N | 4.4E+000 | 8.8E+001 N |
| BENZYL CHLORIDE | 100447 | | 0.17 I | | | y | 6.2E-002 C | 3.7E-002 C | 1.9E-002 C | 3.4E+001 C | 3.8E+000 C | 1.9E-005 | 3.7E-004 C |
| BERYLLIUM | 7440417 | 2.00E-003 I | | 5.7E-006 I | 8.40E+000 I | | 7.3E+001 N | 7.5E-004 C | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | 5.8E+001 | 1.2E+003 N |
| BIPHENYL | 92524 | 5.00E-002 I | | | | y | 3.0E+002 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | 4.8E+000 | 9.6E+001 N |
| BIS(2-CHLOROETHYL)ETHER | 111444 | | 1.10E+000 I | | 1.10E+000 I | y | 9.6E-003 C | 5.7E-003 C | 2.9E-003 C | 5.2E+000 C | 5.8E-001 C | 2.2E-006 | 4.4E-005 C |
| BIS(2-CHLOROISOPROPYL)ETHER | 108601 | 4.00E-002 I | 7.00E-002 H | | 3.50E-002 H | y | 2.6E-001 C | 1.8E-001 C | 4.5E-002 C | 8.2E+001 C | 9.1E+000 C | 8.4E-005 | 1.7E-003 C |
| BIS(CHLOROMETHYL)ETHER | 542881 | | 2.20E+002 I | | 2.20E+002 I | y | 4.8E-005 C | 2.8E-005 C | 1.4E-005 C | 2.6E-002 C | 2.9E-003 C | 9.7E-009 | 1.9E-007 C |
| BIS(2-ETHYLHEXYL)PHTHALATE | 117817 | 2.00E-002 I | 1.40E-002 I | | 1.40E-002 E | | 4.8E+000 C | 4.5E-001 C | 2.3E-001 C | 4.1E+002 C | 4.6E+001 C | 1.4E+002 | 2.9E+003 C |
| BORON | 7440428 | 9.00E-002 I | | 5.70E-003 H | | | 3.3E+003 N | 2.1E+001 N | 1.2E+002 N | 1.8E+005 N | 7.0E+003 N | | |

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil Industrial mg/kg | Residential mg/kg | Region III SSLs, Soil, for groundwater migration: DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BROMODICHLOROMETHANE | 75274 | 2.00E-002 I | 6.20E-002 I | | | y | 1.7E-001 C | 1.0E-001 C | 5.1E-002 C | 9.2E+001 C | 1.0E+001 C | 5.4E-005 | 1.1E-003 C |
| BROMOETHENE | 593602 | | | 8.6E-004 I | 1.10E-001 H | y | 1.1E-001 C | 5.7E-002 C | | | | 5.4E-005 | 1.1E-003 C |
| **BROMOFORM | 75252 | 2.00E-002 I | 7.90E-003 I | | 3.90E-003 I | | 8.5E+000 C | 1.6E+000 C | 4.0E-001 C | 7.2E+002 C | 8.1E+001 C | 3.3E-003 | 6.7E-002 C |
| BROMOMETHANE | 74839 | 1.40E-003 I | | 1.40E-003 I | | y | 8.5E+000 N | 5.1E+000 N | 1.9E+000 N | 2.9E+003 N | 1.1E+002 N | 2.1E-003 | 4.1E-002 N |
| BROMOPHOS | 2104963 | 5.00E-003 H | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| 1,3-BUTADIENE | 106990 | | | | 1.80E+000 H | y | 7.0E-003 C | 3.6E-003 C | | | | 3.9E-006 | 7.8E-005 C |
| 1-BUTANOL | 71363 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 7.8E-001 | 1.6E+001 N |
| BUTYLBENZYLPHTHALATE | 85687 | 2.00E-001 I | | | | | 7.3E+003 N | 7.3E+002 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | 8.4E+002 | 1.7E+004 N |
| BUTYLATE | 2008415 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| N-BUTYLBENZENE | 104518 | 4.00E-002 E | | | | y | 2.4E+002 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| SEC-BUTYLBENZENE | 135988 | 4.00E-002 E | | | | y | 2.4E+002 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| TERT-BUTYLBENZENE | 98066 | 4.00E-002 E | | | | y | 2.4E+002 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| CADMIUM-WATER | 7440439 | 5.00E-004 I | | 5.7E-005 E | 6.30E+000 I | | 1.8E+001 N | 9.9E-004 C | 6.8E-001 N | 1.0E+003 N | 3.9E+001 N | 1.4E+000 | 2.7E+001 N |
| CADMIUM-FOOD | 7440439 | 1.00E-003 I | | 5.7E-005 E | 6.30E+000 I | | 3.7E+001 N | 9.9E-004 C | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | 2.7E+000 | 5.5E+001 N |
| CAPROLACTAM | 105602 | 5.00E-001 I | | | | | 1.8E+004 N | 1.8E+003 N | 6.8E+002 N | 1.0E+006 N | 3.9E+004 N | | |
| CARBARYL | 63252 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 1.5E+000 | 3.0E+001 N |
| CARBON DISULFIDE | 75150 | 1.00E-001 I | | 2.00E-001 I | | y | 1.0E+003 N | 7.3E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 9.5E-001 | 1.9E+001 N |
| CARBON TETRACHLORIDE | 56235 | 7.00E-004 I | 1.30E-001 I | 5.71E-004 E | 5.30E-002 I | y | 1.6E-001 C | 1.2E-001 C | 2.4E-002 C | 4.4E+001 C | 4.9E+000 C | 1.1E-004 | 2.1E-003 C |
| CARBOSULFAN | 55285148 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| CHLORAL HYDRATE | 302170 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| CHLORANIL | 118752 | | 4.00E-001 H | | | | 1.7E-001 C | 1.6E-002 C | 7.9E-003 C | 1.4E+001 C | 1.6E+000 C | | |
| CHLORDANE | 57749 | 5.00E-004 I | 3.5E-001 I | 2.00E-004 I | 3.5E-001 I | | 1.9E-001 C | 1.8E-002 C | 9.0E-003 C | 1.6E+001 C | 1.8E+000 C | 4.6E-002 | 9.2E-001 C |
| CHLORINE | 7782505 | 1.00E-001 I | | 5.7E-005 E | | y | 4.2E-001 N | 2.1E-001 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| CHLORINE DIOXIDE | 10049044 | | | 5.70E-005 I | | y | 4.2E-001 N | 2.1E-001 N | | | | | |
| CHLOROACETIC ACID | 79118 | 2.00E-003 H | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | | |
| 4-CHLOROANILINE | 106478 | 4.00E-003 I | | | | | 1.5E+002 N | 1.5E+001 N | 5.4E+000 N | 8.2E+003 N | 3.1E+002 N | 4.8E-002 | 9.7E-001 N |
| CHLOROBENZENE | 108907 | 2.00E-002 I | | 1.7E-002 E | | y | 1.1E+002 N | 6.2E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 4.0E-002 | 8.0E-001 N |
| CHLOROBENZILATE | 510156 | 2.00E-002 I | 2.70E-001 H | | 2.70E-001 H | | 2.5E-001 C | 2.3E-002 C | 1.2E-002 C | 2.1E+001 C | 2.4E+000 C | 1.3E-003 | 2.7E-002 C |
| P-CHLOROBENZOIC ACID | 74113 | 2.00E-001 H | | | | | 7.3E+003 N | 7.3E+002 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | | |
| 2-CHLORO-1,3-BUTADIENE | 126998 | 2.00E-002 A | | 2.00E-003 H | | y | 1.4E+001 N | 7.3E+000 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 6.0E-003 | 1.2E-001 N |
| 1-CHLOROBUTANE | 109693 | 4.00E-001 H | | | | y | 2.4E+003 N | 1.5E+003 N | 5.4E+002 N | 8.2E+005 N | 3.1E+004 N | 1.0E+000 | 2.0E+001 N |
| 1-CHLORO-1,1-DIFLUOROETHANE | 75683 | | | 1.40E+001 I | | y | 1.0E+005 N | 5.1E+004 N | | | | 7.0E+001 | 1.4E+003 N |
| CHLORODIFLUOROMETHANE | 75456 | | | 1.40E+001 I | | y | 1.0E+005 N | 5.1E+004 N | | | | 7.0E+001 | 1.4E+003 N |
| CHLOROETHANE | 75003 | 4.00E-001 E | 2.90E-003 E | 2.90E+000 I | | y | 3.6E+000 C | 2.2E+000 C | 1.1E+000 C | 2.0E+003 C | 2.2E+002 C | 9.6E-004 | 1.9E-002 C |
| CHLOROFORM | 67663 | 1.00E-002 I | 6.10E-003 I | 8.6E-005 E | 8.10E-002 I | y | 1.5E-001 C I | 7.7E-002 C I | 5.2E-001 C | 9.4E+002 C | 1.0E+002 C I | 4.5E-005 | 8.9E-004 C |
| CHLOROMETHANE | 74873 | | 1.30E-002 H | 8.6E-002 E | 3.5E-003 E | y | 2.1E+000 C | 1.8E+000 C | 2.4E-001 C | 4.4E+002 C | 4.9E+001 C | 5.2E-004 | 1.0E-002 C |
| 4-CHLORO-2-METHYLANILINE | 95692 | | 5.80E-001 H | | | | 1.2E-001 C | 1.1E-002 C | 5.4E-003 C | 9.9E+000 C | 1.1E+000 C | | |
| BETA-CHLORONAPHTHALENE | 91587 | 8.00E-002 I | | | | y | 4.9E+002 N | 2.9E+002 N | 1.1E+002 N | 1.6E+005 N | 6.3E+003 N | 1.6E+000 | 3.2E+001 N |
| O-CHLORONITROBENZENE | 88733 | | 2.50E-002 H | | | y | 4.2E-001 C | 2.5E-001 C | 1.3E-001 C | 2.3E+002 C | 2.6E+001 C | | |
| P-CHLORONITROBENZENE | 100005 | | 1.80E-002 H | | | y | 5.9E-001 C | 3.5E-001 C | 1.8E-001 C | 3.2E+002 C | 3.5E+001 C | | |
| 2-CHLOROPHENOL | 95578 | 5.00E-003 I | | | | y | 3.0E+001 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| 2-CHLOROPROPANE | 75296 | | | 2.90E-002 H | | y | 2.1E+002 N | 1.1E+002 N | | | | 6.6E-002 | 1.3E+000 N |
| O-CHLOROTOLUENE | 95498 | 2.00E-002 I | | | | y | 1.2E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 6.5E-002 | 1.3E+000 N |
| CHLORPYRIFOS | 2921882 | 3.00E-003 I | | | | | 1.1E+002 N | 1.1E+001 N | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | 3.2E+000 | 6.3E+001 N |
| CHLORPYRIFOS-METHYL | 5598130 | 1.00E-002 H | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC <

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil Industrial mg/kg | Residential mg/kg | Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHROMIUM III | 16065831 | 1.50E+000 I | | | | | 5.5E+004 N | 5.5E+003 N | 2.0E+003 N | 3.1E+006 N | 1.2E+005 N | 9.9E+007 | 2.0E+009 N |
| CHROMIUM VI | 18540299 | 3.00E-003 I | | 3.00E-005 I | 4.10E+001 H | | 1.1E+002 N | 1.5E-004 C | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | 2.1E+000 | 4.2E+001 N |
| COBALT | 7440484 | 6.00E-002 E | | | | | 2.2E+003 N | 2.2E+002 N | 8.1E+001 N | 1.2E+005 N | 4.7E+003 N | | |
| *COKE OVEN EMISSIONS (COAL TAR)* | *8007452* | | | | *2.2 I* | | | *2.8E-003 C* | | | | | |
| COPPER | 7440508 | 4.00E-002 H | | | | | 1.5E+003 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | 5.3E+002 | 1.1E+004 N |
| CROTONALDEHYDE | 123739 | | 1.90E+000 H | | | y | 5.6E-003 C | 3.3E-003 C | 1.7E-003 C | 3.0E+000 C | 3.4E-001 C | 1.5E-005 | 3.1E-004 C |
| CUMENE | 98828 | 1.00E-001 I | | 1.10E-001 I | | y | 6.6E+002 N | 4.0E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 3.2E+000 | 6.4E+001 N |
| CYANIDE (FREE) | 57125 | 2.00E-002 I | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 7.4E+000 | 1.5E+002 N |
| CALCIUM CYANIDE | 592018 | 4E-002 I | | | | | 1.5E+003 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| COPPER CYANIDE | 544923 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| CYANAZINE | 21725462 | 2.00E-003 H | 8.40E-001 H | | | | 8.0E-002 C | 7.5E-003 C | 3.8E-003 C | 6.8E+000 C | 7.6E-001 C | 2.6E-005 | 5.3E-004 C |
| CYANOGEN | 460195 | 4.00E-002 I | | | | y | 2.4E+002 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| CYANOGEN BROMIDE | 506683 | 9.00E-002 I | | | | | 3.3E+003 N | 3.3E+002 N | 1.2E+002 N | 1.8E+005 N | 7.0E+003 N | | |
| CYANOGEN CHLORIDE | 506774 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| HYDROGEN CYANIDE | 74908 | 2.00E-002 I | | 8.60E-004 I | | y | 6.2E+000 N | 3.1E+000 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 1.1E-001 | 2.2E+000 N |
| POTASSIUM CYANIDE | 151508 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| POTASSIUM SILVER CYANIDE | 506616 | 2.00E-001 I | | | | | 7.3E+003 N | 7.3E+002 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | | |
| SILVER CYANIDE | 506649 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 3.1E+001 | 6.2E+002 N |
| SODIUM CYANIDE | 143339 | 4.00E-002 I | | | | | 1.5E+003 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| THIOCYANATE | | 5.00E-002 E | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| ZINC CYANIDE | 557211 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | 1.1E+002 | 2.3E+003 N |
| CYCLOHEXANONE | 108941 | 5.00E+000 I | | | | | 1.8E+005 N | 1.8E+004 N | 6.8E+003 N | 1.0E+007 N | 3.9E+005 N | 6.1E+001 | 1.2E+003 N |
| CYHALOTHRIN/KARATE | 68085858 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| CYPERMETHRIN | 52315078 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| DACTHAL | 1861321 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| DALAPON | 75990 | 3.00E-002 I | | | | | 1.1E+003 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | 3.5E-001 | 7.1E+000 N |
| DDD | 72548 | | 2.40E-001 I | | | | 2.8E-001 C | 2.6E-002 C | 1.3E-002 C | 2.4E+001 C | 2.7E+000 C | 5.6E-001 | 1.1E+001 C |
| DDE | 72559 | | 3.40E-001 I | | | | 2.0E-001 C | 1.8E-002 C | 9.3E-003 C | 1.7E+001 C | 1.9E+000 C | 1.8E+000 | 3.5E+001 C |
| DDT | 50293 | 5.00E-004 I | 3.40E-001 I | | 3.40E-001 I | | 2.0E-001 C | 1.8E-002 C | 9.3E-003 C | 1.7E+001 C | 1.9E+000 C | 5.8E-002 | 1.2E+000 C |
| DIAZINON | 333415 | 9.00E-004 H | | | | | 3.3E+001 N | 3.3E+000 N | 1.2E+000 N | 1.8E+003 N | 7.0E+001 N | 2.1E-002 | 4.3E-001 N |
| DIBENZOFURAN | 132649 | 4.00E-003 E | | | | y | 2.4E+001 N | 1.5E+001 N | 5.4E+000 N | 8.2E+003 N | 3.1E+002 N | 3.8E-001 | 7.7E+000 N |
| 1,4-DIBROMOBENZENE | 106376 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| DIBROMOCHLOROMETHANE | 124481 | 2.00E-002 I | 8.40E-002 I | | | y | 1.3E-001 C | 7.5E-002 C | 3.8E-002 C | 6.8E+001 C | 7.6E+000 C | 4.1E-005 | 8.3E-004 C |
| 1,2-DIBROMO-3-CHLOROPROPANE | 96128 | | 1.40E+000 H | 5.70E-005 I | 2.40E-003 H | y | 4.7E-002 C I | 2.1E-001 N | 2.3E-003 C | 4.1E+000 C | 4.6E-001 C | 4.4E-005 | 8.7E-004 C |
| 1,2-DIBROMOETHANE | 106934 | | 8.50E+001 I | 5.70E-005 H | 7.60E-001 I | y | 7.5E-004 C | 8.2E-003 C | 3.7E-005 C | 6.7E-002 C | 7.5E-003 C | 4.3E-007 | 8.5E-006 C |
| DIBUTYLPHTHALATE | 84742 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 2.5E+002 | 5.0E+003 N |
| DICAMBA | 1918009 | 3.00E-002 I | | | | | 1.1E+003 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | 2.2E-001 | 4.5E+000 N |
| 1,2-DICHLOROBENZENE | 95501 | 9.00E-002 I | | | | y | 5.5E+002 N | 3.3E+002 N | 1.2E+002 N | 1.8E+005 N | 7.0E+003 N | 4.6E-001 | 9.3E+000 N |
| 1,3-DICHLOROBENZENE | 541731 | 9.00E-004 E | | | | y | 5.5E+000 N | 3.3E+000 N | 1.2E+000 N | 1.8E+003 N | 7.0E+001 N | 4.4E-003 | 8.7E-002 N |
| 1,4-DICHLOROBENZENE | 106467 | 3.00E-002 E | 2.40E-002 H | 2.29E-001 I | 2.2E-002 E | y | 4.7E-001 C | 2.8E-001 C | 1.3E-001 C | 2.4E+002 C | 2.7E+001 C | 3.6E-004 | 7.1E-003 C |
| 3,3'-DICHLOROBENZIDINE | 91941 | | 4.50E-001 I | | | | 1.5E-001 C | 1.4E-002 C | 7.0E-003 C | 1.3E+001 C | 1.4E+000 C | 2.5E-004 | 4.9E-003 C |
| 1,4-DICHLORO-2-BUTENE | 764410 | | | | 9.30E+000 H | y | 1.3E-003 C | 6.7E-004 C | | | | 4.0E-007 | 8.0E-006 C |
| DICHLORODIFLUOROMETHANE | 75718 | 2.00E-001 I | | 5.00E-002 A | | y | 3.5E+002 N | 1.8E+002 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | 5.5E-001 | 1.1E+001 N |
| 1,1-DICHLOROETHANE | 75343 | 1.00E-001 H | | 1.40E-001 A | | y | 8.0E+002 N | 5.1E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 2.3E-001 | 4.5E+000 N |
| 1,2-DICHLOROETHANE | 107062 | 3.00E-002 E | 9.10E-002 I | 1.40E-003 E | 9.10E-002 I | y | 1.2E-001 C | 6.9E-002 C | 3.5E-002 C | 6.3E+001 C | 7.0E+000 C | 5.2E-005 | 1.0E-003 C |

Sources I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil industrial mg/kg | Residential mg/kg | Region III SSLs: Soil, for groundwater migration: DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,1-DICHLOROETHENE | 75354 | 9.00E-003 I | 6.00E-001 I | | 1.75E-001 I | y | 4.4E-002 C | 3.6E-002 C | 5.3E-003 C | 9.5E+000 C | 1.1E+000 C | 1.8E-005 | 3.6E-004 C |
| CIS-1,2-DICHLOROETHENE | 156592 | 1.00E-002 H | | | | y | 6.1E+001 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | 1.7E-002 | 3.5E-001 N |
| TRANS-1,2-DICHLOROETHENE | 156605 | 2.00E-002 I | | | | y | 1.2E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 4.1E-002 | 8.2E-001 N |
| TOTAL 1,2-DICHLOROETHENE | 540590 | 9.00E-003 H | | | | y | 5.5E+001 N | 3.3E+001 N | 1.2E+001 N | 1.8E+004 N | 7.0E+002 N | 1.9E-002 | 3.7E-001 N |
| 2,4-DICHLOROPHENOL | 120832 | 3.00E-003 I | | | | | 1.1E+002 N | 1.1E+001 N | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | 6.0E-002 | 1.2E+000 N |
| 2,4-D | 94757 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | 4.5E-001 | 9.0E+000 N |
| 4-(2,4-DICHLOROPHENOXY)BUTYRIC ACID | 94826 | 8E-003 I | | | | | 2.9E+002 N | 2.9E+001 N | 1.1E+001 N | 1.6E+004 N | 6.3E+002 N | | |
| 1,2-DICHLOROPROPANE | 78875 | | 6.80E-002 H | 1.14E-003 I | | y | 1.6E-001 C | 9.2E-002 C | 4.6E-002 C | 8.4E+001 C | 9.4E+000 C | 1.0E-004 | 2.1E-003 C |
| 2,3-DICHLOROPROPANOL | 616239 | 3.00E-003 I | | | | | 1.1E+002 N | 1.1E+001 N | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | | |
| **1,3-DICHLOROPROPENE | 542756 | 3.00E-002 I | 1.00E-001 I | 5.71E-003 I | 1.00E-002 I | y | 4.4E-001 C | 6.3E-001 C | 3.2E-002 C | 5.7E+001 C | 6.4E+000 C | 1.6E-004 | 3.1E-003 C |
| DICHLORVOS | 62737 | 5E-004 I | 0.29 I | 1.43E-004 I | | | 2.3E-001 C | 2.2E-002 C | 1.1E-002 C | 2.0E+001 C | 2.2E+000 C | 5.5E-005 | 1.1E-003 C |
| DICOFOL | 115322 | | 4.4E-001 W | | | | 1.5E-001 C | 1.4E-002 C | 7.2E-003 C | 1.3E+001 C | 1.5E+000 C | 9.3E-004 | 1.9E-002 C |
| DICYCLOPENTADIENE | 77736 | 3E-002 H | | 6.00E-005 A | | y | 4.4E-001 N | 2.2E-001 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | | |
| DIELDRIN | 60571 | 5.00E-005 I | 1.60E+001 I | | 1.60E+001 I | | 4.2E-003 C | 3.9E-004 C | 2.0E-004 C | 3.6E-001 C | 4.0E-002 C | 1.1E-004 | 2.2E-003 C |
| DIESEL EMISSIONS | | | | 1.40E-003 I | | | | 5.1E+000 N | | | | | |
| DIETHYLPHTHALATE | 84662 | 8.00E-001 I | | | | | 2.9E+004 N | 2.9E+003 N | 1.1E+003 N | 1.6E+006 N | 6.3E+004 N | 2.3E+001 | 4.5E+002 N |
| DIETHYLENE GLYCOL, MONOBUTYL ETHER | 112345 | | | 5.70E-003 H | | | | 2.1E+001 N | | | | | |
| DIETHYLENE GLYCOL, MONOETHYL ETHER | 111900 | 2.00E+000 H | | | | | 7.3E+004 N | 7.3E+003 N | 2.7E+003 N | 4.1E+006 N | 1.6E+005 N | | |
| DI(2-ETHYLHEXYL)ADIPATE | 103231 | 6.00E-001 I | 1.20E-003 I | | | | 5.6E+001 C | 5.2E+000 C | 2.6E+000 C | 4.8E+003 C | 5.3E+002 C | | |
| DIETHYLSTILBESTROL | 56531 | | 4.70E+003 H | | | | 1.4E-005 C | 1.3E-006 C | 6.7E-007 C | 1.2E-003 C | 1.4E-004 C | | |
| DIFENZOQUAT (AVENGE) | 43222486 | 8.00E-002 I | | | | | 2.9E+003 N | 2.9E+002 N | 1.1E+002 N | 1.6E+005 N | 6.3E+003 N | | |
| 1,1-DIFLUOROETHANE | 75376 | | | 1.10E+001 I | | y | 8.0E+004 N | 4.0E+004 N | | | | | |
| DIISOPROPYL METHYLPHOSPHONATE (DIMP) | 1445756 | 8.00E-002 I | | | | | 2.9E+003 N | 2.9E+002 N | 1.1E+002 N | 1.6E+005 N | 6.3E+003 N | | |
| 3,3'-DIMETHOXYBENZIDINE | 119904 | | 1.40E-002 H | | | | 4.8E+000 C | 4.5E-001 C | 2.3E-001 C | 4.1E+002 C | 4.6E+001 C | | |
| DIMETHYLAMINE | 124403 | | | 5.70E-006 W | | y | 4.2E-002 N | 2.1E-002 N | | | | 8.5E-006 | 1.7E-004 N |
| 2,4-DIMETHYLANILINE HYDROCHLORIDE | 21436964 | | 5.80E-001 H | | | | 1.2E-001 C | 1.1E-002 C | 5.4E-003 C | 9.9E+000 C | 1.1E+000 C | | |
| 2,4-DIMETHYLANILINE | 95681 | | 7.50E-001 H | | | | 8.9E-002 C | 8.3E-003 C | 4.2E-003 C | 7.6E+000 C | 8.5E-001 C | | |
| N,N-DIMETHYLANILINE | 121697 | 2.00E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | | |
| 3,3'-DIMETHYLBENZIDINE | 119937 | | 9.20E+000 H | | | | 7.3E-003 C | 6.8E-004 C | 3.4E-004 C | 6.2E-001 C | 6.9E-002 C | | |
| 1,1-DIMETHYLHYDRAZINE | 57147 | | 2.60E+000 W | | 3.50E+000 W | | 2.6E-002 C | 1.8E-003 C | 1.2E-003 C | 2.2E+000 C | 2.5E-001 C | | |
| 1,2-DIMETHYLHYDRAZINE | 540738 | | 3.70E+001 W | | 3.70E+001 W | | 1.8E-003 C | 1.7E-004 C | 8.5E-005 C | 1.5E-001 C | 1.7E-002 C | | |
| 2,4-DIMETHYLPHENOL | 105679 | 2.00E-002 I | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 3.4E-001 | 6.7E+000 N |
| 2,6-DIMETHYLPHENOL | 576261 | 6.00E-004 I | | | | | 2.2E+001 N | 2.2E+000 N | 8.1E-001 N | 1.2E+003 N | 4.7E+001 N | | |
| 3,4-DIMETHYLPHENOL | 95658 | 1.00E-003 I | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | | |
| DIMETHYLPHTHALATE | 131113 | 1.00E+001 W | | | | | 3.7E+005 N | 3.7E+004 N | 1.4E+004 N | 2.0E+007 N | 7.8E+005 N | | |
| 1,2-DINITROBENZENE | 528290 | 4.00E-004 H | | | | | 1.5E+001 N | 1.5E+000 N | 5.4E-001 N | 8.2E+002 N | 3.1E+001 N | | |
| 1,3-DINITROBENZENE | 99650 | 1.00E-004 I | | | | | 3.7E+000 N | 3.7E-001 N | 1.4E-001 N | 2.0E+002 N | 7.8E+000 N | 1.8E-003 | 3.7E-002 N |
| 1,4-DINITROBENZENE | 100254 | 4.00E-004 H | | | | | 1.5E+001 N | 1.5E+000 N | 5.4E-001 N | 8.2E+002 N | 3.1E+001 N | | |
| 4,6-DINITRO-O-CYCLOHEXYL PHENOL | 131895 | 2.00E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | | |
| 4,6-DINITRO-2-METHYLPHENOL | 534521 | 1.00E-004 E | | | | | 3.7E+000 N | 3.7E-001 N | 1.4E-001 N | 2.0E+002 N | 7.8E+000 N | | |
| 2,4-DINITROPHENOL | 51285 | 2.00E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | | |
| DINITROTOLUENE MIX | | | 6.80E-001 I | | | | 9.8E-002 C | 9.2E-003 C | 4.6E-003 C | 8.4E+000 C | 9.4E-001 C | | |
| 2,4-DINITROTOLUENE | 121142 | 2.00E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | 2.9E-002 | 5.7E-001 N |
| 2,6-DINITROTOLUENE | 606202 | 1.00E-003 H | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | 1.2E-002 | 2.5E-001 N |
| DINOSEB | 88857 | 1.00E-003 I | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | 8.7E-003 | 1.7E-001 N |

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST E = EPA NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC c

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDI mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil Industrial mg/kg | Residential mg/kg | Region III SSLs: Soil, for groundwater migration: DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIOCTYLPHTHALATE | 117840 | 2.00E-002 H | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 1.2E+005 | 2.4E+006 N |
| 1,4-DIOXANE | 123911 | | 1.10E-002 I | | | | 6.1E+000 C | 5.7E-001 C | 2.9E-001 C | 5.2E+002 C | 5.6E+001 C | 1.3E-003 | 2.6E-002 C |
| DIPHENYLAMINE | 122394 | 2.50E-002 I | | | | | 9.1E+002 N | 9.1E+001 N | 3.4E+001 N | 5.1E+004 N | 2.0E+003 N | 1.3E+000 | 2.5E+001 N |
| 1,2-DIPHENYLHYDRAZINE | 122667 | | 8.00E-001 I | | 8.00E-001 I | | 8.4E-002 C | 7.8E-003 C | 3.9E-003 C | 7.2E+000 C | 8.0E-001 C | 1.3E-004 | 2.5E-003 C |
| DIQUAT | 85007 | 2.20E-003 I | | | | | 8.0E+001 N | 8.0E+000 N | 3.0E+000 N | 4.5E+003 N | 1.7E+002 N | 1.7E-002 | 3.3E-001 N |
| DISULFOTON | 298044 | 4.00E-005 I | | | | | 1.5E+000 N | 1.5E-001 N | 5.4E-002 N | 8.2E+001 N | 3.1E+000 N | 3.2E-003 | 6.4E-002 N |
| 1,4-DITHIANE | 505293 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| DIURON | 330541 | 2.00E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | 5.8E-002 | 1.2E+000 N |
| ENDOSULFAN | 115297 | 6.00E-003 I | | | | | 2.2E+002 N | 2.2E+001 N | 8.1E+000 N | 1.2E+004 N | 4.7E+002 N | 9.8E-001 | 2.0E+001 N |
| ENDRIN | 72208 | 3.00E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | 2.7E-001 | 5.4E+000 N |
| EPICHLOROHYDRIN | 106898 | 2.00E-003 H | 9.90E-003 I | 2.86E-004 I | 4.20E-003 I | y | 2.0E+000 N | 1.0E+000 N | 3.2E-001 C I | 5.8E+002 C I | 6.5E+001 C I | 4.2E-004 | 8.4E-003 N |
| ETHION | 563122 | 5.00E-004 I | | | | | 1.8E+001 N | 1.8E+000 N | 6.8E-001 N | 1.0E+003 N | 3.9E+001 N | 3.2E-001 | 6.4E+000 N |
| 2-ETHOXYETHANOL | 110805 | 4.00E-001 H | | 5.70E-002 I | | | 1.5E+004 N | 2.1E+002 N | 5.4E+002 N | 8.2E+005 N | 3.1E+004 N | 3.3E+000 | 6.5E+001 N |
| ETHYL ACETATE | 141786 | 9.00E-001 I | | | | y | 5.5E+003 N | 3.3E+003 N | 1.2E+003 N | 1.8E+006 N | 7.0E+004 N | 1.7E+000 | 3.5E+001 N |
| ETHYLBENZENE | 100414 | 1.00E-001 I | | 2.90E-001 I | | y | 1.3E+003 N | 1.1E+003 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 7.5E-001 | 1.5E+001 N |
| ETHYLENE DIAMINE | 107153 | 2.00E-002 H | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | | |
| ETHYLENE GLYCOL | 107211 | 2.00E+000 I | | | | | 7.3E+004 N | 7.3E+003 N | 2.7E+003 N | 4.1E+006 N | 1.6E+005 N | 1.5E+001 | 3.0E+002 N |
| ETHYLENE GLYCOL, MONOBUTYL ETHER | 111762 | 5.00E-001 I | | 3.70E+000 I | | | 1.8E+004 N | 1.4E+004 N | 6.8E+002 N | 1.0E+006 N | 3.9E+004 N | | |
| ETHYLENE OXIDE | 75218 | | 1.00E+000 H | | 3.50E-001 H | y | 2.3E-002 C | 1.8E-002 C | 3.2E-003 C | 5.7E+000 C | 6.4E-001 C | 4.8E-006 | 9.5E-005 C |
| ETHYLENE THIOUREA | 96457 | 8.00E-005 I | 1.1E-001 H | | | | 6.1E-001 C I | 5.7E-002 C I | 2.9E-002 C I | 5.2E+001 C I | 5.8E+000 C I | | |
| ETHYL ETHER | 60297 | 2.00E-001 I | | | | y | 1.2E+003 N | 7.3E+002 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | 4.2E-001 | 8.5E+000 N |
| ETHYL METHACRYLATE | 97632 | 9.00E-002 H | | | | y | 5.5E+002 N | 3.3E+002 N | 1.2E+002 N | 1.8E+005 N | 7.0E+003 N | 1.0E+000 | 2.1E+001 N |
| FENAMIPHOS | 22224926 | 2.50E-004 I | | | | | 9.1E+000 N | 9.1E-001 N | 3.4E-001 N | 5.1E+002 N | 2.0E+001 N | 7.8E-003 | 1.6E-001 N |
| FLUOMETURON | 2164172 | 1.30E-002 I | | | | | 4.7E+002 N | 4.7E+001 N | 1.8E+001 N | 2.7E+004 N | 1.0E+003 N | | |
| FLUORINE | 7782414 | 6.00E-002 I | | | | | 2.2E+003 N | 2.2E+002 N | 8.1E+001 N | 1.2E+005 N | 4.7E+003 N | | |
| FOMESAFEN | 72178020 | | 1.90E-001 I | | | | 3.5E-001 C | 3.3E-002 C | 1.7E-002 C | 3.0E+001 C | 3.4E+000 C | | |
| FONOFOS | 944229 | 2.00E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | 1.8E-001 | 3.5E+000 N |
| FORMALDEHYDE | 50000 | 2.00E-001 I | | | 4.50E-002 I | | 7.3E+003 N | 1.4E-001 C | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | 1.5E+000 | 3.0E+001 N |
| FORMIC ACID | 64186 | 2.00E+000 H | | | | | 7.3E+004 N | 7.3E+003 N | 2.7E+003 N | 4.1E+006 N | 1.6E+005 N | | |
| FURAN | 110009 | 1.00E-003 I | | | | y | 6.1E+000 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | 1.5E-003 | 3.0E-002 N |
| FURAZOLIDONE | 67458 | | 3.80E+000 H | | | | 1.8E-002 C | 1.6E-003 C | 8.3E-004 C | 1.5E+000 C | 1.7E-001 C | | |
| FURFURAL | 98011 | 3.00E-003 I | | 1.00E-002 A | | | 1.1E+002 N | 3.7E+001 N | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | 2.3E-002 | 4.6E-001 N |
| GLYCIDALDEHYDE | 765344 | 4.00E-004 I | | 2.90E-004 H | | | 1.5E+001 N | 1.1E+000 N | 5.4E-001 N | 8.2E+002 N | 3.1E+001 N | | |
| GLYPHOSATE | 1071836 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | 2.6E+001 | 5.3E+002 N |
| HEPTACHLOR | 76448 | 5.00E-004 I | 4.50E+000 I | | 4.50E+000 I | | 1.5E-002 C | 1.4E-003 C | 7.0E-004 C | 1.3E+000 C | 1.4E-001 C | 4.2E-002 | 8.4E-001 C |
| HEPTACHLOR EPOXIDE | 1024573 | 1.30E-005 I | 9.10E+000 I | | 9.10E+000 I | | 7.4E-003 C | 6.9E-004 C | 3.5E-004 C | 6.3E-001 C | 7.0E-002 C | 1.2E-003 | 2.5E-002 C |
| HEXABROMOBENZENE | 87821 | 2.00E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | | |
| HEXACHLOROBENZENE | 118741 | 8.00E-004 I | 1.60E+000 I | | 1.60E+000 I | | 4.2E-002 C | 3.9E-003 C | 2.0E-003 C | 3.6E+000 C | 4.0E-001 C | 2.6E-003 | 5.2E-002 C |
| HEXACHLOROBUTADIENE | 87683 | 2.00E-004 H | 7.80E-002 I | | 7.80E-002 I | | 8.6E-001 C I | 8.0E-002 C I | 4.0E-002 C I | 7.3E+001 C I | 8.2E+000 C I | 9.2E-002 | 1.8E+000 C |
| ALPHA-HCH | 319846 | | 6.30E+000 I | | 6.30E+000 I | | 1.1E-002 C | 9.9E-004 C | 5.0E-004 C | 9.1E-001 C | 1.0E-001 C | 4.5E-005 | 8.9E-004 C |
| BETA-HCH | 319857 | | 1.80E+000 I | | 1.80E+000 I | | 3.7E-002 C | 3.5E-003 C | 1.8E-003 C | 3.2E+000 C | 3.5E-001 C | 1.6E-004 | 3.1E-003 C |
| GAMMA-HCH (LINDANE) | 58899 | 3.00E-004 I | 1.30E+000 H | | | | 5.2E-002 C | 4.8E-003 C | 2.4E-003 C | 4.4E+000 C | 4.9E-001 C | 2.2E-004 | 4.3E-003 C |
| TECHNICAL HCH | 608731 | | 1.80E+000 I | | 1.80E+000 I | | 3.7E-002 C | 3.5E-003 C | 1.8E-003 C | 3.2E+000 C | 3.5E-001 C | | |
| HEXACHLOROCYCLOPENTADIENE | 77474 | 7.00E-003 I | | 2.00E-005 H | | | 2.6E+002 N | 7.3E-002 N | 9.5E+000 N | 1.4E+004 N | 5.5E+002 N | 1.0E+002 | 2.0E+003 N |
| HEXACHLORODIBENZODIOXIN MIX | 19408743 | | 6.20E+003 I | | 4.55E+003 I | | 1.1E-005 C | 1.4E-006 C | 5.1E-007 C | 9.2E-004 C | 1.0E-004 C | | |

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC <

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil Industrial mg/kg | Residential mg/kg | Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEXACHLOROETHANE | 67721 | 1.00E-003 I | 1.40E-002 I | | 1.40E-002 I | | 4.8E+000 C I | 4.5E-001 C I | 2.3E-001 C I | 4.1E+002 C I | 4.6E+001 C I | 1.8E-002 | 3.6E-001 C |
| HEXACHLOROPHENE | 70304 | 3.00E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | 1.0E+002 | 2.0E+003 N |
| 1,6-HEXAMETHYLENE DIISOCYANATE | 822060 | | | 2.90E-006 I | | | | 1.1E-002 N | | | | | |
| HEXANE | 110543 | 6.00E-002 H | | 5.71E-002 I | | y | 3.5E+002 N | 2.1E+002 N | 8.1E+001 N | 1.2E+005 N | 4.7E+003 N | 6.9E-001 | 1.4E+001 N |
| 2-HEXANONE | 591786 | 4.00E-002 E | | 1.4E-003 E | | | 1.5E+003 N | 5.1E+000 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| HEXAZINONE | 51235042 | 3.30E-002 I | | | | | 1.2E+003 N | 1.2E+002 N | 4.5E+001 N | 6.7E+004 N | 2.6E+003 N | | |
| HMX | 2691410 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| HYDRAZINE | 302012 | | 3.00E+000 I | | 1.70E+001 I | | 2.2E-002 C | 3.7E-004 C | 1.1E-003 C | 1.9E+000 C | 2.1E-001 C | | |
| HYDROGEN CHLORIDE | 7647010 | | | 5.70E-003 I | | | | 2.1E+001 N | | | | | |
| HYDROGEN SULFIDE | 7783064 | 3.00E-003 I | | 2.85E-004 I | | | 1.1E+002 N | 1.0E+000 N | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | | |
| HYDROQUINONE | 123319 | 4.00E-002 H | | | | | 1.5E+003 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | | |
| IRON | 7439896 | 3.00E-001 E | | | | | 1.1E+004 N | 1.1E+003 N | 4.1E+002 N | 6.1E+005 N | 2.3E+004 N | | |
| ISOBUTANOL | 78831 | 3.00E-001 I | | | | y | 1.8E+003 N | 1.1E+003 N | 4.1E+002 N | 6.1E+005 N | 2.3E+004 N | 5.9E-001 | 1.2E+001 N |
| ISOPHORONE | 78591 | 2.00E-001 I | 9.50E-004 I | | | | 7.0E+001 C | 6.6E+000 C | 3.3E+000 C | 6.0E+003 C | 6.7E+002 C | 2.1E-002 | 4.1E-001 C |
| ISOPROPALIN | 3382530 | 1.50E-002 I | | | | | 5.5E+002 N | 5.5E+001 N | 2.0E+001 N | 3.1E+004 N | 1.2E+003 N | | |
| ISOPROPYL METHYL PHOSPHONIC ACID | 1832548 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| TETRAETHYLLEAD | 78002 | 1.00E-007 I | | | | | 3.7E-003 N | 3.7E-004 N | 1.4E-004 N | 2.0E-001 N | 7.8E-003 N | 4.6E-005 | 9.2E-004 N |
| LITHIUM | 7439932 | 2.00E-002 E | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | | |
| MALATHION | 121755 | 2.00E-002 I | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 4.0E-001 | 8.1E+000 N |
| MALEIC ANHYDRIDE | 108316 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| MANGANESE-NONFOOD | 7439965 | 2.00E-002 I | | 1.43E-005 I | | | 7.3E+002 N | 5.2E-002 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 4.8E+001 | 9.5E+002 N |
| MANGANESE-FOOD | 7439965 | 1.40E-001 I | | 1.43E-005 I | | | 5.1E+003 N | 5.2E-002 N | 1.9E+002 N | 2.9E+005 N | 1.1E+004 N | 3.3E+002 | 6.7E+003 N |
| MEPHOSFOLAN | 950107 | 9.00E-005 H | | | | | 3.3E+000 N | 3.3E-001 N | 1.2E-001 N | 1.8E+002 N | 7.0E+000 N | | |
| MEPIQUAT CHLORIDE | 24307264 | 3.00E-002 I | | | | | 1.1E+003 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | | |
| MERCURIC CHLORIDE | 7487947 | 3.00E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | | |
| MERCURY (INORGANIC) | 7439976 | | | 8.60E-005 I | | | | 3.1E-001 N | | | | | |
| METHYLMERCURY | 22967926 | 1.00E-004 I | | | | | 3.7E+000 N | 3.7E-001 N | 1.4E-001 N | 2.0E+002 N | 7.8E+000 N | | |
| METHACRYLONITRILE | 126987 | 1.00E-004 I | | 2.00E-004 A | | y | 1.0E+000 N | 7.3E-001 N | 1.4E-001 N | 2.0E+002 N | 7.8E+000 N | 2.1E-004 | 4.2E-003 N |
| METHANOL | 67561 | 5.00E-001 I | | | | | 1.8E+004 N | 1.8E+003 N | 6.8E+002 N | 1.0E+006 N | 3.9E+004 N | 3.8E+000 | 7.5E+001 N |
| METHIDATHION | 950378 | 1.00E-003 I | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | | |
| METHOXYCHLOR | 72435 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | 1.5E+001 | 3.1E+002 N |
| METHYL ACETATE | 79209 | 1.00E+000 H | | | | y | 6.1E+003 N | 3.7E+003 N | 1.4E+003 N | 2.0E+006 N | 7.8E+004 N | 1.2E+000 | 2.5E+001 N |
| METHYL ACRYLATE | 96333 | 3.00E-002 A | | | | y | 1.8E+002 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | 5.0E-001 | 1.0E+001 N |
| 2-METHYLANILINE | 95534 | | 2.40E-001 H | | | | 2.8E-001 C | 2.6E-002 C | 1.3E-002 C | 2.4E+001 C | 2.7E+000 C | 2.8E-004 | 5.7E-003 C |
| 4-(2-METHYL-4-CHLOROPHENOXY) BUTYRIC ACID | 94815 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| 2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA) | 94746 | 5.00E-004 I | | | | | 1.8E+001 N | 1.8E+000 N | 6.8E-001 N | 1.0E+003 N | 3.9E+001 N | | |
| 2-(2-METHYL-4-CHLOROPHENOXY)PROPIONIC ACID (MCPP) | 93652 | 1.00E-003 I | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | | |
| METHYLCYCLOHEXANE | 108872 | | | 6.60E-001 H | | y | 6.3E+003 N | 3.1E+003 N | | | | | |
| METHYLENE BROMIDE | 74953 | 1.00E-002 A | | | | y | 6.1E+001 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | 1.5E-002 | 3.0E-001 N |
| METHYLENE CHLORIDE | 75092 | 6.00E-002 I | 7.50E-003 I | 8.60E-001 H | 1.65E-003 I | y | 4.1E+000 C | 3.8E+000 C | 4.2E-001 C | 7.6E+002 C | 8.5E+001 C | 9.5E-004 | 1.9E-002 C |
| 4,4'-METHYLENE BIS(2-CHLOROANILINE) | 101144 | 7.00E-004 H | 1.30E-001 H | | 1.30E-001 H | | 5.2E-001 C | 4.8E-002 C | 2.4E-002 C | 4.4E+001 C | 4.9E+000 C | | |
| 4,4'-METHYLENE BIS(N,N'-DIMETHYL)ANILINE | 101611 | | 4.60E-002 I | | | | 1.5E+000 C | 1.4E-001 C | 6.9E-002 C | 1.2E+002 C | 1.4E+001 C | | |
| 4,4'-METHYLENEDIPHENYL ISOCYANATE | 101688 | | | 1.7E-004 I | | | | 6.2E-001 N | | | | | |
| METHYL ETHYL KETONE (2-BUTANONE) | 78933 | 6.00E-001 I | | 2.86E-001 I | | y | 1.9E+003 N | 1.0E+003 N | 8.1E+002 N | 1.2E+006 N | 4.7E+004 N | 4.0E-001 | 7.9E+000 N |
| METHYL HYDRAZINE | 60344 | | 1.10E+000 W | | | | 6.1E-002 C | 5.7E-003 C | 2.9E-003 C | 5.2E+000 C | 5.8E-001 C | | |

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E = EPA NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = HBC at HI of 0.1 < RBC <

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil industrial mg/kg | Residential mg/kg | Region III SSLs: Soil, for groundwater migration: DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | 108101 | 8.00E-002 H | | 2.00E-002 A | | y | 1.4E+002 N | 7.3E+001 N | 1.1E+002 N | 1.6E+005 N | 6.3E+003 N | 6.5E-002 | 1.3E+000 N |
| METHYL METHACRYLATE | 80626 | 1.40E+000 I | | 2.00E-001 I | | y | 1.4E+003 N | 7.3E+002 N | 1.9E+003 N | 2.9E+006 N | 1.1E+005 N | 3.2E-001 | 6.5E+000 N |
| 2-METHYL-5-NITROANILINE | 99558 | | 3.30E-002 H | | | | 2.0E+000 C | 1.9E-001 C | 9.6E-002 C | 1.7E+002 C | 1.9E+001 C | | |
| METHYL PARATHION | 298000 | 2.50E-004 I | | | | | 9.1E+000 N | 9.1E-001 N | 3.4E-001 N | 5.1E+002 N | 2.0E+001 N | 4.3E-003 | 8.5E-002 N |
| 2-METHYLPHENOL | 95487 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| 3-METHYLPHENOL | 108394 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| 4-METHYLPHENOL | 106445 | 5.00E-003 H | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| METHYLSTYRENE MIX | 25013154 | 6.00E-003 A | | 1.00E-002 A | | y | 5.5E+001 N | 3.7E+001 N | 8.1E+000 N | 1.2E+004 N | 4.7E+002 N | 5.1E-002 | 1.0E+000 N |
| ALPHA-METHYLSTYRENE | 98839 | 7.00E-002 A | | | | y | 4.3E+002 N | 2.6E+002 N | 9.5E+001 N | 1.4E+005 N | 5.5E+003 N | 4.0E-001 | 7.9E+000 N |
| METHYL TERT-BUTYL ETHER | 1634044 | | | 8.57E-001 I | | y | 6.3E+003 N | 3.1E+003 N | | | | 1.4E+000 | 2.8E+001 N |
| METOLACHLOR (DUAL) | 51218452 | 1.50E-001 I | | | | | 5.5E+003 N | 5.5E+002 N | 2.0E+002 N | 3.1E+005 N | 1.2E+004 N | | |
| MIREX | 2385855 | 2.00E-004 I | | | | | 7.3E+000 N | 7.3E-001 N | 2.7E-001 N | 4.1E+002 N | 1.6E+001 N | | |
| MOLYBDENUM | 7439987 | 5E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| MONOCHLORAMINE | 10599903 | 1E-001 I | | 1.00E-001 H | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| NALED | 300765 | 2E-003 I | | | | | 7.3E+001 N | 7.3E+000 N | 2.7E+000 N | 4.1E+003 N | 1.6E+002 N | | |
| NICKEL REFINERY DUST | | | | | 8.4E-001 I | | | 7.5E-003 C | | | | | |
| NICKEL | 7440020 | 2.00E-002 I | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | | |
| NITRATE | 14797558 | 1.60E+000 I | | | | | 5.8E+004 N | 5.8E+003 N | 2.2E+003 N | 3.3E+006 N | 1.3E+005 N | | |
| NITRIC OXIDE | 10102439 | 1.00E-001 W | | | | y | 6.1E+002 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| NITRITE | 14797650 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| 2-NITROANILINE | 88744 | | | 5.70E-005 H | | | | 2.1E-001 N | | | | | |
| NITROBENZENE | 98953 | 5.00E-004 I | | 6.00E-004 A | | y | 3.5E+000 N | 2.2E+000 N | 6.8E-001 N | 1.0E+003 N | 3.9E+001 N | 1.2E-003 | 2.3E-002 N |
| NITROFURANTOIN | 67209 | 7.00E-002 H | | | | | 2.6E+003 N | 2.6E+002 N | 9.5E+001 N | 1.4E+005 N | 5.5E+003 N | | |
| NITROFURAZONE | 59870 | | 1.50E+000 H | | | | 4.5E-002 C | 4.2E-003 C | 2.1E-003 C | 3.8E+000 C | 4.3E-001 C | | |
| NITROGEN DIOXIDE | 10102440 | 1.00E+000 W | | | | y | 6.1E+003 N | 3.7E+003 N | 1.4E+003 N | 2.0E+006 N | 7.8E+004 N | | |
| NITROGLYCERIN | 55630 | | 1.4E-002 E | | | | 4.8E+000 C | 4.5E-001 C | 2.3E-001 C | 4.1E+002 C | 4.6E+001 C | | |
| 4-NITROPHENOL | 100027 | 8.00E-003 E | | | | | 2.9E+002 N | 2.9E+001 N | 1.1E+001 N | 1.6E+004 N | 6.3E+002 N | 8.7E-002 | 1.7E+000 N |
| 2-NITROPROPANE | 79469 | | | 5.70E-003 I | 9.40E+000 H | y | 1.3E-003 C | 6.7E-004 C | | | | 3.2E-007 | 6.4E-006 C |
| N-NITROSO-DI-N-BUTYLAMINE | 924163 | | 5.40E+000 I | | 5.60E+000 I | y | 1.9E-003 C | 1.1E-003 C | 5.8E-004 C | 1.1E+000 C | 1.2E-001 C | 1.4E-006 | 2.7E-005 C |
| N-NITROSODIETHANOLAMINE | 1116547 | | 2.80E+000 I | | | | 2.4E-002 C | 2.2E-003 C | 1.1E-003 C | 2.0E+000 C | 2.3E-001 C | | |
| N-NITROSODIETHYLAMINE | 55185 | | 1.50E+002 I | | 1.50E+002 I | | 4.5E-004 C | 4.2E-005 C | 2.1E-005 C | 3.8E-002 C | 4.3E-003 C | 1.1E-007 | 2.3E-006 C |
| N-NITROSODIMETHYLAMINE | 62759 | | 5.10E+001 I | | 5.10E+001 I | | 1.3E-003 C | 1.2E-004 C | 6.2E-005 C | 1.1E-001 C | 1.3E-002 C | 2.8E-007 | 5.7E-006 C |
| N-NITROSODIPHENYLAMINE | 86306 | | 4.90E-003 I | | | | 1.4E+001 C | 1.3E+000 C | 6.4E-001 C | 1.2E+003 C | 1.3E+002 C | 3.8E-002 | 7.6E-001 C |
| N-NITROSODIPROPYLAMINE | 621647 | | 7.00E+000 I | | | | 9.6E-003 C | 8.9E-004 C | 4.5E-004 C | 8.2E-001 C | 9.1E-002 C | 2.4E-006 | 4.7E-005 C |
| N-NITROSO-N-ETHYLUREA | 759739 | | 1.40E+002 H | | | | 4.6E-004 C | 4.5E-005 C | 2.3E-005 C | 4.1E-002 C | 4.6E-003 C | | |
| N-NITROSO-N-METHYLETHYLAMINE | 10595956 | | 2.20E+001 I | | | | 3.0E-003 C | 2.8E-004 C | 1.4E-004 C | 2.6E-001 C | 2.9E-002 C | | |
| N-NITROSOPYRROLIDINE | 930552 | | 2.10E+000 I | | 2.10E+000 I | | 3.2E-002 C | 3.0E-003 C | 1.5E-003 C | 2.7E+000 C | 3.0E-001 C | | |
| M-NITROTOLUENE | 99081 | 2.00E-002 E | | | | y | 1.2E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | | |
| O-NITROTOLUENE | 88722 | 1.00E-002 H | | | | y | 6.1E+001 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| P-NITROTOLUENE | 99990 | 1.00E-002 H | | | | y | 6.1E+001 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| NUSTAR | 85509199 | 7.00E-004 I | | | | | 2.6E+001 N | 2.6E+000 N | 9.5E-001 N | 1.4E+003 N | 5.5E+001 N | | |
| ORYZALIN | 19044883 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| OXADIAZON | 19666309 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| OXAMYL | 23135220 | 2.50E-002 I | | | | | 9.1E+002 N | 9.1E+001 N | 3.4E+001 N | 5.1E+004 N | 2.0E+003 N | 1.9E-001 | 3.8E+000 N |
| OXYFLUORFEN | 42874033 | 3.00E-003 I | | | | | 1.1E+002 N | 1.1E+001 N | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PARAQUAT DICHLORIDE | 1910425 | 4.50E-003 I | | | | | 1.6E+002 N | 1.6E+001 N | 6.1E+000 N | 9.2E+003 N | 3.5E+002 N | | |
| PARATHION | 56382 | 6.00E-003 H | | | | | 2.2E+002 N | 2.2E+001 N | 8.1E+000 N | 1.2E+004 N | 4.7E+002 N | 5.0E-001 | 1.0E+001 N |
| PENTACHLOROBENZENE | 608935 | 8.00E-004 I | | | | | 2.9E+001 N | 2.9E+000 N | 1.1E+000 N | 1.6E+003 N | 6.3E+001 N | 1.0E+000 | 2.0E+001 N |
| PENTACHLORONITROBENZENE | 82688 | 3.00E-003 I | 2.60E-001 H | | | | 2.6E-001 C | 2.4E-002 C | 1.2E-002 C | 2.2E+001 C | 2.5E+000 C | 4.1E-003 | 8.2E-002 C |
| PENTACHLOROPHENOL | 87865 | 3.00E-002 I | 1.20E-001 I | | | | 5.6E-001 C | 5.2E-002 C | 2.6E-002 C | 4.8E+001 C | 5.3E+000 C | | |
| PERMETHRIN | 52645531 | 5.00E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | 1.2E+002 | 2.4E+003 N |
| PHENOL | 108952 | 6.00E-001 I | | | | | 2.2E+004 N | 2.2E+003 N | 8.1E+002 N | 1.2E+006 N | 4.7E+004 N | 6.7E+000 | 1.3E+002 N |
| M-PHENYLENEDIAMINE | 108452 | 6.00E-003 I | | | | | 2.2E+002 N | 2.2E+001 N | 8.1E+000 N | 1.2E+004 N | 4.7E+002 N | 4.9E-002 | 9.8E-001 N |
| O-PHENYLENEDIAMINE | 95545 | | 4.70E-002 H | | | | 1.4E+000 C | 1.3E-001 C | 6.7E-002 C | 1.2E+002 C | 1.4E+001 C | | |
| P-PHENYLENEDIAMINE | 106503 | 1.90E-001 H | | | | | 6.9E+003 N | 6.9E+002 N | 2.6E+002 N | 3.9E+005 N | 1.5E+004 N | | |
| 2-PHENYLPHENOL | 90437 | | 1.90E-003 H | | | | 3.5E+001 C | 3.3E+000 C | 1.7E+000 C | 3.0E+003 C | 3.4E+002 C | | |
| PHOSPHINE | 7803512 | 3.00E-004 I | | 8.60E-005 I | | | 1.1E+001 N | 3.1E-001 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | | |
| PHOSPHORIC ACID | 7664382 | | | 2.90E-003 I | | | | 1.1E+001 N | | | | | |
| PHOSPHORUS (WHITE) | 7723140 | 2.00E-005 I | | | | | 7.3E-001 N | 7.3E-002 N | 2.7E-002 N | 4.1E+001 N | 1.6E+000 N | | |
| P-PHTHALIC ACID | 100210 | 1.00E+000 H | | | | | 3.7E+004 N | 3.7E+003 N | 1.4E+003 N | 2.0E+006 N | 7.8E+004 N | | |
| PHTHALIC ANHYDRIDE | 85449 | 2.00E+000 I | | 3.43E-002 H | | | 7.3E+004 N | 1.3E+002 N | 2.7E+003 N | 4.1E+006 N | 1.6E+005 N | 2.6E+001 | 5.2E+002 N |
| POLYBROMINATED BIPHENYLS | | 7.00E-006 H | 8.90E+000 H | | | | 7.5E-003 C | 7.0E-004 C | 3.5E-004 C | 6.4E-001 C | 7.2E-002 C I | | |
| POLYCHLORINATED BIPHENYLS | 1336363 | | 2.00E+000 I | | 2.00E+000 I | | 3.3E-002 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C | 2.1E-002 | 4.1E-001 C |
| AROCLOR-1016 | 12674112 | 7.00E-005 I | 7.00E-002 I | | 7.00E-002 I | | 9.6E-001 C I | 8.9E-002 C I | 4.5E-002 C I | 8.2E+001 C I | 5.5E+000 N | 2.1E-001 | 4.2E+000 C |
| AROCLOR-1221 | 11104282 | | 2.00E+000 I | | 2.00E+000 I | | 3.3E-002 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C | | |
| AROCLOR-1232 | 11141165 | | 2.00E+000 I | | 2.00E+000 I | | 3.3E-002 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C | | |
| AROCLOR-1242 | 53469219 | | 2.00E+000 I | | 2.00E+000 I | | 3.3E-002 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C | | |
| AROCLOR-1248 | 12672296 | | 2.00E+000 I | | 2.00E+000 I | | 3.3E-002 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C | | |
| AROCLOR-1254 | 11097691 | 2.00E-005 I | 2.00E+000 I | | 2.00E+000 I | | 3.3E-002 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C I | 5.4E-002 | 1.1E+000 C |
| AROCLOR-1260 | 11096825 | | 2.00E+000 I | | 2.00E+000 I | | 3.3E-002 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C | | |
| POLYCHLORINATED TERPHENYLS | 61788338 | | 4.50E+000 E | | | | 1.5E-002 C | 1.4E-003 C | 7.0E-004 C | 1.3E+000 C | 1.4E-001 C | | |
| POLYNUCLEAR AROMATIC HYDROCARBONS: | | | | | | | | | | | | | |
| ACENAPHTHENE | 83329 | 6.00E-002 I | | | | y | 3.7E+002 N | 2.2E+002 N | 8.1E+001 N | 1.2E+005 N | 4.7E+003 N | 5.2E+000 | 1.0E+002 N |
| ANTHRACENE | 120127 | 3.00E-001 I | | | | y | 1.8E+003 N | 1.1E+003 N | 4.1E+002 N | 6.1E+005 N | 2.3E+004 N | 2.3E+001 | 4.7E+002 N |
| BENZ[A]ANTHRACENE | 56553 | | 7.30E-001 E | | | | 9.2E-002 C | 8.6E-003 C | 4.3E-003 C | 7.8E+000 C | 8.7E-001 C | 7.3E-002 | 1.5E+000 C |
| BENZO[B]FLUORANTHENE | 205992 | | 7.30E-001 E | | | | 9.2E-002 C | 8.6E-003 C | 4.3E-003 C | 7.8E+000 C | 8.7E-001 C | 2.3E-001 | 4.5E+000 C |
| BENZO[K]FLUORANTHENE | 207089 | | 7.30E-002 E | | | | 9.2E-001 C | 8.6E-002 C | 4.3E-002 C | 7.8E+001 C | 8.7E+000 C | 2.3E+000 | 4.5E+001 C |
| BENZO[A]PYRENE | 50328 | | 7.30E+000 I | | 3.10E+000 E | | 9.2E-003 C | 2.0E-003 C | 4.3E-004 C | 7.8E-001 C | 8.7E-002 C | 1.9E-002 | 3.7E-001 C |
| CARBAZOLE | 86748 | | 2.00E-002 H | | | | 3.3E+000 C | 3.1E-001 C | 1.6E-001 C | 2.9E+002 C | 3.2E+001 C | 2.3E-002 | 4.7E-001 C |
| CHRYSENE | 218019 | | 7.30E-003 E | | | | 9.2E+000 C | 8.6E-001 C | 4.3E-001 C | 7.8E+002 C | 8.7E+001 C | 7.3E+000 | 1.5E+002 C |
| DIBENZ[A,H]ANTHRACENE | 53703 | | 7.30E+000 E | | | | 9.2E-003 C | 8.6E-004 C | 4.3E-004 C | 7.8E-001 C | 8.7E-002 C | 7.0E-002 | 1.4E+000 C |
| DIBENZOFURAN | 132649 | 4.00E-003 E | | | | y | 2.4E+001 N | 1.5E+001 N | 5.4E+000 N | 8.2E+003 N | 3.1E+002 N | 3.8E-001 | 7.7E+000 N |
| FLUORANTHENE | 206440 | 4.00E-002 I | | | | | 1.5E+003 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | 3.1E+002 | 6.3E+003 N |
| FLUORENE | 86737 | 4.00E-002 I | | | | y | 2.4E+002 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | 6.8E+000 | 1.4E+002 N |
| INDENO[1,2,3-C,D]PYRENE | 193395 | | 7.30E-001 E | | | | 9.2E-002 C | 8.6E-003 C | 4.3E-003 C | 7.8E+000 C | 8.7E-001 C | 6.4E-001 | 1.3E+001 C |
| 2-METHYLNAPHTHALENE | 91576 | 2.00E-002 E | | | | y | 1.2E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 1.1E+000 | 2.2E+001 N |
| NAPHTHALENE | 91203 | 2.00E-002 I | | 9.00E-004 I | | y | 6.5E+000 N | 3.3E+000 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | 7.7E-003 | 1.5E-001 N |
| PYRENE | 129000 | 3.00E-002 I | | | | y | 1.8E+002 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | 3.4E+001 | 6.8E+002 N |
| PROMETON | 1610180 | 1.50E-002 I | | | | | 5.5E+002 N | 5.5E+001 N | 2.0E+001 N | 3.1E+004 N | 1.2E+003 N | | |
| PROMETRYN | 7287196 | 4.00E-003 I | | | | | 1.5E+002 N | 1.5E+001 N | 5.4E+000 N | 8.2E+003 N | 3.1E+002 N | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROPACHLOR | 1918167 | 1.30E-002 I | | | | | 4.7E+002 N | 4.7E+001 N | 1.8E+001 N | 2.7E+004 N | 1.0E+003 N | | |
| PROPANIL | 709988 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| PROPARGITE | 2312358 | 2.00E-002 I | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | | |
| N-PROPYLBENZENE | 103651 | 4.00E-002 E | | | | y | 2.4E+002 N | 1.5E+002 N | 5.4E+001 N | 8.2E+004 N | 3.1E+003 N | 1.4E+000 | 2.8E+001 N |
| PROPYLENE GLYCOL | 57556 | 2.00E+001 H | | | | | 7.3E+005 N | 7.3E+004 N | 2.7E+004 N | 4.1E+007 N | 1.6E+006 N | | |
| PROPYLENE GLYCOL, MONOETHYL ETHER | 52125538 | 7.00E-001 H | | | | | 2.6E+004 N | 2.6E+003 N | 9.5E+002 N | 1.4E+006 N | 5.5E+004 N | | |
| PROPYLENE GLYCOL, MONOMETHYL ETHER | 107982 | 7.00E-001 H | | 5.70E-001 I | | | 2.6E+004 N | 2.1E+003 N | 9.5E+002 N | 1.4E+006 N | 5.5E+004 N | | |
| PURSUIT | 81335775 | 2.50E-001 I | | | | | 9.1E+003 N | 9.1E+002 N | 3.4E+002 N | 5.1E+005 N | 2.0E+004 N | | |
| PYRIDINE | 110861 | 1.00E-003 I | | | | | 3.7E+001 N | 3.7E+000 N | 1.4E+000 N | 2.0E+003 N | 7.8E+001 N | | |
| QUINOLINE | 91225 | | 1.20E+001 H | | | | 5.6E-003 C | 5.2E-004 C | 2.6E-004 C | 4.8E-001 C | 5.3E-002 C | | |
| RDX | 121824 | 3.00E-003 I | 1.10E-001 I | | | | 6.1E-001 C | 5.7E-002 C | 2.9E-002 C | 5.2E+001 C | 5.8E+000 C | | |
| RESMETHRIN | 10453868 | 3.00E-002 I | | | | | 1.1E+003 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | | |
| RONNEL | 299843 | 5.00E-002 H | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| ROTENONE | 83794 | 4.00E-003 I | | | | | 1.5E+002 N | 1.5E+001 N | 5.4E+000 N | 8.2E+003 N | 3.1E+002 N | | |
| SELENIOUS ACID | 7783008 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| SELENIUM | 7782492 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | 9.5E-001 | 1.9E+001 N |
| SILVER | 7440224 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | 1.6E+000 | 3.1E+001 N |
| SIMAZINE | 122349 | 5.00E-003 I | 1.20E-001 H | | | | 5.6E-001 C | 5.2E-002 C | 2.6E-002 C | 4.8E+001 C | 5.3E+000 C | 1.7E-004 | 3.3E-003 C |
| SODIUM AZIDE | 26628228 | 4.00E-003 I | | | | | 1.5E+002 N | 1.5E+001 N | 5.4E+000 N | 8.2E+003 N | 3.1E+002 N | | |
| SODIUM DIETHYLDITHIOCARBAMATE | 148185 | 3.00E-002 I | 2.70E-001 H | | | | 2.5E-001 C | 2.3E-002 C | 1.2E-002 C | 2.1E+001 C | 2.4E+000 C | | |
| STRONTIUM, STABLE | 7440246 | 6.00E-001 I | | | | | 2.2E+004 N | 2.2E+003 N | 8.1E+002 N | 1.2E+006 N | 4.7E+004 N | 7.7E+002 | 1.5E+004 N |
| STRYCHNINE | 57249 | 3.00E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | 8.3E-003 | 1.7E-001 N |
| STYRENE | 100425 | 2.00E-001 I | | 2.86E-001 I | | y | 1.6E+003 N | 1.0E+003 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | 2.9E+000 | 5.7E+001 N |
| 2,3,7,8-TETRACHLORODIBENZODIOXIN | 1746016 | | 1.50E+005 H | | 1.50E+005 H | | 4.5E-007 C | 4.2E-008 C | 2.1E-008 C | 3.8E-005 C | 4.3E-006 C | 4.3E-007 | 8.6E-006 C |
| 1,2,4,5-TETRACHLOROBENZENE | 95943 | 3.00E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | 3.3E-002 | 6.6E-001 N |
| 1,1,1,2-TETRACHLOROETHANE | 630206 | 3.00E-002 I | 2.60E-002 I | | 2.60E-002 I | y | 4.1E-001 C | 2.4E-001 C | 1.2E-001 C | 2.2E+002 C | 2.5E+001 C | 2.0E-004 | 4.0E-003 C |
| 1,1,2,2-TETRACHLOROETHANE | 79345 | 6.00E-002 E | 2.00E-001 I | | 2.00E-001 I | y | 5.3E-002 C | 3.1E-002 C | 1.6E-002 C | 2.9E+001 C | 3.2E+000 C | 3.4E-005 | 6.8E-004 C |
| TETRACHLOROETHENE | 127184 | 1.00E-002 I | 5.20E-002 E | 1.4E-001 E | 2.00E-003 E | y | 1.1E+000 C | 3.1E+000 C | 6.1E-002 C | 1.1E+002 C | 1.2E+001 C | 2.4E-003 | 4.8E-002 C |
| 2,3,4,6-TETRACHLOROPHENOL | 58902 | 3.00E-002 I | | | | | 1.1E+003 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | | |
| P,A,A,A-TETRACHLOROTOLUENE | 5216251 | | 2.00E+001 H | | | | 3.3E-003 C | 3.1E-004 C | 1.6E-004 C | 2.9E-001 C | 3.2E-002 C | | |
| 1,1,1,2-TETRAFLUOROETHANE | 811972 | | | 2.29E+001 I | | y | 1.7E+005 N | 8.4E+004 N | | | | | |
| TETRAHYDROFURAN | 109999 | 2.00E-001 E | 7.6E-003 E | 8.6E-002 E | 6.8E-003 E | | 8.8E+000 C | 9.2E-001 C | 4.2E-001 C | 7.5E+002 C | 8.4E+001 C | | |
| TETRYL | 479458 | 1.00E-002 H | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| THALLIC OXIDE | 1314325 | 7.00E-005 W | | | | | 2.6E+000 N | 2.6E-001 N | 9.5E-002 N | 1.4E+002 N | 5.5E+000 N | | |
| THALLIUM | 7440280 | 7.00E-005 O | | | | | 2.6E+000 N | 2.6E-001 N | 9.5E-002 N | 1.4E+002 N | 5.5E+000 N | 1.8E-001 | 3.6E+000 N |
| THALLIUM ACETATE | 563688 | 9.00E-005 I | | | | | 3.3E+000 N | 3.3E-001 N | 1.2E-001 N | 1.8E+002 N | 7.0E+000 N | | |
| THALLIUM CARBONATE | 6533739 | 8.00E-005 I | | | | | 2.9E+000 N | 2.9E-001 N | 1.1E-001 N | 1.6E+002 N | 6.3E+000 N | | |
| THALLIUM CHLORIDE | 7791120 | 8.00E-005 I | | | | | 2.9E+000 N | 2.9E-001 N | 1.1E-001 N | 1.6E+002 N | 6.3E+000 N | | |
| THALLIUM NITRATE | 10102451 | 9.00E-005 I | | | | | 3.3E+000 N | 3.3E-001 N | 1.2E-001 N | 1.8E+002 N | 7.0E+000 N | | |
| THALLIUM SULFATE (2:1) | 7446186 | 8.00E-005 I | | | | | 2.9E+000 N | 2.9E-001 N | 1.1E-001 N | 1.6E+002 N | 6.3E+000 N | | |
| THIOBENCARB | 28249776 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | | |
| TIN | 7440315 | 6.00E-001 H | | | | | 2.2E+004 N | 2.2E+003 N | 8.1E+002 N | 1.2E+006 N | 4.7E+004 N | | |

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Risk-based concentrations: Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil Industrial mg/kg | Residential mg/kg | Region III SSLs: Soil, for groundwater migration DAF 1 mg/kg | DAF 20 mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITANIUM | 7440326 | 4.00E+000 E | | 8.60E-003 E | | | 1.5E+005 N | 3.1E+001 N | 5.4E+003 N | 8.2E+006 N | 3.1E+005 N | | |
| TITANIUM DIOXIDE | 13463677 | 4.00E+000 E | | 8.60E-003 E | | | 1.5E+005 N | 3.1E+001 N | 5.4E+003 N | 8.2E+006 N | 3.1E+005 N | | |
| TOLUENE | 108883 | 2.00E-001 I | | 1.14E-001 I | | y | 7.5E+002 N | 4.2E+002 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | 4.4E-001 | 8.8E+000 N |
| TOLUENE-2,4-DIAMINE | 95807 | | 3.20E+000 H | | | | 2.1E-002 C | 2.0E-003 C | 9.9E-004 C | 1.8E+000 C | 2.0E-001 C | | |
| TOLUENE-2,5-DIAMINE | 95705 | 6.00E-001 H | | | | | 2.2E+004 N | 2.2E+003 N | 8.1E+002 N | 1.2E+006 N | 4.7E+004 N | | |
| TOLUENE-2,6-DIAMINE | 823405 | 2.00E-001 H | | | | | 7.3E+003 N | 7.3E+002 N | 2.7E+002 N | 4.1E+005 N | 1.6E+004 N | | |
| P-TOLUIDINE | 106490 | | 1.90E-001 H | | | | 3.5E-001 C | 3.3E-002 C | 1.7E-002 C | 3.0E+001 C | 3.4E+000 C | 3.0E-004 | 5.9E-003 C |
| TOXAPHENE | 8001352 | | 1.10E+000 I | | 1.10E+000 I | | 6.1E-002 C | 5.7E-003 C | 2.9E-003 C | 5.2E+000 C | 5.8E-001 C | 3.1E-002 | 6.3E-001 C |
| 1,2,4-TRIBROMOBENZENE | 615543 | 5.00E-003 I | | | | | 1.8E+002 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | | |
| TRIBUTYLTIN OXIDE | 56359 | 3.00E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | | |
| 2,4,6-TRICHLOROANILINE | 634935 | | 3.40E-002 H | | | | 2.0E+000 C | 1.8E-001 C | 9.3E-002 C | 1.7E+002 C | 1.9E+001 C | | |
| 1,2,4-TRICHLOROBENZENE | 120821 | 1.00E-002 I | | 5.70E-002 H | | y | 1.9E+002 N | 2.1E+002 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | 3.8E-001 | 7.5E+000 N |
| 1,1,1-TRICHLOROETHANE | 71556 | 2.80E-001 E | | 6.30E-001 E | | y | 3.2E+003 N | 2.3E+003 N | 3.8E+002 N | 5.7E+005 N | 2.2E+004 N | 3.0E+000 | 6.0E+001 N |
| 1,1,2-TRICHLOROETHANE | 79005 | 4.00E-003 I | 5.70E-002 I | | 5.60E-002 I | y | 1.9E-001 C | 1.1E-001 C | 5.5E-002 C | 1.0E+002 C | 1.1E+001 C | 3.9E-005 | 7.8E-004 C |
| TRICHLOROETHENE | 79016 | 6.00E-003 E | 1.10E-002 E | | 6.00E-003 E | y | 1.6E+000 C | 1.0E+000 C | 2.9E-001 C | 5.2E+002 C | 5.8E+001 C I | 7.7E-004 | 1.5E-002 C |
| TRICHLOROFLUOROMETHANE | 75694 | 3.00E-001 I | | 2.00E-001 A | | y | 1.3E+003 N | 7.3E+002 N | 4.1E+002 N | 6.1E+005 N | 2.3E+004 N | 1.1E+000 | 2.3E+001 N |
| 2,4,5-TRICHLOROPHENOL | 95954 | 1.00E-001 I | | | | | 3.7E+003 N | 3.7E+002 N | 1.4E+002 N | 2.0E+005 N | 7.8E+003 N | | |
| 2,4,6-TRICHLOROPHENOL | 88062 | | 1.10E-002 I | | 1.00E-002 I | | 6.1E+000 C | 6.3E-001 C | 2.9E-001 C | 5.2E+002 C | 5.8E+001 C | | |
| 2,4,5-T | 93765 | 1.00E-002 I | | | | | 3.7E+002 N | 3.7E+001 N | 1.4E+001 N | 2.0E+004 N | 7.8E+002 N | 9.8E-002 | 2.0E+000 N |
| 2-(2,4,5-TRICHLOROPHENOXY)PROPIONIC ACID | 93721 | 8.00E-003 I | | | | | 2.9E+002 N | 2.9E+001 N | 1.1E+001 N | 1.6E+004 N | 6.3E+002 N | 1.1E+000 | 2.1E+001 N |
| 1,1,2-TRICHLOROPROPANE | 598776 | 5.00E-003 I | | | | y | 3.0E+001 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | 1.2E-002 | 2.5E-001 N |
| 1,2,3-TRICHLOROPROPANE | 96184 | 6.00E-003 I | 2.00E+000 E | 1.4E-003 E | | y | 5.3E-003 C | 3.1E-003 C | 1.6E-003 C | 2.9E+000 C | 3.2E-001 C | 1.8E-006 | 3.6E-005 C |
| 1,2,3-TRICHLOROPROPENE | 96195 | 5.00E-003 H | | | | y | 3.0E+001 N | 1.8E+001 N | 6.8E+000 N | 1.0E+004 N | 3.9E+002 N | 1.2E-002 | 2.5E-001 N |
| 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE | 76131 | 3.00E+001 I | | 8.60E+000 H | | y | 5.9E+004 N | 3.1E+004 N | 4.1E+004 N | 6.1E+007 N | 2.3E+006 N | 1.2E+002 | 2.3E+003 N |
| 1,2,4-TRIMETHYLBENZENE | 95636 | 5.00E-002 E | | 1.70E-003 E | | y | 1.2E+001 N | 6.2E+000 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| 1,3,5-TRIMETHYLBENZENE | 108678 | 5.00E-002 E | | 1.70E-003 E | | y | 1.2E+001 N | 6.2E+000 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |
| TRIMETHYL PHOSPHATE | 512561 | | 3.70E-002 H | | | | 1.8E+000 C | 1.7E-001 C | 8.5E-002 C | 1.5E+002 C | 1.7E+001 C | | |
| 1,3,5-TRINITROBENZENE | 99354 | 3.00E-002 I | | | | | 1.1E+003 N | 1.1E+002 N | 4.1E+001 N | 6.1E+004 N | 2.3E+003 N | | |
| 2,4,6-TRINITROTOLUENE | 118967 | 5.00E-004 I | 3.00E-002 I | | | | 2.2E+000 C I | 2.1E-001 C I | 1.1E-001 C I | 1.9E+002 C I | 2.1E+001 C I | | |
| **URANIUM (SOLUBLE SALTS; from IRIS) | 7440611 | 3.00E-003 I | | | | | 1.1E+002 N | 1.1E+001 N | 4.1E+000 N | 6.1E+003 N | 2.3E+002 N | | |
| **URANIUM (SOLUBLE SALTS; provisional) | 7440611 | 2.00E-004 E | | | | | 7.3E+000 N | 7.3E-001 N | 2.7E-001 N | 4.1E+002 N | 1.6E+001 N | | |
| VANADIUM | 7440622 | 7.00E-003 H | | | | | 2.6E+002 N | 2.6E+001 N | 9.5E+000 N | 1.4E+004 N | 5.5E+002 N | 2.6E+002 | 5.1E+003 N |
| VANADIUM PENTOXIDE | 1314621 | 9.00E-003 I | | | | | 3.3E+002 N | 3.3E+001 N | 1.2E+001 N | 1.8E+004 N | 7.0E+002 N | | |
| VANADIUM SULFATE | 16785812 | 2.00E-002 H | | | | | 7.3E+002 N | 7.3E+001 N | 2.7E+001 N | 4.1E+004 N | 1.6E+003 N | | |
| VINCLOZOLIN | 50471448 | 2.50E-002 I | | | | | 9.1E+002 N | 9.1E+001 N | 3.4E+001 N | 5.1E+004 N | 2.0E+003 N | | |
| VINYL ACETATE | 108054 | 1.00E+000 H | | 5.71E-002 I | | y | 4.1E+002 N | 2.1E+002 N | 1.4E+003 N | 2.0E+006 N | 7.8E+004 N | 8.7E-002 | 1.7E+000 N |
| **VINYL CHLORIDE: lifetime | 75014 | 3.00E-003 I | 1.50E+000 I | 2.8E-002 I | 3.00E-002 I | y | 4.0E-002 C | 2.1E-001 C | 2.1E-003 C | 3.8E+000 C | 4.3E-001 C | 1.7E-005 | 3.3E-004 C |
| **VINYL CHLORIDE: adult | 75014 | 3.00E-003 I | 7.50E-001 I | 2.8E-002 I | 1.5E-002 I | y | 8.1E-002 C | 4.2E-001 C | 4.2E-003 C | 7.6E+000 C | 8.5E-001 C | 3.3E-005 | 6.6E-004 C |
| WARFARIN | 81812 | 3.00E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | 2.2E-002 | 4.4E-001 N |
| M-XYLENE | 108383 | 2.00E+000 H | | | | y | 1.2E+004 N | 7.3E+003 N | 2.7E+003 N | 4.1E+006 N | 1.6E+005 N | 1.3E+001 | 2.5E+002 N |
| O-XYLENE | 95476 | 2.00E+000 H | | | | y | 1.2E+004 N | 7.3E+003 N | 2.7E+003 N | 4.1E+006 N | 1.6E+005 N | 1.1E+001 | 2.3E+002 N |
| P-XYLENE | 106423 | | | | | y | | | | | | | |

| Sources: I = IRIS, H = HEAST, A = HEAST Alternate, W = Withdrawn from IRIS or HEAST<br>E = EPA NCEA provisional value, O = other | | | | | | | Basis: C = Carcinogenic effects, N = Noncarcinogenic effects, I = RBC at HI of 0.1 < RBC-c<br>Risk-based concentrations | | | | | Region III SSLs<br>Soil, for groundwater migration | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | CAS | RfDo mg/kg/d | CSFo 1/mg/kg/d | RfDi mg/kg/d | CSFi 1/mg/kg/d | VOC | Tap water ug/l | Ambient air ug/m3 | Fish mg/kg | Soil Industrial mg/kg | Residential mg/kg | DAF 1 mg/kg | DAF 20 mg/kg |
| XYLENES | 1330207 | 2.00E+000 I | | | | y | 1.2E+004 N | 7.3E+003 N | 2.7E+003 N | 4.1E+006 N | 1.6E+005 N | 8.5E+000 | 1.7E+002 N |
| ZINC | 7440666 | 3.00E-001 I | | | | | 1.1E+004 N | 1.1E+003 N | 4.1E+002 N | 6.1E+005 N | 2.3E+004 N | 6.8E+002 | 1.4E+004 N |
| ZINC PHOSPHIDE | 1314847 | 3E-004 I | | | | | 1.1E+001 N | 1.1E+000 N | 4.1E-001 N | 6.1E+002 N | 2.3E+001 N | | |
| ZINEB | 12122677 | 5E-002 I | | | | | 1.8E+003 N | 1.8E+002 N | 6.8E+001 N | 1.0E+005 N | 3.9E+003 N | | |

# APPENDIX E

# FEDERAL AMBIENT WATER QUALITY CRITERIA

federal register

Thursday
December 10, 1998

# Part IV

# Environmental Protection Agency

## National Recommended Water Quality Criteria; Notice; Republication

## ENVIRONMENTAL PROTECTION AGENCY

[FRL-OW-6186-6a]

## National Recommended Water Quality Criteria; Republication

**Editorial Note:** FR Doc. 98-30272 was originally published as Part IV (63 FR 67548-67558) in the issue of Monday, December 7, 1998. At the request of the agency, due to incorrect footnote identifiers in the tables, the corrected document is being republished in its entirety.

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Compilation of recommended water quality criteria and notice of process for new and revised criteria.

**SUMMARY:** EPA is publishing a compilation of its national recommended water quality criteria for 157 pollutants, developed pursuant to section 304(a) of the Clean Water Act (CWA or the Act). These recommended criteria provide guidance for States and Tribes in adopting water quality standards under section 303(c) of the CWA. Such standards are used in implementing a number of environmental programs, including setting discharge limits in National Pollutant Discharge Elimination System (NPDES) permits. These water quality criteria are not regulations, and do not impose legally binding requirements on EPA, States, Tribes or the public.

This document also describes changes in EPA's process for deriving new and revised 304(a) criteria. Comments provided to the Agency about the content of this Notice will be considered in future publications of water quality criteria and in carrying out the process for deriving water quality criteria. With this improved process the public will have more opportunity to provide data and views for consideration by EPA. The public may send any comments or observations regarding the compilation format or the process for deriving new or revised water quality criteria to the Agency now, or anytime while the process is being implemented.

**ADDRESSES:** A copy of the document, "National Recommended Water Quality Criteria" is available from the U.S. EPA, National Center for Environmental Publications and Information, 11029 Kenwood Road, Cincinnati, Ohio 45242, phone (513) 489-8190. The publication is also available electronically at: http://www.epa.gov/ost. Send an original and 3 copies of written comments to W-98-24 Comment Clerk, Water Docket, MC 4104, US EPA, 401 M Street, S.W., Washington, D.C. 20460. Comments may also be submitted electronically to OW-Docket@epamail.epa.gov. Comments should be submitted as a WP5.1, 6.1 or an ASCII file with no form of encryption. The documents cited in the compilation of recommended criteria are available for inspection from 9 to 4 p.m., Monday through Friday, excluding legal holidays, at the Water Docket, EB57, East Tower Basement, USEPA, 401 M St., S.W., Washington, D.C. 20460. For access to these materials, please call (202) 260-3027 to schedule an appointment.

**FOR FURTHER INFORMATION CONTACT:** Cindy A. Roberts, Health and Ecological Criteria Division (4304), U.S. EPA, 401 M. Street, S.W., Washington, D.C. 20460; (202) 260-2787; roberts.cindy@epamail.epa.gov.

**SUPPLEMENTARY INFORMATION:**

### I. What Are Water Quality Criteria?

Section 304(a)(1) of the Clean Water Act requires EPA to develop and publish, and from time to time revise, criteria for water quality accurately reflecting the latest scientific knowledge. Water quality criteria developed under section 304(a) are based solely on data and scientific judgments on the relationship between pollutant concentrations and environmental and human health effects. Section 304(a) criteria do not reflect consideration of economic impacts or the technological feasibility of meeting the chemical concentrations in ambient water. Section 304(a) criteria provide guidance to States and Tribes in adopting water quality standards that ultimately provide a basis for controlling discharges or releases of pollutants. The criteria also provide guidance to EPA when promulgating federal regulations under section 303(c) when such action is necessary.

### II. What is in the Compilation Published Today?

EPA is today publishing a compilation of its national recommended water quality criteria for 157 pollutants. This compilation is also available in hard copy at the address given above.

The compilation is presented as a summary table containing EPA's water quality criteria for 147 pollutants, and for an additional 10 pollutants, criteria solely for organoleptic effects. For each set of criteria, EPA lists a **Federal Register** citation, EPA document number or Integrated Risk Information System (IRIS) entry (www.epa.gov/ngispgm3/iris/irisdat). Specific information pertinent to the derivation of individual criteria may be found in cited references. If no criteria are listed for a pollutant, EPA does not have any national recommended water quality criteria.

These water quality criteria are the Agency's current recommended 304(a) criteria, reflecting the latest scientific knowledge. They are generally applicable to the waters of the United States. EPA recommends that States and Tribes use these water quality criteria as guidance in adopting water quality standards pursuant to section 303(c) of the Act and the implementing of federal regulations at 40 CFR part 131. Water quality criteria derived to address site-specific situations are not included; EPA recommends that States and Tribes follow EPA's technical guidance in the "Water Quality Standards Handbook—2nd Edition," EPA, August 1994, in deriving such site-specific criteria. EPA recognizes that in limited circumstances there may be regulatory voids in the absence of State or Tribal water quality standards for specific pollutants. However, States and Tribes should utilize the existing State and Tribal narrative criteria to address such situations; States and Tribes may consult EPA criteria documents and cites in the summary table for additional information.

The national recommended water quality criteria include: previously published criteria that are unchanged; criteria that have been recalculated from earlier criteria; and newly calculated criteria, based on peer-reviewed assessments, methodologies and data, that have not been previously published.

The information used to calculate the water quality criteria is not included in the summary table. Most information has been previously published by the Agency in a variety of sources, and the summary table cites those sources.

When using these 304(a) criteria as guidance in adopting water quality standards, EPA recommends States and Tribes consult the citations referenced in the summary table for additional information regarding the derivation of individual criteria.

The Agency intends to revise the compilation of national recommended water quality criteria from time to time to keep States and Tribes informed as to the most current recommended water quality criteria.

### III. How Are National Recommended Water Quality Criteria Used?

Once new or revised 304(a) criteria are published by EPA, the Agency expects States and Tribes to adopt promptly new or revised numeric water quality criteria into their standards consistent with one of the three options

in 40 CFR 131.11. These options are: (1) Adopt the recommended section 304(a) criteria; (2) adopt section 304(a) criteria modified to reflect site-specific conditions; or, (3) adopt criteria derived using other scientifically defensible methods. In adopting criteria under option (2) or (3), States and Tribes must adopt water quality criteria sufficient to protect the designated uses of their waters. When establishing a numerical value based on 304(a) criteria, States and Tribes may reflect site specific conditions or use other scientifically defensible methods. However, States and Tribes should not selectively apply data or selectively use endpoints, species, risk levels, or exposure parameters in deriving criteria; this would not accurately characterize risk and would not result in criteria protective of designated uses.

EPA emphasizes that, in the course of carrying out its responsibilities under section 303(c), it reviews State and Tribal water quality standards to assess the need for new or revised water quality criteria. EPA generally believes that five years from the date of EPA's publication of new or revised water quality criteria is a reasonable time by which States and Tribes should take action to adopt new or revised water quality criteria necessary to protect the designated uses of their waters. This period is intended to accommodate those States and Tribes that have begun a triennial review and wish to complete the actions they have underway, deferring initiating adoption of new or revised section 304(a) criteria until the next triennial review.

## IV. What is the Status of Existing Criteria While They Are Under Revision?

The question of the status of the existing section 304(a) criteria often arises when EPA announces that it is beginning a reassessment of existing criteria. The general answer is that water quality criteria published by EPA remain the Agency's recommended water quality criteria until EPA revises or withdraws the criteria. For example, while undertaking recent reassessments of dioxin, PCBs, and other chemicals, EPA has consistently upheld the use of the current section 304(a) criteria for these chemicals and considers them to be scientifically sound until new, peer reviewed, scientific assessments indicate changes are needed. Therefore, the criteria in today's notice are and will continue to be the Agency's national recommended water quality criteria for States and Tribes to use in adopting or revising their water quality standards until superseded by the publication of revised criteria, or withdrawn by notice in the **Federal Register**.

## V. What is the Process for Developing New or Revised Criteria?

Section 304(a)(1) of the CWA requires the Agency to develop and publish, and from time to time revise, criteria for water quality accurately reflecting the latest scientific knowledge. The Agency has developed an improved process that it intends to use when deriving new criteria or conducting a major reassessment of existing criteria. The purpose of the improved process is to provide expanded opportunities for public input, and to make the process more efficient.

When deriving new criteria, or when initiating a major reassessment of existing criteria, EPA will take the following steps.

1. EPA will first undertake a comprehensive review of available data and information.

2. EPA will publish a notice in the **Federal Register** and on the Internet announcing its assessment or reassessment of the pollutant. The notice will describe the data available to the Agency, and will solicit any additional pertinent data or views that may be useful in deriving new or revised criteria. EPA is especially interested in hearing from the public regarding new data or information that was unavailable to the Agency, and scientific views as to the application of the relevant Agency methodology for deriving water quality criteria.

3. After public input is received and evaluated, EPA will then utilize information obtained from both the Agency's literature review and the public to develop draft recommended water quality criteria.

4. EPA will initiate a peer review of the draft criteria. Agency peer review consists of a documented critical review by qualified independent experts. Information about EPA peer review practices may be found in the Science Policy Council's Peer Review Handbook (EPA 100–B–98–001, www.epa.gov).

5. Concurrent with the peer review in step four, EPA will publish a notice in the **Federal Register** and on the Internet, of the availability of the draft water quality criteria and solicit views from the public on issues of science pertaining to the information used in deriving the draft criteria. The Agency believes it is important to provide the public with the opportunity to provide scientific views on the draft criteria even though we are not required to invite and respond to written comments.

6. EPA will evaluate the results of the peer review, and prepare a response document for the record in accordance with EPA's Peer Review Handbook. EPA at the same time will consider views provided by the public on issues of science. Major scientific issues will be addressed in the record whether from the peer review or the public.

7. EPA will then revise the draft criteria as necessary, and announce the availability of the final water quality criteria in the **Federal Register** and on the Internet.

## VI. What is the Process for Minor Revisions to Criteria?

In addition to developing new criteria, and conducting major reassessments of existing criteria, EPA also from time to time recalculates criteria based on new information pertaining to individual components of the criteria. For example, in today's notice, EPA has recalculated a number of criteria based on new, peer-reviewed data contained in EPA's IRIS. Because such recalculations normally result in only minor changes to the criteria, do not ordinarily involve a change in the underlying scientific methodologies, and reflect peer-reviewed data, EPA will typically publish such recalculated criteria directly as the Agency's recommended water quality criteria. If it appears that a recalculation results in a significant change EPA will follow the process of peer review and public input outlined above. Further, when EPA recalculates national water quality criteria in the course of proposing or promulgating state-specific federal water quality standards pursuant to section 303(c), EPA will offer an opportunity for national public input on the recalculated criteria.

## VII. How Does the Process Outlined Above Improve Public Input and Efficiency?

In the past, EPA developed draft criteria documents and announced their availability for public comment in the **Federal Register**. This led to new data and views coming to EPA's attention after draft criteria had already been developed. Responding to new data would sometimes lead to extensive revisions.

The steps outlined above improve the criteria development process in the following ways.

1. The new process is Internet-based which is in line with EPA policy for public access and dissemination of information gathered by EPA. Use of the Internet will allow the public to be more engaged in the criteria development process than previously and to more

knowledgeably follow criteria development. For new criteria or major revisions, EPA will announce its intentions to derive the new or revised criteria on the Internet and include a list of the available literature. This will give the public an opportunity to provide additional data that might not otherwise be identified by the Agency.

2. The public now has two opportunities to contribute data and views, before development and during development, instead of a single opportunity after development.

3. EPA has instituted broader and more formal peer review procedures. This independent scientific review is a more rigorous disciplinary practice to ensure technical improvements in Agency decision making. Previously, EPA used the public comment process outlined above to obtain peer review. The new process allows for both public input and a formal peer review, resulting in a more thorough and complete evaluation of the criteria.

4. Announcing the availability of the draft water quality criteria on the Internet will give the public an opportunity to provide input on issues of science in a more timely manner.

## VIII. Where Can I Find More Information About Water Quality Criteria and Water Quality Standards?

For more information about water quality criteria and Water Quality Standards refer to the following: Water Quality Standards Handbook (EPA 823-B94-005a); Advanced Notice of Proposed Rule Making (ANPRM), (63 FR 36742); Water Quality Criteria and Standards Plan—Priorities for the Future (EPA 822-R-98-003); Guidelines and Methodologies Used in the Preparation of Health Effects Assessment Chapters of the Consent Decree Water Criteria Documents (45 FR 79347); Draft Water Quality Criteria Methodology Revisions: Human Health (63 FR 43755, EPA 822-Z-98-001); and Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (EPA 822/R-85-100); National Strategy for the Development of Regional Nutrient Criteria (EPA 822-R-98-002).

These publications may also be accessed through EPA's National Center for Environmental Publications and Information (NCEPI) or on the Office of Science and Technology's Home-page (www.epa.gov/OST).

## IX. What Are the National Recommended Water Quality Criteria?

The following compilation and its associated footnotes and notes presents the national recommended water quality criteria.

NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR PRIORITY TOXIC POLLUTANTS

| Priority pollutant | CAS No. | Freshwater | | Saltwater | | Human health for consumption of: | | FR cite/source |
|---|---|---|---|---|---|---|---|---|
| | | CMC (µg/L) | CCC (µg/L) | CMC (µg/L) | CCC (µg/L) | Water + organism (µg/L) | Organism only (µg/L) | |
| 1 Antimony | 7440360 | | | | | 14[B,Z] | 4300[B] | 57 FR 60848 |
| 2 Arsenic | 7440382 | 340[A,D,K] | 150[A,D,K] | 69[A,D,bb] | 36[A,D,bb] | | | 62 FR 42160 |
| | | | | | | 0.018[C,M,S] | 0.14[C,M,S] | 57 FR 60848 |
| 3 Beryllium | 7440417 | | | | | [J,Z] | [J] | 62 FR 42160 |
| 4 Cadmium | 7440439 | 4.3[D,E,K] | 2.2[D,E,K] | 42[D,bb] | 9.3[D,bb] | [J,Z] | [J] | 62 FR 42160 |
| 5a Chromium III | 16065831 | 570[D,E,K] | 74[D,E,K] | | | | | EPA 820/B-96-001 |
| | | | | | | [J,Z Total] | [J] | 62 FR 42160 |
| 5b Chromium VI | 18540299 | 16[D,K] | 11[D,K] | 1,100[D,bb] | 50[D,bb] | [J,Z Total] | [J] | 62 FR 42160 |
| 6 Copper | 7440508 | 13[D,E,K,cc] | 9.0[D,E,K,cc] | 4.8[D,cc,ff] | 3.1[D,cc,ff] | 1,300[U] | | 62 FR 42160 |
| 7 Lead | 7439921 | 65[D,E,bb,gg] | 2.5[D,E,bb,gg] | 210[D,bb] | 8.1[D,bb] | [J] | [J] | 62 FR 42160 |
| 8 Mercury | 7439976 | 1.4[D,K,hh] | 0.77[D,K,hh] | 1.8[D,ee,hh] | 0.94[D,ee,hh] | 0.050[B] | 0.051[B] | 62 FR 42160 |
| 9 Nickel | 7440020 | 470[D,E,K] | 52[D,E,K] | 74[D,bb] | 8.2[D,bb] | 610[B] | 4,600[B] | 62 FR 42160 |
| 10 Selenium | 7782492 | [L,R,T] | 5.0[T] | 290[D,bb,dd] | 71[D,bb,dd] | | | 62 FR 42160 |
| | | | | | | 170[Z] | 11,000 | IRIS 09/01/91 |
| 11 Silver | 7440224 | 3.4[D,E,G] | | 1.9[D,G] | | | | 62 FR 42160 |
| 12 Thallium | 7440280 | | | | | 1.7[B] | 6.3[B] | 57 FR 60848 |
| 13 Zinc | 7440666 | 120[D,E,K] | 120[D,E,K] | 90[D,bb] | 81[D,bb] | | | 62 FR 42160 |
| | | | | | | 9,100[U] | 69,000[U] | IRIS 10/01/92 |
| 14 Cyanide | 57125 | 22[K,Q] | 5.2[K,Q] | | | | | EPA 820/B-96-001 |
| | | | | 1[Q,bb] | 1[Q,bb] | 700[B,Z] | 220,000[B,H] | 57 FR 60848 |
| 15 Asbestos | 1332214 | | | | | 7 million fibers/L[I] | | 57 FR 60848 |
| 16 2, 3, 7, 8-TCDD Dioxin | 1746016 | | | | | 1.3E-8[C] | 1.4E-8[C] | 62 FR 42160 |
| 17 Acrolein | 107028 | | | | | 320 | 780 | 57 FR 60848 |
| 18 Acrylonitrile | 107131 | | | | | 0.059[B,C] | 0.66[B,C] | 57 FR 60848 |
| 19 Benzene | 71432 | | | | | 1.2[B,C] | 71[B,C] | 62 FR 42160 |
| 20 Bromoform | 75252 | | | | | 4.3[B,C] | 360[B,C] | 62 FR 42160 |
| 21 Carbon Tetrachloride | 56235 | | | | | 0.25[B,C] | 4.4[B,C] | 57 FR 60848 |
| 22 Chlorobenzene | 108907 | | | | | 680[B,Z] | 21,000[B,H] | 57 FR 60848 |
| 23 Chlorodibromomethane | 124481 | | | | | 0.41[B,C] | 34[B,C] | 62 FR 42160 |
| 24 Chloroethane | 75003 | | | | | | | |
| 25 2-Chloroethylvinyl Ether | 110758 | | | | | | | |
| 26 Chloroform | 67663 | | | | | 5.7[B,C] | 470[B,C] | 62 FR 42160 |
| 27 Dichlorobromomethane | 75274 | | | | | 0.56[B,C] | 46[B,C] | 62 FR 42160 |
| 28 1,1-Dichloroethane | 75343 | | | | | | | |
| 29 1,2-Dichloroethane | 107062 | | | | | 0.38[B,C] | 99[B,C] | 57 FR 60848 |
| 30 1,1-Dichloroethylene | 75354 | | | | | 0.057[B,C] | 3.2[B,C] | 57 FR 60848 |
| 31 1,2-Dichloropropane | 78875 | | | | | 0.52[B,C] | 39[B,C] | 62 FR 42160 |
| 32 1,3-Dichloropropene | 542756 | | | | | 10[B] | 1,700[B] | 57 FR 60848 |
| 33 Ethylbenzene | 100414 | | | | | 3,100[B,Z] | 29,000[B] | 62 FR 42160 |
| 34 Methyl Bromide | 74839 | | | | | 48[B] | 4000[B] | 62 FR 42160 |
| 35 Methyl Chloride | 74873 | | | | | [J] | [J] | 62 FR 42160 |
| 36 Methylene Chloride | 75092 | | | | | 4.7[B,C] | 1600[B,C] | 62 FR 42160 |
| 37 1,1,2,2-Tetrachloroethane | 79345 | | | | | 0.17[B,C] | 11[B,C] | 57 FR 60848 |
| 38 Tetrachloroethylene | 127184 | | | | | 0.8[C] | 8.85[C] | 57 FR 60848 |
| 39 Toluene | 108883 | | | | | 6,800[B,Z] | 200,000[B] | 62 FR 42160 |
| 40 1,2-Trans-Dichloroethylene | 156605 | | | | | 700[B,Z] | 140,000[B] | 62 FR 42160 |
| 41 1,1,1-Trichloroethane | 71556 | | | | | [J,Z] | [J] | 62 FR 42160 |
| 42 1,1,2-Trichloroethane | 79005 | | | | | 0.60[B,C] | 42[B,C] | 57 FR 60848 |
| 43 Trichloroethylene | 79016 | | | | | 2.7[C] | 81[C] | 57 FR 60848 |
| 44 Vinyl Chloride | 75014 | | | | | 2.0[C] | 525[C] | 57 FR 60848 |
| 45 2-Chlorophenol | 95578 | | | | | 120[B,U] | 400[B,U] | 62 FR 42160 |
| 46 2,4-Dichlorophenol | 120832 | | | | | 93[B,U] | 790[B,U] | 57 FR 60848 |
| 47 2,4-Dimethylphenol | 105679 | | | | | 540[B,U] | 2,300[B,U] | 62 FR 42160 |
| 48 2-Methyl-4,6-Dinitrophenol | 534521 | | | | | 13.4 | 765 | 57 FR 60848 |
| 49 2,4-Dinitrophenol | 51285 | | | | | 70[B] | 14,000[B] | 57 FR 60848 |
| 50 2-Nitrophenol | 88755 | | | | | | | |
| 51 4-Nitrophenol | 100027 | | | | | | | |
| 52 3-Methyl-4-Chlorophenol | 59507 | | | | | [U] | [U] | |

NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR PRIORITY TOXIC POLLUTANTS—Continued

| Priority pollutant | CAS No. | Freshwater | | Saltwater | | Human health for consumption of: | | FR cite/source |
|---|---|---|---|---|---|---|---|---|
| | | CMC (µg/L) | CCC (µg/L) | CMC (µg/L) | CCC (µg/L) | Water + organism (µg/L) | Organism only (µg/L) | |
| 53 Pentachlorophenol | 87865 | 19[F,K] | 15[F,K] | 13[bb] | 7.9[bb] | 0.28[B,C] | 8.2[B,C,H] | 62 FR 42160 |
| 54 Phenol | 108952 | | | | | 21,000[B,U] | | 62 FR 42160 |
| | | | | | | | 4,600,000[B,H,U] | 57 FR 60848 |
| 55 2,4,6-Trichlorophenol | 88062 | | | | | 2.1[B,C,U] | 6.5[B,C] | 62 FR 42160 |
| 56 Acenaphthene | 83329 | | | | | 1,200[B,U] | 2,700[B,U] | 62 FR 42160 |
| 57 Acenaphthylene | 208968 | | | | | | | |
| 58 Anthracene | 120127 | | | | | 9,600[B] | 110,000[B] | 62 FR 42160 |
| 59 Benzidine | 92875 | | | | | 0.00012[B,C] | 0.00054[B,C] | 57 FR 60848 |
| 60 BenzoaAnthracene | 56553 | | | | | 0.0044[B,C] | 0.049[B,C] | 62 FR 42160 |
| 61 BenzoaPyrene | 50328 | | | | | 0.0044[B,C] | 0.049[B,C] | 62 FR 42160 |
| 62 BenzobFluoranthene | 205992 | | | | | 0.0044[B,C] | 0.049[B,C] | 62 FR 42160 |
| 63 BenzoghiPerylene | 191242 | | | | | | | |
| 64 BenzokFluoranthene | 207089 | | | | | 0.0044[B,C] | 0.049[B,C] | 62 FR 42160 |
| 65 Bis2-ChloroethoxyMethane | 111911 | | | | | | | |
| 66 Bis2-ChloroethylEther | 111444 | | | | | 0.031[B,C] | 1.4[B,C] | 57 FR 60848 |
| 67 Bis2-ChloroisopropylEther | 39638329 | | | | | 1,400[B] | | 62 FR 42160 |
| | | | | | | | 170,000[B] | 57 FR 60848 |
| 68 Bis2-EthylhexylPhthalate[X] | 117817 | | | | | 1.8[B,C] | 5.9[B,C] | 57 FR 60848 |
| 69 4-Bromophenyl Phenyl Ether | 101553 | | | | | | | |
| 70 Butylbenzyl Phthalate[W] | 85687 | | | | | 3,000[B] | 5,200[B] | 62 FR 42160 |
| 71 2-Chloronaphthalene | 91587 | | | | | 1,700[B] | 4,300[B] | 62 FR 42160 |
| 72 4-Chlorophenyl Phenyl Ether | 7005723 | | | | | | | |
| 73 Chrysene | 218019 | | | | | 0.0044[B,C] | 0.049[B,C] | 62 FR 42160 |
| 74 Dibenzoa,hAnthracene | 53703 | | | | | 0.0044[B,C] | 0.049[B,C] | 62 FR 42160 |
| 75 1,2-Dichlorobenzene | 95501 | | | | | 2,700[B,Z] | 17,000[B] | 62 FR 42160 |
| 76 1,3-Dichlorobenzene | 541731 | | | | | 400 | 2,600 | 62 FR 42160 |
| 77 1,4-Dichlorobenzene | 106467 | | | | | 400[Z] | 2,600 | 62 FR 42160 |
| 78 3,3'-Dichlorobenzidine | 91941 | | | | | 0.04[B,C] | 0.077[B,C] | 57 FR 60848 |
| 79 Diethyl Phthalate[W] | 84662 | | | | | 23,000[B] | 120,000[B] | 57 FR 60848 |
| 80 Dimethyl Phthalate[W] | 131113 | | | | | 313,000 | 2,900,000 | 57 FR 60848 |
| 81 Di-n-Butyl Phthalate[W] | 84742 | | | | | 2,700[B] | 12,000[B] | 57 FR 60848 |
| 82 2,4-Dinitrotoluene | 121142 | | | | | 0.11[C] | 9.1[C] | 57 FR 60848 |
| 83 2,6-Dinitrotoluene | 606202 | | | | | | | |
| 84 Di-n-Octyl Phthalate | 117840 | | | | | | | |
| 85 1,2-Diphenylhydrazine | 122667 | | | | | 0.040[B,C] | 0.54[B,C] | 57 FR 60848 |
| 86 Fluoranthene | 206440 | | | | | 300[B] | 370[B] | 62 FR 42160 |
| 87 Fluorene | 86737 | | | | | 1,300[B] | 14,000[B] | 62 FR 42160 |
| 88 Hexachlorobenzene | 118741 | | | | | 0.00075[B,C] | 0.00077[B,C] | 62 FR 42160 |
| 89 Hexachlorobutadiene | 87683 | | | | | 0.44[B,C] | 50[B,C] | 57 FR 60848 |
| 90 Hexachlorocyclopentadiene | 77474 | | | | | 240[B,U,Z] | 17,000[B,H,U] | 57 FR 60848 |
| 91 Hexachloroethane | 67721 | | | | | 1.9[B,C] | 8.9[B,C] | 57 FR 60848 |
| 92 Ideno 1,2,3-cdPyrene | 193395 | | | | | 0.0044[B,C] | 0.049[B,C] | 62 FR 42160 |
| 93 Isophorone | 78591 | | | | | 36[B,C] | 2,600[B,C] | IRIS 11/01/97 |
| 94 Naphthalene | 91203 | | | | | | | |
| 95 Nitrobenzene | 98953 | | | | | 17[B] | 1,900[B,H,U] | 57 FR 60848 |
| 96 N-Nitrosodimethylamine | 62759 | | | | | 0.00069[B,C] | 8.1[B,C] | 57 FR 60848 |
| 97 N-Nitrosodi-n-Propylamine | 621647 | | | | | 0.005[B,C] | 1.4[B,C] | 62 FR 42160 |
| 98 N-Nitrosodiphenylamine | 86306 | | | | | 5.0[B,C] | 16[B,C] | 57 FR 60848 |
| 99 Phenanthrene | 85018 | | | | | | | |
| 100 Pyrene | 129000 | | | | | 960[B] | 11,000[B] | 62 FR 42160 |
| 101 1,2,4-Trichlorobenzene | 120821 | | | | | 260[Z] | 940 | IRIS 11/01/96 |
| 102 Aldrin | 309002 | 3.0[G] | | 1.3[G] | | 0.00013[B,C] | 0.00014[B,C] | 62 FR 42160 |
| 103 alpha-BHC | 319846 | | | | | 0.0039[B,C] | 0.013[B,C] | 62 FR 42160 |
| 104 beta-BHC | 319857 | | | | | 0.014[B,C] | 0.046[B,C] | 62 FR 42160 |
| 105 gamma-BHC (Lindane) | 58899 | 0.95[K] | | 0.16[G] | | 0.019[C] | 0.063[C] | 62 FR 42160 |
| 106 delta-BHC | 319868 | | | | | | | |
| 107 Chlordane | 57749 | 2.4[G] | 0.0043[G,aa] | 0.09[G] | 0.004[G,aa] | | | 62 FR 42160 |
| | | | | | | 0.0021[B,C] | 0.0022[B,C] | IRIS 02/07/98 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 108 | 4,4'-DDT | 50293 | 1.1[G] | 0.001[G,aa] | 0.13[G] | 0.001[G,aa] | 0.00059[B,C] | 0.00059[B,C] | 62 FR 42160 |
| 109 | 4,4'-DDE | 72559 | | | | | 0.00059[B,C] | 0.00059[B,C] | 62 FR 42160 |
| 110 | 4,4'-DDD | 72548 | | | | | 0.00083[B,C] | 0.00084[B,C] | 62 FR 42160 |
| 111 | Dieldrin | 60571 | 0.24[K] | 0.056[K,O] | 0.71[G] | 0.0019[G,aa] | 0.00014[B,C] | 0.00014[B,C] | 62 FR 42160 |
| 112 | alpha-Endosulfan | 959988 | 0.22[G,Y] | 0.056[G,Y] | 0.034[G,Y] | 0.0087[G,Y] | 110[B] | 240[B] | 62 FR 42160 |
| 113 | beta-Endosulfan | 33213659 | 0.22[G,Y] | 0.056[G,Y] | 0.034[G,Y] | 0.0087[G,Y] | 110[B] | 240[B] | 62 FR 42160 |
| 114 | Endosulfan Sulfate | 1031078 | | | | | 110[B] | 240[B] | 62 FR 42160 |
| 115 | Endrin | 72208 | 0.086[K] | 0.036[K,O] | 0.037[G] | 0.0023[G,aa] | 0.76[B] | 0.81[B,H] | 62 FR 42160 |
| 116 | Endrin Aldehyde | 7421934 | | | | | 0.76[B] | 0.81[B,H] | 62 FR 42160 |
| 117 | Heptachlor | 76448 | 0.52[G] | 0.0038[G,aa] | 0.053[G] | 0.0036[G,aa] | 0.00021[B,C] | 0.00021[B,C] | 62 FR 42160 |
| 118 | Heptachlor Epoxide | 1024573 | 0.52[G,V] | 0.0038[G,V,aa] | 0.053[G,V] | 0.0036[G,V,aa] | 0.00010[B,C] | 0.00011[B,C] | 62 FR 42160 |
| 119 | Polychlorinated Biphenyls | | | 0.014[N,aa] | | 0.03[N,aa] | | | 62 FR 42160 |
| | PCBs | | | | | | 0.00017[B,C,P] | 0.00017[B,C,P] | 63 FR 16182 |
| 120 | Toxaphene | 8001352 | 0.73 | 0.0002[aa] | 0.21 | 0.0002[aa] | 0.00073[B,C] | 0.00075[B,C] | 62 FR 42160 |

**Footnotes:**

[A] This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic, which might imply that arsenic (III) and arsenic (V) are equally toxic to aquatic life and that their toxicities are additive. In the arsenic criteria document (EPA 440/5–84–033, January 1985), Species Mean Acute Values are given for both arsenic (III) and arsenic (V) for five species and the ratios of the SMAVs for each species range from 0.6 to 1.7. Chronic values are available for both arsenic (III) and arsenic (V) for one species; for the fathead minnow, the chronic value for arsenic (V) is 0.29 times the chronic value for arsenic (III). No data are known to be available concerning whether the toxicities of the forms of arsenic to aquatic organisms are additive.

[B] This criterion has been revised to reflect The Environmental Protection Agency's q1* or RfD, as contained in the Integrated Risk Information System (IRIS) as of April 8, 1998. The fish tissue bioconcentration factor (BCF) from the 1980 Ambient Water Quality Criteria document was retained in each case.

[C] This criterion is based on carcinogenicity of $10^{-6}$ risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of $10^{-5}$, move the decimal point in the recommended criterion one place to the right).

[D] Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. The recommended water quality criteria value was calculated by using the previous 304(a) aquatic life criteria expressed in terms of total recoverable metal, and multiplying it by a conversion factor (CF). The term "Conversion Factor" (CF) represents the recommended conversion factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column. (Conversion Factors for saltwater CCCs are not currently available. Conversion factors derived for saltwater CMCs have been used for both saltwater CMCs and CCCs.) See "Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria," October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington, DC 20460; and 40 CFR § 131.36(b)(1). Conversion Factors applied in the table can be found in Appendix A to the Preamble—Conversion Factors for Dissolved Metals.

[E] The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated from the following: CMC (dissolved) = exp $\{m_A [\ln(\text{hardness})]+b_A\}$ (CF), or CCC (dissolved) = exp $\{m_C [\ln(\text{hardness})]+b_C\}$ (CF) and the parameters specified in Appendix B to the Preamble—Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent.

[F] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMD=exp(1.005(pH) − 4.869); CCC=exp(1.005 (pH) − 5.134). Values displayed in table correspond to a pH of 7.8.

[G] This Criterion is based on 304(a) aquatic life criterion issued in 1980, and was issued in one of the following documents: Aldrin/Dieldrin (EPA 440/5–80–019), Chlordane (EPA 440/5–80–027), DDT (EPA 440/5–80–038), Endosulfan (EPA 440/5–80–046), Endrin (EPA 440/5–80–047), Heptachlor (440/5–80–052), Hexachlorocyclohexane (EPA 440/5–80–054), Silver (EPA 440/5–80–071). The Minimum Data Requirements and derivation procedures were different in the 1980 Guidelines than in the 1985 Guidelines. For example, a "CMC" derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

[H] No criterion for protection of human health from consumption of aquatic organisms excluding water was presented in the 1980 criteria document or in the 1986 Quality Criteria for Water. Nevertheless, sufficient information was presented in the 1980 document to allow the calculation of a criterion, even though the results of such a calculation were not shown in the document.

[I] This criterion for asbestos is the Maximum Contaminant Level (MCL) developed under the Safe Drinking Water Act (SDWA).

[J] EPA has not calculated human health criterion for this contaminant. However, permit authorities should address this contaminant in NPDES permit actions using the State's existing narrative criteria for toxics.

[K] This recommended criterion is based on a 304(a) aquatic life criterion that was issued in the 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water, (EPA–820–B–96–011, September 1996). This value was derived using the GLI Guidelines (60 FR 15393–15399, March 23, 1995; 40 CFR 132 Appendix A); the difference between the 1985 Guidelines and the GLI Guidelines are explained on page iv of the 1995 Updates. None of the decisions concerning the derivation of this criterion were affected by any considerations that are specific to the Great Lakes.

[L] The CMC=1/[(f1/CMC1)=(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/l and 12.83 µg/l, respectively.

[M] EPA is currently reassessing the criteria for arsenic. Upon completion of the reassessment the Agency will publish revised criteria as appropriate.

[N] PCBs are a class of chemicals which include aroclors, 1242, 1254, 1221, 1232, 1248, 1260, and 1016, CAS numbers 53469219, 11097691, 11104282, 11141165, 12672296, 11096825 and 12674112 respectively. The aquatic life criteria apply to this set of PCBs.

[O] The derivation of the CCC for this pollutant did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels.

[P] This criterion applies to total pcbs, i.e., the sum of all congener or all isomer analyses.

[Q] This recommended water quality criterion is expressed as µg free cyanide (as CN)/L.

[R] This value was announced (61 FR 58444–58449, November 14, 1996) as a proposed GLI 303(c) aquatic life criterion. EPA is currently working on this criterion and so this value might change substantially in the near future.

[S] This recommended water quality criterion refers to the inorganic form only.

[T] This recommended water quality criterion is expressed in terms of total recoverable metal in the water column. It is scientifically acceptable to use the conversion factor of 0.922 that was used in the GLI to convert this to a value that is expressed in terms of dissolved metal.

[U] The organoleptic effect criterion is more stringent than the value for priority toxic pollutants.

[v] This value was derived from data for heptachlor and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.

[w] Although EPA has not published a final criteria document for this compound it is EPA's understanding that sufficient data exist to allow calculation of aquatic criteria. It is anticipated that industry intends to publish in the peer reviewed literature draft aquatic life criteria generated in accordance with EPA Guidelines. EPA will review such criteria for possible issuance as national WQC.

[x] There is a full set of aquatic life toxicity data that show that DEHP is not toxic to aquatic organisms at or below its solubility limit.

[y] This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.

[z] A more stringent MCL has been issued by EPA. Refer to drinking water regulations (40 CFR 141) or Safe Drinking Water Hotline (1–800–426–4791) for values.

[aa] This CCC is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60FR 15393–15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.

[bb] This water quality criterion is based on 304(a) aquatic life criterion that was derived using the 1985 Guidelines (Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, PB85–227049, January 1985) and was issued in one of the following criteria documents: Arsenic (EPA 440/5–84–033), Cadmium (EPA 440/5–84–032), Chromium (EPA 440/5–84–029), Copper (EPA 440/5–84–031), Cyanide (EPA 400/5–84–028), Lead (EPA 440/5–84–027), Nickel (EPA 440/5–86–004), Pentachlorophenol (EPA 440/5–86–009), Toxaphene (EPA 440/5–86–006), Zinc (EPA 440/5–87–003).

[cc] When the concentration of dissolved organic carbon is elevated, copper is substantially less toxic and use of Water-Effect Ratios might be appropriate.

[dd] The selenium criteria document (EPA 440/5–87–006), September 1987) provides that if selenium is as toxic to saltwater fishes in the field as it is to freshwater fishes in the field, the status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 µg/L in salt water because the saltwater CCC does not take into account uptake via the food chain.

[ee] This recommended water quality criterion was derived on page 43 of the mercury criteria document (EPA 440/5–84–026, January 1985). The saltwater CCC of 0.025 µg/L given on page 23 of the criteria document is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60FR15393–15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.

[ff] This recommended water quality criterion was derived in Ambient Water Quality Criteria Saltwater Copper Addendum (Draft, April 14, 1995) and was promulgated in the Interim Final National Toxics Rule (60FR22228–222237, May 4, 1995).

[gg] EPA is actively working on this criterion and so this recommended water quality criterion may change substantially in the near future.

[hh] This recommended water quality criterion was derived from data for inorganic mercury (II), but is applied here to total mercury. If a substantial portion of the mercury in the water column is methylmercury, this criterion will probably be under protective. In addition, even though inorganic mercury is converted to methylmercury and methylmercury bioaccumulates to a great extent, this criterion does not account for uptake via the food chain because sufficient data were not available when the criteria was derived.

## NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR NON PRIORITY POLLUTANTS

| | Non priority pollutant | CAS No. | Freshwater | | Saltwater | | Human health for consumption of: | | FR cite/source |
|---|---|---|---|---|---|---|---|---|---|
| | | | CMC (µg/L) | CCC (µg/L) | CMC (µg/L) | CCC (µg/L) | Water + organism (µg/L) | Organism only (µg/L) | |
| 1 | Alkalinity | | | 20000[F] | | | | | Gold Book |
| 2 | Aluminum pH 6.5–9.0 | 7429905 | 750[G,I] | 87[G,I,L] | | | | | 53 FR 33178 |
| 3 | Ammonia | 7664417 | FRESHWATER CRITERIA ARE pH DEPENDENT—SEE DOCUMENT | | | | | | EPA822–R–98–008 |
| | | | SALTWATER CRITERIA ARE pH AND TEMPERATURE DEPENDENT[D] | | | | | | EPA440/5–88–004 |
| 4 | Aesthetic Qualities | | NARRATIVE STATEMENT—SEE DOCUMENT | | | | | | Gold Book |
| 5 | Bacteria | | FOR PRIMARY RECREATION AND SHELLFISH USES—SEE DOCUMENT | | | | | | Gold Book |
| 6 | Barium | 7440393 | | | | | 1,000[A] | | Gold Book |
| 7 | Boron | | NARRATIVE STATEMENT—SEE DOCUMENT | | | | | | Gold Book |
| 8 | Chloride | 16887006 | 860000[G] | 230000[G] | | | | | 53 FR 19028 |
| 9 | Chlorine | 7782505 | 19 | 11 | 13 | 7.5 | [C] | | Gold Book |
| 10 | Chlorophenoxy Herbicide 2,4,5,-TP | 93721 | | | | | 10[A] | | Gold Book |
| 11 | Chlorophenoxy Herbicide 2,4-D | 94757 | | | | | 100[A,C] | | Gold Book |
| 12 | Chloropyrifos | 2921882 | 0.083[G] | 0.041[G] | 0.011[G] | 0.0056[G] | | | Gold Book |
| 13 | Color | | NARRATIVE STATEMENT—SEE DOCUMENT[F] | | | | | | Gold Book |
| 14 | Demeton | 8065483 | | 0.1[F,H] | | 0.1[F,H] | | | Gold Book |
| 15 | Ether, Bis Chloromethyl | 542881 | | | | | 0.00013[B] | 0.00078[B] | IRIS 01/01/91 |
| 16 | Gases, Total Dissolved | | NARRATIVE STATEMENT—SEE DOCUMENT[F] | | | | | | Gold Book |
| 17 | Guthion | 86500 | | 0.01[F,H] | | 0.01[F,H] | | | Gold Book |
| 18 | Hardness | | NARRATIVE STATEMENT—SEE DOCUMENT | | | | | | Gold Book |
| 19 | Hexachlorocyclo-hexane-Technical | 319868 | | | | | 0.0123 | 0.0414 | Gold Book |
| 20 | Iron | 7439896 | | 1000[F] | | | 300[A] | | Gold Book |
| 21 | Malathion | 121755 | | 0.1[F,H] | | | | | Gold Book |
| 22 | Manganese | 7439965 | | | | | 50[A] | 100[A] | Gold Book |
| 23 | Methoxychlor | 72435 | | 0.03[F,H] | | 0.03[F,H] | 100[A,C] | | Gold Book |
| 24 | Mirex | 2385855 | | 0.001[F,H] | | 0.001[F,H] | | | Gold Book |
| 25 | Nitrates | 14797558 | | | | | 10,000[A] | | Gold Book |
| 26 | Nitrosamines | | | | | | 0.0008 | 1.24 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 27 | Dinitrophenols | 25550587 | | | | | 70 | 14,000 | Gold Book |
| 28 | Nitrosodibutylamine,N | 924163 | | | | | 0.0064[A] | 0.587[A] | Gold Book |
| 29 | Nitrosodiethylamine,N | 55185 | | | | | 0.0008[A] | 1.24[A] | Gold Book |
| 30 | Nitrosopyrrolidine,N | 930552 | | | | | 0.016 | 91.9 | Gold Book |
| 31 | Oil and Grease | | NARRATIVE STATEMENT—SEE DOCUMENT[F] | | | | | | Gold Book |
| 32 | Oxygen, Dissolved | 7782447 | WARMWATER AND COLDWATER MATRIX—SEE DOCUMENT[O] | | | | | | Gold Book |
| 33 | Parathion | 56382 | 0.065[J] | 0.013[J] | | | | | Gold Book |
| 34 | Pentachlorobenzene | 608935 | | | | | 3.5[E] | 4.1[E] | IRIS 03/01/88 |
| 35 | pH | | | 6.5–9[F] | | 6.5–8.5[F,K] | 5–9 | | Gold Book |
| 36 | Phosphorus Elemental | 7723140 | | | | 0.1[F,K] | | | Gold Book |
| 37 | Phosphate Phosphorus | | NARRATIVE STATEMENT—SEE DOCUMENT | | | | | | Gold Book |
| 38 | Solids Dissolved and Salinity | | | | | | 250,000[A] | | Gold Book |
| 39 | Solids Suspended and Turbidity | | NARRATIVE STATEMENT—SEE DOCUMENT[F] | | | | | | Gold Book |
| 40 | Sulfide-Hydrogen Sulfide | 7783064 | | 2.0[F,H] | | 2.0[F,H] | | | Gold Book |
| 41 | Tainting Substances | | NARRATIVE STATEMENT—SEE DOCUMENT | | | | | | Gold Book |
| 42 | Temperature | | SPECIES DEPENDENT CRITERIA—SEE DOCUMENT[M] | | | | | | Gold Book |
| 43 | Tetrachlorobenzene,1,2,4,5- | 95943 | | | | | 2.3[E] | 2.9[E] | IRIS03/01/91 |
| 44 | Tributyltin TBT | | 0.46[N] | 0.063[N] | 0.37[N] | 0.010[N] | | | 62 FR 42554 |
| 45 | Trichlorophenol,2,4,5- | 95954 | | | | | 2,600[B,E] | 9,800[B,E] | IRIS 03/01/88 |

**Footnotes:**

[A] This human health criterion is the same as originally published in the Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value is now published in the Gold Book

[B] The organoleptic effect criterion is more stringent than the value presented in the non priority pollutants table.

[C] A more stringent Maximum Contaminant Level (MCL) has been issued by EPA under the Safe Drinking Water Act. Refer to drinking water regulations 40 CFR 141 or Safe Drinking Water Hotline (1–800–426–4791) for values.

[D] According to the procedures described in the Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, except possibly where a very sensitive species is important at a site, freshwater aquatic life should be protected if both conditions specified in Appendix C to the Preamble—Calculation of Freshwater Ammonia Criterion are satisfied.

[E] This criterion has been revised to reflect The Environmental Protection Agency's q1* or RfD, as contained in the Integrated Risk Information System (IRIS) as of April 8, 1998. The fish tissue bioconcentration factor (BCF) used to derive the original criterion was retained in each case.

[F] The derivation of this value is presented in the Red Book (EPA 440/9–76–023, July, 1976).

[G] This value is based on a 304(a) aquatic life criterion that was derived using the 1985 Guidelines (Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, PB85–227049, January 1985) and was issued in one of the following criteria documents: Aluminum (EPA 440/5–86–008); Chloride (EPA 440/5–88–001); Chloropyrifos (EPA 440/5–86–005).

[H] This CCC is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60 FR 15393–15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.

[I] This value is expressed in terms of total recoverable metal in the water column.

[J] This value is based on a 304(a) aquatic life criterion that was issued in the 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA–820–B–96–001). This value was derived using the GLI Guidelines (60 FR 15393–15399, March 23, 1995; 40 CFR 132 Appendix A); the differences between the 1985 Guidelines and the GLI Guidelines are explained on page iv of the 1995 Updates. No decision concerning this criterion was affected by any considerations that are specific to the Great Lakes.

[K] According to page 181 of the Red Book: For open ocean waters where the depth is substantially greater than the euphotic zone, the pH should not be changed more than 0.2 units from the naturally occurring variation or any case outside the range of 6.5 to 8.5. For shallow, highly productive coastal and estuarine areas where naturally occurring pH variations approach the lethal limits of some species, changes in pH should be avoided but in any case should not exceed the limits established for fresh water, i.e., 6.5–9.0.

[L] There are three major reasons why the use of Water-Effect Ratios might be appropriate. (1) The value of 87 µg/l is based on a toxicity test with the striped bass in water with pH=6.5–6.6 and hardness <10 mg/L. Data in "Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia" (May 1994) indicate that aluminum is substantially less toxic at higher pH and hardness, but the effects of pH and hardness are not well quantified at this time. (2) In tests with the brook trout at low pH and hardness, effects increased with increasing concentrations of total aluminum even though the concentration of dissolved aluminum was constant, indicating that total recoverable is a more appropriate measurement than dissolved, at least when particulate aluminum is primarily aluminum hydroxide particles. In surface waters, however, the total recoverable procedure might measure aluminum associated with clay particles, which might be less toxic than aluminum associated with aluminum hydroxide. (3) EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 µg aluminum/L, when either total recoverable or dissolved is measured.

[M] U.S. EPA. 1973. Water Quality Criteria 1972. EPA–R3–73–033. National Technical Information Service, Springfield, VA.; U.S. EPA. 1977. Temperature Criteria for Freshwater Fish: Protocol and Procedures. EPA–600/3–77–061. National Technical Information Service, Springfield, VA.

[N] This value was announced (62 FR 42554, August 7, 1997) as a proposed 304(a) aquatic life criterion. Although EPA has not responded to public comment, EPA is publishing this as a 304(a) criterion in today's notice as guidance for States and Tribes to consider when adopting water quality criteria.

[O] U.S. EPA. 1986. Ambient Water Quality Criteria for Dissolved Oxygen. EPA 440/5–86–003. National Technical Information Service, Springfield, VA.

NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR ORGANOLEPTIC EFFECTS

| | Pollutant | CAS No. | Organoleptic effect criteria (µg/L) | FR cite/source |
|---|---|---|---|---|
| 1 | Acenaphthene | 208968 | 20 | Gold Book |
| 2 | Monochlorobenzene | 108907 | 20 | Gold Book |
| 3 | 3-Chlorophenol | | 0.1 | Gold Book |
| 4 | 4-Chlorophenol | 106489 | 0.1 | Gold Book |
| 5 | 2,3-Dichlorophenol | | 0.04 | Gold Book |
| 6 | 2,5-Dichlorophenol | | 0.5 | Gold Book |
| 7 | 2,6-Dichlorophenol | | 0.2 | Gold Book |
| 8 | 3,4-Dichlorophenol | | 0.3 | Gold Book |
| 9 | 2,4,5-Trichlorophenol | 95954 | 1 | Gold Book |
| 10 | 2,4,6-Trichlorophenol | 88062 | 2 | Gold Book |
| 11 | 2,3,4,6-Tetrachlorophenol | | 1 | Gold Book |
| 12 | 2-Methyl-4-Chlorophenol | | 1800 | Gold Book |
| 13 | 3-Methyl-4-Chlorophenol | 59507 | 3000 | Gold Book |
| 14 | 3-Methyl-6-Chlorophenol | | 20 | Gold Book |
| 15 | 2-Chlorophenol | 95578 | 0.1 | Gold Book |
| 16 | Copper | 744058 | 1000 | Gold Book |
| 17 | 2,4-Dichlorophenol | 120832 | 0.3 | Gold Book |
| 18 | 2,4-Dimethylphenol | 105679 | 400 | Gold Book |
| 19 | Hexachlorocyclopentadiene | 77474 | 1 | Gold Book |
| 20 | Nitrobenzene | 98953 | 30 | Gold Book |
| 21 | Pentachlorophenol | 87865 | 30 | Gold Book |
| 22 | Phenol | 108952 | 300 | Gold Book |
| 23 | Zinc | 7440666 | 5000 | 45 FR 79341 |

**General Notes:**

1. These criteria are based on organoleptic (taste and odor) effects. Because of variations in chemical nomenclature systems, this listing of pollutants does not duplicate the listing in Appendix A of 40 CFR Part 423. Also listed are the Chemical Abstracts Service (CAS) registry numbers, which provide a unique identification for each chemical.

## National Recommended Water Quality Criteria

### Additional Notes

#### 1. Criteria Maximum Concentration and Criterion Continuous Concentration

The Criteria Maximum Concentration (CMC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The Criterion Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. The CMC and CCC are just two of the six parts of a aquatic life criterion; the other four parts are the acute averaging period, chronic averaging period, acute frequency of allowed exceedence, and chronic frequency of allowed exceedence. Because 304(a) aquatic life criteria are national guidance, they are intended to be protective of the vast majority of the aquatic communities in the United States.

#### 2. Criteria Recommendations for Priority Pollutants, Non Priority Pollutants and Organoleptic Effects

This compilation lists all priority toxic pollutants and some non priority toxic pollutants, and both human health effect and organoleptic effect criteria issued pursuant to CWA § 304(a). Blank spaces indicate that EPA has no CWA § 304(a) criteria recommendations. For a number of non-priority toxic pollutants not listed, CWA § 304(a) "water + organism" human health criteria are not available, but, EPA has published MCLs under the SDWA that may be used in establishing water quality standards to protect water supply designated uses. Because of variations in chemical nomenclature systems, this listing of toxic pollutants does not duplicate the listing in Appendix A of 40 CFR Part 423. Also listed are the Chemical Abstracts Service CAS registry numbers, which provide a unique identification for each chemical.

#### 3. Human Health Risk

The human health criteria for the priority and non priority pollutants are based on carcinogenicity of $10^{-6}$ risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10–5, move the decimal point in the recommended criterion one place to the right).

#### 4. Water Quality Criteria Published Pursuant to Section 304(a) or Section 303(c) of the CWA

Many of the values in the compilation were published in the proposed California Toxics Rule (CTR, 62 FR 42160). Although such values were published pursuant to Section 303(c) of the CWA, they represent the Agency's most recent calculation of water quality criteria and thus are published today as the Agency's 304(a) criteria. Water quality criteria published in the proposed CTR may be revised when EPA takes final action on the CTR.

#### 5. Calculation of Dissolved Metals Criteria

The 304(a) criteria for metals, shown as dissolved metals, are calculated in one of two ways. For freshwater metals criteria that are hardness-dependent, the dissolved metal criteria were calculated using a hardness of 100 mg/l as $CaCO_3$ for illustrative purposes only. Saltwater and freshwater metals' criteria that are not hardness-dependent are calculated by multiplying the total recoverable criteria before rounding by the appropriate conversion factors. The final dissolved metals' criteria in the table are rounded to two significant figures. Information regarding the calculation of hardness dependent conversion factors are included in the footnotes.

#### 6. Correction of Chemical Abstract Services Number

The Chemical Abstract Services number (CAS) for Bis(2-Chloroisopropyl) Ether, has been corrected in the table. The correct CAS number for this chemical is 39638–32–9. Previous publications listed 108–60–1 as the CAS number for this chemical.

**7. Maximum Contaminant Levels**

The compilation includes footnotes for pollutants with Maximum Contaminant Levels (MCLs) more stringent than the recommended water quality criteria in the compilation. MCLs for these pollutants are not included in the compilation, but can be found in the appropriate drinking water regulations (40 CFR 141.11–16 and 141.60–63), or can be accessed through the Safe Drinking Water Hotline (800–426–4791) or the Internet (http://www.epa.gov/ost/tools/dwstds-s.html).

**8. Organoleptic Effects**

The compilation contains 304(a) criteria for pollutants with toxicity-based criteria as well as non-toxicity based criteria. The basis for the non-toxicity based criteria are organoleptic effects (e.g., taste and odor) which would make water and edible aquatic life unpalatable but not toxic to humans. The table includes criteria for organoleptic effects for 23 pollutants. Pollutants with organoleptic effect criteria more stringent than the criteria based on toxicity (e.g., included in both the priority and non-priority pollutant tables) are footnoted as such.

**9. Category Criteria**

In the 1980 criteria documents, certain recommended water quality criteria were published for categories of pollutants rather than for individual pollutants within that category. Subsequently, in a series of separate actions, the Agency derived criteria for specific pollutants within a category. Therefore, in this compilation EPA is replacing criteria representing categories with individual pollutant criteria (e.g., 1,3-dichlorobenzene, 1,4-dichlorobenzene and 1,2-dichlorobenzene).

**10. Specific Chemical Calculations**

*A. Selenium*

(1) Human Health

In the 1980 Selenium document, a criterion for the protection of human health from consumption of water and organisms was calculated based on a BCF of 6.0 L/kg and a maximum water-related contribution of 35 µg Se/day. Subsequently, the EPA Office of Health and Environmental Assessment issued an errata notice (February 23, 1982), revising the BCF for selenium to 4.8 L/kg. In 1988, EPA issued an addendum (ECAO–CIN–668) revising the human health criteria for selenium. Later in the final National Toxic Rule (NTR, 57 FR 60848), EPA withdrew previously published selenium human health criteria, pending Agency review of new epidemiological data.

This compilation includes human health criteria for selenium, calculated using a BCF of 4.8 L/kg along with the current IRIS RfD of 0.005 mg/kg/day. EPA included these recommended water quality criteria in the compilation because the data necessary for calculating a criteria in accordance with EPA's 1980 human health methodology are available.

(2) Aquatic Life

This compilation contains aquatic life criteria for selenium that are the same as those published in the proposed CTR. In the CTR, EPA proposed an acute criterion for selenium based on the criterion proposed for selenium in the Water Quality Guidance for the Great Lakes System (61 FR 58444). The GLI and CTR proposals take into account data showing that selenium's two most prevalent oxidation states, selenite and selenate, present differing potentials for aquatic toxicity, as well as new data indicating that various forms of selenium are additive. The new approach produces a different selenium acute criterion concentration, or CMC, depending upon the relative proportions of selenite, selenate, and other forms of selenium that are present.

EPA notes it is currently undertaking a reassessment of selenium, and expects the 304(a) criteria for selenium will be revised based on the final reassessment (63 FR 26186). However, until such time as revised water quality criteria for selenium are published by the Agency, the recommended water quality criteria in this compilation are EPA's current 304(a) criteria.

*B. 1,2,4-Trichlorobenzene and Zinc*

Human health criteria for 1,2,4-trichlorobenzene and zinc have not been previously published. Sufficient information is now available for calculating water quality criteria for the protection of human health from the consumption of aquatic organisms and the consumption of aquatic organisms and water for both these compounds. Therefore, EPA is publishing criteria for these pollutants in this compilation.

*C. Chromium (III)*

The recommended aquatic life water quality criteria for chromium (III) included in the compilation are based on the values presented in the document titled: 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water, however, this document contains criteria based on the total recoverable fraction. The chromium (III) criteria in this compilation were calculated by applying the conversion factors used in the Final Water Quality Guidance for the Great Lakes System (60 FR 15366) to the 1995 Update document values.

*D. Ether, Bis (Chloromethyl), Pentachlorobenzene, Tetrachlorobenzene 1,2,4,5- Trichlorophenol*

Human health criteria for these pollutants were last published in EPA's Quality Criteria for Water 1986 or "Gold Book". Some of these criteria were calculated using Acceptable Daily Intake (ADIs) rather than RfDs. Updated q1*s and RfDs are now available in IRIS for ether, bis (chloromethyl), pentachlorobenzene, tetrachlorobenzene 1,2,4,5-, and trichlorophenol, and were used to revise the water quality criteria for these compounds. The recommended water quality criteria for ether, bis (chloromethyl) were revised using an updated q1*, while criteria for pentachlorobenzene, and tetrachlorobenzene 1,2,4,5-, and trichlorophenol were derived using an updated RfD value.

*E. PCBs*

In this compilation EPA is publishing aquatic life and human health criteria based on total PCBs rather than individual arochlors. These criteria replace the previous criteria for the seven individual arochlors. Thus, there are criteria for a total of 102 of the 126 priority pollutants.

Dated: October 26, 1998.

**J. Charles Fox,**

*Assistant Administrator, Office of Water.*

## Appendix A—Conversion Factors for Dissolved Metals

| Metal | Conversion factor freshwater CMC | Conversion factor freshwater CCC | Conversion factor saltwater CMC | Conversion factor saltwater CCC |
|---|---|---|---|---|
| Arsenic | 1.000 | 1.000 | 1.000 | 1.000 |
| Cadmium | 1.138672-[(ln hardness)(0.041838)] | 1.101672-[(ln hardness)(0.041838)] | 0.994 | 0.994 |
| Chromium III | 0.316 | 0.860 | | |
| Chromium VI | 0.982 | 0.962 | 0.993 | 0.993 |
| Copper | 0.960 | 0.960 | 0.83 | 0.83 |
| Lead | 1.46203-[(ln hardness)(0.145712)] | 1.46203-[(ln hardness)(0.145712)] | 0.951 | 0.951 |
| Mercury | 0.85 | 0.85 | 0.85 | 0.85 |
| Nickel | 0.998 | 0.997 | 0.990 | 0.990 |
| Selenium | | | 0.998 | 0.998 |
| Silver | 0.85 | | 0.85 | |
| Zinc | 0.978 | 0.986 | 0.946 | 0.946 |

## Appendix B—Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent

| Chemical | $m_A$ | $b_A$ | $m_C$ | $b_C$ | Freshwater conversion factors (CF) | |
|---|---|---|---|---|---|---|
| | | | | | Acute | Chronic |
| Cadmium | 1.128 | −3.6867 | 0.7852 | −2.715 | 1.136672-[ln (hardness)(0.041838)] | 1.101672-[ln (hardness)(0.041838)] |
| Chromium III | 0.8190 | 3.7256 | 0.8190 | 0.6848 | 0.316 | 0.860 |
| Copper | 0.9422 | −1.700 | 0.8545 | −1.702 | 0.960 | 0.960 |
| Lead | 1.273 | −1.460 | 1.273 | −4.705 | 1.46203-[ln (hardness)(0.145712)] | 1.46203-[ln (hardness)(0.145712)] |
| Nickel | 0.8460 | 2.255 | 0.8460 | 0.0584 | 0.998 | 0.997 |
| Silver | 1.72 | −6.52 | | | 0.85 | |
| Zinc | 0.8473 | 0.884 | 0.8473 | 0.884 | 0.978 | 0.986 |

## Appendix C—Calculation of Freshwater Ammonia Criterion

1. The one-hour average concentration of total ammonia nitrogen (in mg N/L) does not exceed, more than once every three years on the average, the CMC calculated using the following equation:

$$CMC = \frac{0.275}{1+10^{7.204-pH}} + \frac{39.0}{1+10^{pH-7.204}}$$

In situations where salmonids do not occur, the CMC may be calculated using the following equation:

$$CMC = \frac{0.411}{1+10^{7.204-pH}} + \frac{58.4}{1+10^{pH-7.204}}$$

2. The thirty-day average concentration of total ammonia nitrogen (in mg N/L) does not exceed, more than once every three years on the average, the CCC calculated using the following equation:

$$CCC = \frac{0.0858}{1+10^{7.688-pH}} + \frac{3.70}{1+10^{pH-7.688}}$$

**Editorial Note:** FR Doc. 98-30272 was originally published as Part IV (63 FR 67548-67558) in the issue of Monday, December 7, 1998. At the request of the agency, due to incorrect footnote identifiers in the tables, the corrected document is being republished in its entirety.

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