Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater

Volume 2: Background Documentation For The Development of Tier 1 Environmental Screening Levels

Appendix 1

Prepared for:
Commonwealth of the Northern Mariana Islands
Division of Environmental Quality
Saipan, CNMI

October 2005

Contacts:
Ray Masga
Commonwealth of the Northern Mariana Islands
Division of Environmental Quality
Saipan, MP 96950-1304
Telephone: 1-670-664-8500
E-mail: ray.masga@saipan.com

Prepared By:
Roger Brewer, Ph.D
Hawai'i Department of Health
Hazard Evaluation and Emergency Response
919 Ala Moana Boulevard
Honolulu, Hawai'i 96816
Telephone: 1-808-586-4328
E-mail: roger.brewer@doh.hawaii.gov

DISCLAIMER

This document, *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (October 2005), is a technical report prepared for the Commonwealth of the Northern Mariana Islands Division of Environmental Quality (CNMI DEQ). This document is not intended to establish policy or regulation. The Environmental Screening Levels presented in this document and the accompanying text are specifically not intended to serve as: 1) a stand-alone decision making tool, 2) guidance for the preparation of baseline ("Tier 3") environmental assessments, 3) a rule to determine if a waste is hazardous under the state or federal regulations, or 4) a rule to determine when the release of hazardous chemicals must be reported to the overseeing regulatory agency.

The information presented in this document is not final action. The DEQ reserves the right to change this information at any time without public notice. This document is not intended, nor can it be relied upon, to create any rights enforceable by any party in litigation in the CNMI. Staff in overseeing regulatory agencies may decide to follow the information provided herein or act at a variance with the information, based on an analysis of site-specific circumstances.

This document will be periodically updated as needed. Please send comments, edits, etc. in writing to the above contacts. The DEQ should be contacted prior to use of this document in order to ensure that the document is applicable to the site under investigation and that the user has the most up-to-date version available. This document is not copyrighted. Copies may be freely made and distributed. It is cautioned, however, that reference to the screening levels presented in this document without adequate review of the accompanying narrative could result in misinterpretation and misuse of the information.

VOLUME 2: BACKGROUND DOCUMENTATION FOR THE DEVELOPMENT OF TIER 1 SOIL AND GROUNDWATER SCREENING LEVELS

APPENDICES

1 DEVELOPMENT OF TIER 1 LOOKUP TABLES

2 EQUATIONS FOR DERIVATION OF ENVIRONMENTAL SCREENING LEVELS FOR SOIL (DIRECT EXPOSURE), INDOOR AIR AND DRINKING WATER

3 RELEVANT PORTIONS OF *USER'S GUIDE FOR EVALUATING SUBSURFACE VAPOR INTRUSION INTO BUILDINGS S*

4 EXAMPLE PRINTOUTS OF USEPA VAPOR INTRUSION IMPACT MODELS

5 DEVELOPMENT OF SOIL LEACHING SCREENING LEVELS

6 RATIONAL FOR MOEE ECOTOXICITY-BASED SOIL CRITERIA

7 SUMMARY OF MADEP CARBON RANGE AND TOTAL PETROLEUM HYDROCARBON ENVIRONMENTAL SCREENING LEVELS

SUPPLEMENTAL DOCUMENTS AND SPREADSHEETS

- ESL SURFER (OCTOBER 2005, ELECTRONIC LOOKUP TABLES)
- SUPPLEMENTAL GUIDE FOR REVIEW OF ENVIRONMETNAL RISK ASSESSMENTS BY REGULATORS
- TIER 2 SOIL DIRECT EXPOSURE MODEL
- TIER 2 GROUNDWATER VAPOR INTRUSION MODEL
- TIER 2 SOIL LEACHING MODEL

GLOSSARY OF TERMS

AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CCM: Criterion for Maximum Concentration
CNMI: Commonwealth of the Northern Mariana Islands
DEQ: CNMI Division of Environmental Quality
EPA: Environmental Protection Agency
ESL: Environmental Screening Level
FVC: Final Chronic Value
HH: Human Health
LOEL: Lowest-Observed-Effects Level
MADEP: Massachusetts Department of Environmental Protection
MCL: Maximum Concentration Level
MOEE: Ontario Ministry of Environment and Energy
MTBE: Methyl tert-Butyl Ethylene
PCE: Tetrachloroethylene
PRG: USEPA Region IX Preliminary Remediation Goals
RWQCB: San Francisco Bay Regional Water Quality Control Board (California EPA)
TPH: Total Petroleum Hydrocarbons
USEPA: U.S. Environmental Protection Agency
USDOE: U.S. Department of Energy

APPENDIX 1

DEVELOPMENT OF TIER 1 LOOKUP TABLES

APPENDIX 1
DEVELOPMENT OF TIER 1 LOOKUP TABLES

Table of Contents

1 DEVELOPMENT OF TIER 1 LOOKUP TABLES 1-1

1.1 INTRODUCTION 1-1
1.2 EXAMPLE SELECTION OF TIER 1 ESLS FOR TETRACHLOROETHYLENE (PCE) 1-2
1.3 CUMULATIVE RISK 1-4

2 GROUNDWATER AND SURFACE WATER SCREENING LEVELS 2-1

2.1 INTRODUCTION 2-1
2.2 SCREENING LEVELS FOR DRINKING WATER (TOXICITY) 2-2
2.3 SCREENING LEVELS FOR AQUATIC HABITAT PROTECTION 2-3
2.3.1 Surface Water Aquatic Habitat Goals 2-3
2.3.2 Groundwater Screening Levels for Aquatic Habitat Impacts 2-4
2.4 GROUNDWATER SCREENING LEVELS FOR POTENTIAL VAPOR INTRUSION CONCERNS 2-5
2.4.1 Vapor Intrusion Model Parameters 2-5
2.4.2 Background and Use of USEPA Vapor Intrusion Model 2-7
2.5 SURFACE WATER AND GROUNDWATER CEILING LEVELS FOR GROSS CONTAMINATION CONCERNS 2-8
2.6 OTHER GROUNDWATER SCREENING LEVELS 2-9

3 SOIL SCREENING LEVELS 3-1

3.1 INTRODUCTION - SHALLOW VERSUS DEEP SOILS 3-1
3.2 SOIL SCREENING LEVELS FOR DIRECT-EXPOSURE CONCERNS 3-2
3.2.1 Target Risks 3-2
3.2.2 Shallow Soils 3-3
3.2.3 Deep Soils 3-4
3.3 SOIL SCREENING LEVELS FOR POTENTIAL VAPOR INTRUSION CONCERNS 3-5
3.4 SOIL SCREENING LEVELS FOR GROUNDWATER PROTECTION 3-6
3.5 SOIL SCREENING LEVELS FOR TERRESTRIAL HABITATS 3-9
3.6 SOIL CEILING LEVELS FOR GROSS CONTAMINATION CONCERNS 3-10

4 INDOOR AIR AND SOIL GAS SCREENING LEVELS 4-1

4.1 INTRODUCTION 4-1
4.2 INDOOR AIR SCREENING LEVELS 4-1
4.3 SOIL GAS SCREENING LEVELS 4-2

5 SOIL AND GROUNDWATER SCREENING LEVELS FOR TPH 5-1

5.1 INTRODUCTION 5-1
5.2 TPH SCREENING LEVELS FOR GROUNDWATER 5-3
5.3 TPH SCREENING LEVELS FOR SOIL 5-4
5.3.1 TPH (gasolines, middle distillates) 5-4
5.3.2 TPH (residual fuels) 5-5
5.3.3 Ethanol 5-6

6 OTHER ISSUES 6-1

6.1 LABORATORY REPORTING LEVELS AND BACKGROUND CONCENTRATIONS 6-1
6.2 REPORTING OF SOIL DATA 6-2
6.3 ADDITIONAL SOIL PARAMETERS 6-2

6.4 DEGRADATION TO DAUGHTER PRODUCTS 6-2
7 REFERENCES 7-1

FIGURES

1 SUMMARY OF HUMAN HEALTH AND ENVIRONMENTAL CONCERNS CONSIDERED IN SOIL ESLS

2 INDIVIDUAL SCREENING LEVELS USED TO DEVELOP FINAL, TIER 1 SOIL AND GROUNDWATER ESLS FOR TETRACHLOROETHYLENE.

SUPPLEMENTAL DOCUMENTS AND SPREADSHEETS

- ESL SURFER (OCTOBER 2005, ELECTRONIC LOOKUP TABLES)
- SUPPLEMENTAL GUIDE FOR REVIEW OF ENVIRONMETNAL RISK ASSESSMENTS BY REGULATORS
- TIER 2 SOIL DIRECT EXPOSURE MODEL
- TIER 2 GROUNDWATER VAPOR INTRUSION MODEL
- TIER 2 SOIL LEACHING MODEL

TABLES

TABLE 1-1. ENVIRONMENTAL CONCERNS CONSIDERED IN LOOKUP TABLES

A-1. SHALLOW SOIL SCREENING LEVELS (<3M BGS) RESIDENTIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

A-2. SHALLOW SOIL SCREENING LEVELS (<3M BGS) COMMERCIAL / INDUSTRIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

B-1. SHALLOW SOIL SCREENING LEVELS (<3M BGS) RESIDENTIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

B-2. SHALLOW SOIL SCREENING LEVELS (<3M BGS) COMMERCIAL / INDUSTRIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

C-1. DEEP SOIL SCREENING LEVELS (>3M BGS) RESIDENTIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

C-2. DEEP SOIL SCREENING LEVELS (>3M BGS) COMMERCIAL / INDUSTRIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

D-1. DEEP SOIL SCREENING LEVELS (>3M BGS) RESIDENTIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

D-2. DEEP SOIL SCREENING LEVELS (>3M BGS) COMMERCIAL / INDUSTRIAL LAND USE (POTENTIALLY IMPACTED GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

E-1A. GROUNDWATER SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (VOLATILE CHEMICALS ONLY)

E-1B. SOIL SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (VOLATILE CHEMICALS ONLY)

E-2. SHALLOW SOIL GAS SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (VOLATILE CHEMICALS ONLY)

E-3. INDOOR AIR SCREENING LEVELS

F-1A. GROUNDWATER SCREENING LEVELS (GROUNDWATER IS A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

F-1B. GROUNDWATER SCREENING LEVELS (GROUNDWATER IS NOT A CURRENT OR POTENTIAL DRINKING WATER RESOURCE)

F-2A. SURFACE WATER SCREENING LEVELS FRESH WATER HABITATS

F-2B. SURFACE WATER SCREENING LEVELS MARINE HABITATS

F-2C. SURFACE WATER SCREENING LEVELS ESTUARY HABITATS

F-3. SUMMARY OF DRINKING WATER SCREENING LEVELS FOR HUMAN TOXICITY

F-4A. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS

F-4B. SUMMARY OF USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS

F-4C. SURFACE WATER QUALITY STANDARDS FOR BIOACCUMULATION AND HUMAN CONSUMPTION OF AQUATIC ORGANISMS

F-5. AGRICULTURAL WATER QUALITY GOALS

F-6. TOXICITY-BASED DRINKING WATER GOALS

G-1. SOIL SCREENING LEVELS FOR LEACHING CONCERNS

H-1. CRITERIA FOR ASSIGNMENT OF SOIL GROSS CONTAMINATION CEILING LEVELS

H-2. COMPONENTS FOR SHALLOW SOIL GROSS CONTAMINATION CEILING LEVELS

H-3. COMPONENTS FOR DEEP SOIL GROSS CONTAMINATION CEILING LEVELS

I-1. GROUNDWATER CEILING LEVELS (GROUNDWATER IS A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER)

I-2. GROUNDWATER GROSS CONTAMINATION CEILING LEVELS (GROUNDWATER IS NOT A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER)

I-3. SURFACE WATER CEILING LEVELS (SURFACE WATER IS A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER)

I-4. SURFACE WATER GROSS CONTAMINATION CEILING LEVELS (SURFACE WATER IS NOT A CURRENT OR POTENTIAL SOURCE OF DRINKING WATER)

J. PHYSIO-CHEMICAL AND TOXICITY CONSTANTS USED IN MODELS

K-1. DIRECT-EXPOSURE SCREENING LEVELS, RESIDENTIAL EXPOSURE SCENARIO

K-2. DIRECT-EXPOSURE SCREENING LEVELS, COMMERCIAL/INDUSTRIAL WORKER EXPOSURE SCENARIO

K-3. DIRECT-EXPOSURE SCREENING LEVELS, CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

L. TARGET ORGANS AND CHRONIC HEALTH EFFECTS

1

Development of Tier 1 Lookup Tables

1.1 Introduction

Compilation and presentation of the environmental screening levels (ESLs) presented in this document is modeled after similar documents published by the California Environmental Protection Agency (RWQCBSFB 2005), the Hawai'i Department of Health (HIDOH 2005), the Ontario Ministry of Environment and Energy (MOEE 1996), the Massachusetts Department of Environmental Protection (MADEP 1994) and the Netherlands (Vetger 1993). The document also incorporates Preliminary Remediation Goals for soil and tapwater prepared by USEPA Region IX (USEPA 2004). Screening levels for the following environmental concerns are presented (refer also to Figure 1):

Groundwater:

- Protection of human health
  - Current or potential drinking water resource;
  - Intrusion of subsurface vapors to building interiors;
- Protection of aquatic habitats (discharges to surface water);
- Protection against gross contamination concerns (free product, odors, etc.) and general resource degradation.

Soil:

- Protection of human health
  - Direct/indirect exposure with impacted soil (ingestion, dermal absorption, inhalation of vapors and dust in outdoor air);
  - Intrusion of subsurface vapors to building interiors;
- Protection of groundwater quality (leaching of chemicals from soil);
- Protection of terrestrial (nonhuman) habitats;
- Protection against gross contamination concerns (free product, odors, etc.) and general resource degradation.

Shallow Soil Gas:

- Protection of human health
  - Intrusion of subsurface vapors to building interiors.

For use in this document, the term "soil" refers to any unconsolidated material found in the subsurface, including actual soil, saprolite, sediment, fill material, etc. Screening levels for each concern are organized as follows:

[1]BENEFICIAL USE OF THREATENED GROUNDWATER	[2]LOCATION OF IMPACTED SOIL	
	Shallow Soil (≤ 3m bgs)	**[3]Deep Soil (> 3m bgs)**
Current or Potential Source of Drinking Water	Soil: Tables A-1, A-2 Soil Gas: Table E-3 Water: Table F-1a	Soil: Tables C-1, C-2 Water: Table F-1a
NOT a Current or Potential Source of Drinking Water	Soil: Tables B-1, B-2 Soil Gas: Table E-2 Water: Table F-2	Soil: Tables D-1, D-2 Water: Table F-2

bgs: below ground surface
1. Shallow-most saturated zone beneath the subject site and deeper zones as appropriate.
2. Depth to top of impacted soil from ground surface (3 meters = 10 feet).
3. Application of Deep Soil ESLs to soils <3m deep may require institutional controls (see text).

The A through D series tables summarize screening levels complied for soil under residential/unrestricted (A-1, B-1, C-1, D-1) and commercial/industrial (A-2, B-2, C-2, D-2) land use scenarios. The Table E series summarizes screening levels complied for the potential intrusion of subsurface vapors into buildings. Screening levels for groundwater and surface water are summarized in the Table F series. Tables G through L provide supporting screening levels and other information for the earlier tables. An electronic version of the lookup tables, the “ESL Surfer”, is also available from the CNMI Division of Environmental Quality (DEQ).

A discussion of screening levels compiled for surface water and groundwater is provided in Chapter 2. Screening levels compiled for soil are discussed in Chapter 3. Chapter 4 discusses screening levels compiled for indoor air and related screening levels for shallow soil gas. Screening levels developed for Total Petroleum Hydrocarbon (TPH) are discussed in Chapter 5. Other issues pertinent to the lookup tables are discussed in Chapter 6.

1.2 Example Selection of Tier 1 ESLs for Tetrachloroethylene (PCE)

Figure 2 illustrates the selection of final Tier 1 soil and groundwater ESLs for the chemical tetrachloroethylene (PCE). The example assumes impacts to shallow soils (≤3 meters below ground surface) under an unrestricted (e.g., residential) land-use scenario. Groundwater immediately underlying the site is assumed to be a potential source of

drinking water. This scenario places the site under Table A-1 of the Tier 1 lookup tables (refer to Section 1.1).

The Tier 1 ESL for PCE in shallow soil is selected as the lowest of the individual screening levels for Direct Exposure (0.48 mg/kg), Vapor Intrusion (0.07 mg/kg), Gross Contamination (230 mg/kg) and Groundwater Protection (leaching concerns, (0.70 mg/kg)). Screening levels are not available for Terrestrial Biota concerns. The final soil ESL for PCE is the lowest of the individual screening levels, or 0.07 mg/kg, based on potential vapor intrusion concerns for buildings overlying contaminated soil (see also Table A-1 in this appendix and Table A in Volume 1).

The process for selection of a Tier 1 PCE ESL in groundwater is similar (refer to Figure 2). Individual screening levels for Drinking Water (5.0 ug/L), Vapor Intrusion (99 ug/L), Discharge to Surface Water (120 ug/L) and Gross Contamination (170 ug/L) concerns are compared and the lowest of these is selected for inclusion in the Volume 1 summary, Tier 1 lookup tables. In this example, the groundwater screening level for drinking water concerns drives potential risks and is selected as the Tier 1 ESL (5.0 ug/L). Note that two screening levels are presented in the lookup tables for indoor air concerns (Table E-1b), one for high-permeability vadose-zone soils (120 ug/L) and one for low-permeability soils (500 ug/L). Only the screening level for sites with high-permeability vadose-zone soils is carried through for inclusion in the summary lookup tables, however (refer to Tables F-1a and F-1b). The latter screening level is provided for reference only.

Selection of ESLs for PCE in deep soils is similar. For deep soils, however, potential impacts to terrestrial biota are not considered, the direct-exposure screening level is modified to reflect a less stringent, construction/trench worker exposure scenario, and the ceiling level for gross contamination concerns is generally somewhat less stringent. Soil screening levels for leaching and groundwater protection concerns remain the same.

The process described above was carried out for each of the 100+ chemicals included in the Tier 1 lookup tables under each combination of groundwater beneficial use, soil depth and land use. The results are summarized in Tables A through D (soil) and Table F (groundwater) of this appendix. As can be seen from a review of these tables, the selection of final, Tier 1 ESLs for highly mobile or highly toxic chemicals is typically driven by groundwater protection or vapor intrusion concerns (e.g., see selection process for benzene or vinyl chloride ESLs in Table A-1). Final ESLs for chemicals that are relatively immobile in soils but highly toxic are typically driven by direct-exposure concerns (e.g., see selection process for PCBs in Table A-1). In contrast, selection of ESLs for heavy metals that are relatively non-toxic to humans is typically driven by ecological concerns or ceiling levels for general resource degradation (e.g., see selection process for copper ESL in Table A-1). For chemicals that have particularly strong odors, selection of ESLs may be driven in part by gross contamination concerns ("ceiling levels", e.g., see Total Petroleum Hydrocarbons (TPH) ESLs in Table B-1). The consideration of gross contamination becomes especially important in the selection of ESLs for relatively immobile chemicals in isolated, deep soils (e.g., refer to Table C-1).

1.3 Cumulative Risk

Additive risk due to the potential presence of multiple chemicals with similar target health effects is addressed under Tier 1 through use of conservative exposure assumptions (exposure frequency and duration, ingestion and inhalation rates, etc.) and target risk levels. Exposure assumptions used to develop direct-exposure and indoor-air screening levels primarily reflect parameter values presented in USEPA risk assessment guidance for Superfund sites (refer to USEPA 2004). Alternative, and in some cases less conservative, exposure assumptions are presented in the USEPA technical document *Exposure Factors Handbook* (USEPA 1997), among other examples. For example, recommended inhalation rates for residents are 11.3 m3/day for women and 15.2 m^3/day for men, in comparison to the value of 20 m^3/day used to develop the direct-exposure screening levels presented in this appendix (Section 3.2). The average time (50th percentile) spent at one residence is also stated to be 9.0 years, in contrast to the more conservative exposure duration used of 30 years. The average occupational tenure is similarly stated to be 6.6 years, in contrast to the occupational exposure duration used of 25 years. While the more conservative exposure assumptions are still generally recommended for use in site-specific risk assessments, the variance in the assumptions helps to demonstrate the overall conservative nature of the models referenced in this document.

For carcinogens, the risk-based screening levels for residential and commercial/industrial exposure scenarios are in general based on a target excess cancer risk of 10^{-6}. This represents the upper end (most stringent) of the potentially acceptable range of 10^{-4} to 10^{-6} recommended by the USEPA (USEPA 1989a,b). Remediation or risk management is almost always warranted at sites where the estimated cancer risk exceeds 10^{-4}. For sites where the estimated risk is between 10^{-4} and 10^{-6}, the need for active remediation or risk management is evaluated on a site-specific basis (i.e., risks within this range are "potentially acceptable", depending on site-specific considerations).

An alternative target excess cancer risk of 10^{-5} was used to generate soil screening levels for polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs), due to their near ubiquitous presence at trace levels in urban areas (from auto exhaust, asphalt, etc., refer also to Section 3.2.1). A target excess cancer risk of 10^{-5} was used to generate both soil and indoor air screening levels for trichloroethylene. This was done in order to reflect the inclusion of provisional, stringent cancer slope factors in the direct-exposure models and the need to identify and prioritize higher risk sites contaminated by this chemical.

The use of alternative exposure assumptions in a more "site-specific" risk assessment could result in an increase of direct-exposure screening levels by a factor of three or more while still meeting the noted target excess cancer risks. Based on above discussion and the conservative nature of the human exposure models in general, the direct-exposure screening levels presented in this appendix and the soil ESLs in general are considered to be adequate for use at sites where up to three carcinogenic chemicals of concern have

been identified. Additional evaluation may be required for sites where more than three carcinogens are identified.

A cumulative, target Hazard Index of 1.0 is typically used in human health risk assessments for evaluation of noncarcinogenic risks. The USEPA Preliminary Remediation Goals (PRGs) for soil were developed based on a chemical-specific, target Hazard Quotient of 1.0. To account for potential cumulative effects, the PRGs were adjusted to a target Hazard Quotient of 0.2 for use in the ESL lookup tables (see Section 3.2 and Tables K-1 and K-2). This adjustment reflects an assumption that up to five chemicals with the same chronic health effects may be present at a given site. A similar target Hazard Quotient was used by the Massachusetts DEP (MADEP 1994) and Ontario MOEE (MOEE 1996) to develop screening levels for direct-exposure concerns. Additional evaluation may be required for sites where more than five chemicals with similar noncarcinogenic health effects are present. For reference, a compilation of chronic health effects for the chemicals listed in the ESLs is provided in Table L of this appendix.

As one exception, a Hazard Quotient of 0.5 was used for calculation of health-based screening levels for Total Petroleum Hydrocarbons (TPH, see Appendix 2). The TPH parameter incorporates a multiple of chemicals within specified carbon ranges. In effect, this partially addresses potential cumulative risk concerns and a less stringent target Hazard Quotient is considered justified. The need to calculate cumulative risks in more detail should be evaluated on a site-by-site basis.

The direct-exposure screening levels not address potential synergistic effects (e.g., 1+1=3). Synergistic effects are primarily of concern for exposure to multiple chemicals at concentrations significantly higher than those expressed in the direct-exposure ESLs. Conservative target risk goals and exposure assumptions used to develop the screening levels further reduce this concern. Methods to quantitatively assess synergistic effects have not been developed.

2

Groundwater And Surface Water Screening Levels

2.1 Introduction

Screening levels for groundwater and surface water are summarized in the "F" series of tables at the end of this appendix. A discuss of individual concerns considered in the screening levels is provided in this Chapter and summarized below.

For the purpose of developing Tier 1 screening levels, it is assumed that all groundwater could at some point in time potentially discharge to a body of surface water and impact an aquatic habitat. Discharge could occur through natural processes (e.g., natural discharge of groundwater to a stream, river, lake, wetland, bay, etc. via springs) or through human activities (e.g., pumping and discharge of groundwater at remediation or construction dewatering projects). The final groundwater ESL for sites that threaten drinking water resources reflects the lowest of a chemicals screening level for drinking water toxicity, aquatic habitat protection, vapor intrusion concerns (volatile chemicals only) and a "ceiling level" for tastes & odors or other nuisance concerns (Table F-1a). The final groundwater ESL for sites that do not threaten drinking water resources (Table F-1b) reflects the lowest of a chemicals screening level for the same set of environmental concerns with the exception of the drinking water component and an alternative ceiling level.

Screening levels for surface water were compiled in a similar manner with the exception that impacts to indoor air were not considered. For freshwater surface water bodies, the final ESL reflects the lowest of a chemicals screening level for drinking water toxicity, aquatic habitat protection (discharges to surface water) and nuisance concerns (Table F-2a). For marine surface water bodies, the final ESL reflects the lowest of a chemicals screening level for aquatic habitat protection (discharges to surface water) and nuisance concerns (Table F-2b). For estuarine systems, the lowest of the aquatic-habitat screening levels for freshwater and marine surface water bodies were selected (Table F-2c). Drinking water concerns were not considered.

As discussed below, groundwater screening levels for potential discharges to aquatic habitats are based on chronic surface water quality goals. For some chemicals, additional aquatic habitat goals have been developed for the potential bioaccumulation of contaminants in aquatic organisms and subsequent consumption of the organisms by humans. These goals apply primary to aquatic organisms living in the water column. Use of the bioaccumulation goals is generally recommended for comparison to surface water data only and not for screening of groundwater data.

2.2 Screening Levels for Drinking Water (Toxicity)

A summary of drinking water standards and guidelines used in this document is provided in Table F-3. The Central Valley Water Board technical document *A Compilation of Water Quality Goals* (RWQCBCV 2000 and updates) was used as the primary reference. Screening levels for drinking water intended to address human toxicity were generally selected based on the following order of preference:

- CNMI Primary Maximum Contaminant Level (MCL) or Action Level (AL);
- Hawai'i Department of Health Primary MCL (as referenced in HDOH 2005);
- Risk-based goal calculated using USEPA Region IX PRG Tapwater model.

CNMI primary MCLs and action levels are based on standards published by the USEPA (CNMI 2005). Primary MCLs and action levels are available for approximately half of the chemicals listed in the lookup tables (refer to Table F-3). Although numerous factors are taken into account in development of primary MCLs (toxicity, detection limits, attainability, etc.), these standards are primarily intended to address toxicity to humans in drinking water supplies and are used for this purpose in this document.

The USEPA Region IX model for tapwater Preliminary Remediation Goals was used to develop risk-based drinking water goals for chemicals that lack a promulgated Primary MCLs (USEPA 2004, refer to Table F-3 and Equations 14 and 15 in Appendix 2). For volatile chemicals, the tapwater goals take into account uptake via inhalation of vapors during showering and other activities in addition to toxicity via normal ingestion of drinking water. Goals for nonvolatile chemicals are based on ingestion only. Risk-based goals for noncarcinogenic effects take precedence over goals for carcinogenic effects if lower. Drinking water goals intended to address taste and odor concerns (e.g., Secondary MCLs) take precedence over toxicity-based goals if lower (refer to Table F-1a and Section 2.5).

2.3 Screening Levels for Aquatic Habitat Protection

2.3.1 Surface Water Aquatic Habitat Goals

A summary of aquatic habitat goals considered for use in this document is provided in Tables F-4a through F-4c. Separate goals were compiled for freshwater, marine and estuarine habitats. Tidally influenced portions of creeks, rivers and streams flowing into marine habitats are considered to be estuarine. Final goals were selected based on the following order of preference and availability:

- CNMI CCC;
- Lowest of USEPA Ecotox AWQC and FVC Threshold Value (or Tier II value if no AWQC or FVC) or 50% USEPA Chronic LOEL;
- USDOE Chronic PRG;
- 50% MOEE Chronic AWQC or LOEL;
- 10% USEPA CMC (or 10% Acute LOEL if no CMC);
- 10% MOEE Acute AWQC or LOEL;
- Other aquatic water quality criteria (e.g., 5% LC 50);
- Drinking water screening level.

abbreviations:
AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CCM: Criterion for Maximum Concentration
EPA: Environmental Protection Agency
FVC: Final Chronic Value
LC50: Lethal Concentration (50th percentile)
MOEE: Ontario Ministry of Environment and Energy
PRG: Preliminary Remediation Goals
USEPA: U.S. Environmental Protection Agency
USDOE: U.S. Department of Energy (chronic values only)

Goals provided in each reference are generally based on dissolved-phase concentrations of the chemicals in water. Goals for arsenic, selenium and chromium VI are, however, based on total concentrations.

Chronic freshwater goals were used as screening levels for saltwater ("marine") if chronic goals for the latter were not available, and vise versa. Acute goals were substituted in a similar manner. Other exceptions to the prioritization scheme include the use of chemical-specific USDOE PRGs in place of USEPA chronic LOELs when the LOEL

was developed for a general group of compounds rather than a specific chemical (e.g., halomethanes).

CNMI regulations incorporate USEPA surface water standards by reference (CNMI 2002). Promulgated “Criterion for Continuous Concentration” surface water standards are not available for the majority of chemicals listed in the ESL lookup tables, however. The California EPA technical document *A Compilation of Water Quality Goals* was referred to as the primary source of aquatic habitat goals (RWQCBCV 2000). Other sources referenced include: USEPA's *Ecotox Thresholds* (USEPA 1996b), USEPA's *National Recommended Water Quality Criteria* (USEPA 2002), U.S. Department of Energy's *Preliminary Remediation Goals for Ecological Endpoints* (USDOE 1997), and Ontario MOEE's Rational For The Development and Application of Generic Soil, Groundwater and Sediment Criteria (MOEE 1996).

For chemicals where chronic, No Adverse Effect Level goals or the equivalent were not available, alternative goals were selected and modified as noted (refer also to Table F-4a). Modification factors in general followed recommendations and methods provided in the USEPA Great Lakes water quality initiative guidance (USEPA 1995). CNMI surface water standards for potential bioaccumulation of chemicals in aquatic organisms and subsequent human consumption of these organisms are presented in Table F-4c. These standards should be applied to surface water data only.

2.3.2 Groundwater Screening Levels for Aquatic Habitat Impacts

For the purposes of this document, and based on the natural setting of the CNMI area, it is assumed that groundwater could discharge into an estuary environment. As such, goals for aquatic habitat protection are based on the lowest of the goals for marine versus freshwater environments. Target surface water goals and correlative groundwater goals can be adjusted on a site-specific basis in areas where this is not appropriate.

Dilution of groundwater upon discharge to surface water was not considered in the selection of groundwater screening levels for aquatic habitat protection. Benthic organisms were assumed to be exposed to the full concentration of chemicals in impacted groundwater prior to mixing of the groundwater with surface water. Potential dilution of groundwater upon discharge to surface water or in groundwater "mixing zones" adjacent to shorelines areas was therefore not appropriate for development of conservative screening levels. Adjustment of the final groundwater screening levels with respect to potential dilution may, however, be appropriate on a site-specific basis (e.g., no significant benthic habitat present, see Volume 1, Section 3.0).

The USEPA Ecotox goal for barium (3.9 ug/L) was not considered as a screening level for groundwater due to low confidence in the goal and comparison to typical, natural background concentrations of this metal in groundwater (up to >100 ug/L). Background concentrations of boron, copper, lead, mercury, selenium, thallium and zinc may also be

present in excess of the groundwater screening levels presented in Tables F-1a and F-1b. This issue should be evaluated on a site-by-site basis as needed.

2.4 Groundwater Screening Levels for Potential Vapor Intrusion Concerns

2.4.1 Vapor Intrusion Model Parameters

Groundwater screening levels intended to address the intrusion of vapors into buildings and subsequent impact on indoor-air quality are summarized in Table E-1a and included in Tables F-1a and F-1b. Correlative soil gas screening levels and indoor air screening levels are presented in Tables E-2 and E-3, respectively, and discussed in Chapter 4.

The screening levels were generated using a computer spreadsheet model published by the U.S Environmental Protection Agency (available online, USEPA 2003a). The spreadsheet is based on a model presented in the document *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors Into Buildings* (Johnson and Ettinger, 1991). The model considers both diffusive and convective flow of subsurface vapors into buildings. Summary text from the guidance document accompanying the spreadsheet is provided in Appendix 3, as is a sensitivity evaluation of the Johnson and Ettinger model. Example printouts of the model as used to calculate screening levels for this document are included in Appendix 4. Input parameter values used in the models are noted in the examples (front pages). Default parameters values presented in the spreadsheet technical document were generally selected for use.

Human exposure assumptions were set equal to assumptions used in the USEPA Region IX PRGs. Default, USEPA toxicity factors included in the original spreadsheet were replaced with California EPA factors as available (see Appendix 4, last page of first example). Screening levels were calculated using a target risk of 10^{-6} for chemicals with carcinogenic health effects and a target hazard quotient of 0.2 for chemicals with noncarcinogenic health effects (0.5 for TPH). An exception is TCE, where a target risk of 10^{-5} was used (refer to Section 1.3). For consistency purposes, default physio-chemical constants included in the spreadsheet were replaced with constants used in the USEPA PRGs models if different.

All groundwater was assumed to potentially flow offsite and pass under residential areas. Final screening levels are therefore based on a residential land use exposure scenario. Groundwater screening levels for commercial/industrial areas are included in Table E-1a for reference but were not carried on for use in subsequent lookup tables.

Default building characteristics presented in the spreadsheet guidance were used in the models. The thickness of the building floor was assumed to be 15 cm. For both residential land use and commercial/industrial exposure scenarios, the models assume a small (9.6m x 9.6m square), one-story building situated on mono-slab concrete base.

This may be overly conservative for commercial/industrial sites with existing, larger buildings but is considered to be protective of future redevelopment of such sites. A default value of 1mm was used for the assumed perimeter crack width. For screening level evaluation of larger buildings, an assumed crack spacing of 10m is recommended. A default ceiling height of 2.44 meters was retained for use in the ESL models.

The model also assumes that potential convective flow from the subsurface into buildings (i.e., flow driven by air pressures that are lower inside the building than in the vadose zone) is not short circuited by open crawl spaces or other building designs that negate differences between indoor and subsurface air pressures. Default indoor-air exchange rates of one-time per hour for residences and two-times per hour for commercial/industrial buildings are based on a comparison of risk assessment guidance published by the City of Oakland (Oakland 2000) and comments received during a 2003 peer review of the December 2001 edition of the CalEPA ESL document (RWQCBSF 2003).

The vapor intrusion model is highly sensitive to the permeability of vadose-zone soil that soil gas must migrate through before being emitted at the ground surface. Screening levels generated for sites characterized by fine-grained, vadose-zone soils (clays and silts) of low permeability can be several orders of magnitude less stringent (i.e., higher) than those calculated for more permeable, coarse-grained soils. For this reason, screening levels were developed for both soil types. In Table E-1a, the first screening level presented is intended for use at sites with vadose-zone soils of highly to moderately permeability. The second screening level is intended for use at sites with lower permeability soils in the vadose zone.

For the purposes of this document, the high-permeability vadose-zone soil profile is modeled as one meter of coarse-grained, dry, sandy soil (S) overlying two meters of somewhat more moist clayey loam (CL, 1/3 sand, 1/3 silt, 1/3 clay). This is considered to be representative of the majority of sites in the CNMI area. The low permeability soil profile is modeled as one meter of loamy sand loam (LS) overlying two meters of silt (SI). "Sand" is defined as material that is equal to or greater than 0.075 mm in diameter (i.e., will not pass through a U.S. Standard 200 mesh sieve). Silt and clay are defined as material that is less than 0.075 mm in diameter (i.e., will pass through a U.S. Standard 200 mesh sieve). These definitions are consistent with default parameter values for soil types presented in the USEPA model (USEPA 2003a). The depth to from the ground surface to the top of impacted groundwater in both sets of models was assumed to be 3.0 meters. This is just above the minimum thickness allowed for modeling of vapor transport through the low/moderate permeability vadose-zone soil profile due to capillary fringe height constraints.

Input soil parameter values for total porosity, water-filled porosity and fraction organic carbon for the upper portion of the soil profiles were set equal to values used by USEPA Region IX in development of the PRGs (USEPA 2004). Soil moisture was assumed to be somewhat higher for the lower soil units than the upper units, at 0.30 (vs 0.15), consistent

with the default recommended in the USEPA vapor intrusion guidance document. Default values presented in the spreadsheet were used for remaining soil properties. For site-specific assessments, soil moisture data should be collected within five feet of the groundwater surface and well above the capillary fringe zone.

Default soil vapor permeability values for the selected soil types were used in the models. For site-specific estimation of this parameter, the use of rigorous, in-situ methods intended for the design of soil vapor extraction systems is recommended. Secondary porosity and permeability in fine-grained soils can be significantly enhanced by plant roots, desiccation cracks, disturbance during redevelopment, faulting, etc. Reliance on a small number of borings or laboratory analysis could significantly underestimate the actual vapor permeability of the site and in turn underestimate the risk of potential impacts to indoor air.

Note that when using the spreadsheet to back calculate a groundwater screening level from an input target risk, the values appearing in the spreadsheet for "Csource" (concentration in soil gas) and "Cbuilding" (concentration in indoor air) are based on a theoretical initial soil concentration of 1E-06 g/g or 1,000 micrograms per kilogram and are not directly related to the modeled screening level. The values presented do not represent actual modeled concentrations and should be ignored.

2.4.2 Background and Use of USEPA Vapor Intrusion Model

2.4.2.1 Background

The Johnson and Ettinger model incorporated into the USEPA vapor intrusion spreadsheets was originally developed to predict impacts to indoor air due to the subsurface emission of naturally occurring radon gas (Johnson and Ettinger, 1991). Pertinent sections of the guidance document published with the model are presented in Appendix 4. Based on concerns over the conservativeness of the model and a lack of field validation studies, the USEPA initially declined to promote use of the model to develop generic screening levels (USEPA 1996a, 2001). They instead suggested that the model should be used in conjunction with soil gas data to evaluate potential indoor air impacts. In 1997, however, the USEPA published a user's guide to the Johnson and Ettinger model and included a spreadsheet. The 2003 updates to the vapor intrusion spreadsheets developed by USEPA allowed direct input of soil gas data (USEPA 2003a).

The USEPA version of the Johnson and Ettinger considers both diffusive and convective flow of soil gas into buildings. Diffusive flow occurs as soil gas migrates from areas of higher concentration to areas of lower concentration. Wind effects and indoor heating can cause a decrease in air pressure inside a building and lead to upward, convective flow of subsurface vapors through cracks and gaps in the building floor. As described in the USEPA guidance document, effective convective flow of subsurface vapors into buildings is expected to be limited to deep soils within the "immediate" area of the building.

2.4.2.2 Adjustment of Screening Levels

Field studies at sites impacted by volatile chemicals have clearly documented impacts to indoor air due to the intrusion of subsurface vapors, particularly for sites where soil or groundwater has been impacted by chlorinated volatile organic compounds. One example is the report *An Evaluation of Vapor Intrusion Into Buildings Through A Study of Field Data* prepared by staff of the Massachusetts DEP (Fitzpatrick and Fitzgerald 1997). Results of the Massachusetts DEP study suggest that the vapor intrusion model may over-predict the concentration of chlorinated, volatile chemicals in soil gas by an order of magnitude or more with respect to the measured concentration of the chemical in groundwater, although in some cases the model appeared to be slightly under conservative. More significantly, the Massachusetts DEP field study indicated that the vapor intrusion model over-predicted the soil gas concentration of petroleum-based volatile organic compounds (e.g., benzene) in the vadose zone by up to three or more orders of magnitude. This was interpreted to reflect substantial, natural biodegradation of the vapor-phase of these chemicals in the subsurface. This in turn causes the models to over predict impacts to indoor air by several orders of magnitude and makes use of the model for this group of chemicals questionable, particularly in the absence of field-based soil gas data.

To account for the potentially over conservative nature of the vapor intrusion model for nonchlorinated volatile chemicals, screening levels generated by the model were adjusted upwards by a factor of ten (refer to Table E-1a). As discussed below, the use of soil gas data in combination with groundwater studies may be most appropriate for evaluating sites where a more detailed evaluation of this issue is warranted. Evaluation of this issue is ongoing.

2.5 Surface Water and Groundwater Ceiling Levels For Gross Contamination Concerns

Ceiling levels based on gross contamination concerns for surface water and groundwater are summarized in the Table I series. Ceiling levels for surface water and groundwater that is considered to be a current or potential source of drinking water are based on the lowest of the chemicals taste and odor threshold (e.g., Secondary MCLs), one-half the solubility and a maximum of 50000 ug/L for any chemical based on general resource degradation concerns (Tables I-1 and I-3, after MADEP 1994). Taste and odor thresholds for drinking water were selected in the following order of preference and availability:

- CNMI and USEPA Secondary MCLs;
- California Department of Health Services Taste and Odor Action Levels;
- Taste and odor levels developed by Amoore and Hautala (as presented in RWQCBCV 2000);

- Odor thresholds presented in Massachusetts DEP (MADEP 1994) and Ontario MOEE (MOEE 1996) guidance documents.

CNMI drinking water regulations reference USEPA Secondary MCLs for a short list of chemicals (CNMI 2005). With the exception of the MADEP and MOEE odor thresholds, data for the noted alternative references are summarized in the document *A Compilation of Water Quality Goals* (RWQCBCV 2000 and updates).

Ceiling levels for surface water and groundwater that is NOT considered to be a current or potential source of drinking water were selected in a similar manner with the exception that the drinking water taste and odor thresholds were replaced with general nuisance thresholds and gross contamination concerns (Tables I-2 and I-4). Nuisance thresholds are intended to reflect the concentration at which a chemical in water poses unacceptable odor problems. Thresholds presented in the Massachusetts DEP and Ontario MOEE guidance documents were used as the primary sources of data. Taste and odor levels developed by Amoore and Hautala (in RWQCBCV 2000) were referred to for chemicals that lack odor thresholds in the Ontario guidance, although conservative considerations for drinking water concerns could cause these criteria to be overly stringent. It is apparent, however, that similar sources were used to develop both the Ontario MOEE and the Amoore and Hautala databases (compare Tables I-1 and I-2). In keeping with the Ontario and Massachusetts guidance documents, a ten-fold dilution/attenuation of chemical concentrations in groundwater upon discharge to surface water was assumed (non-drinking water resources, gross contamination screening levels only). The nuisance threshold for MTBE presented in Table I-2 is based on average, upper range at which most subjects in a USEPA study could smell MTBE in water (180 ug/L), as summarized in the public health goals document for MTBE prepared by Cal EPA (CalEPA 1999a). This was selected as a nuisance screening level for MTBE in surface water. Assuming a dilution factor of ten yields the odor threshold of 1,800 ug/L for groundwater.

2.6 Other Groundwater Screening Levels

Additional screening levels for groundwater provided in the California EPA technical document *A Compilation of Water Quality Goals* include USEPA and National Academy of Sciences "Suggested No-Adverse-Response (SNARL)" goals for toxicity other than cancer risk and "Agricultural Water Quality" goals developed by the United Nations (RWQCBCV 2000). The SNARL goals largely duplicate risk-based screening levels for drinking water presented in Table F-3. Agricultural Water Quality goals for 12 metals are provided in Table F-5. These goals were not considered in the final lookup tables but may need to be considered on a site-specific basis. The agricultural goals are higher than screening levels for both drinking water and surface water protection for seven of the 12 metals listed. Agricultural goals for copper, cobalt, selenium and zinc are higher than goals for aquatic habitat protection but are lower than goals for drinking water (i.e., drinking water goals may not be adequately protective for irrigation use). The agricultural goal for molybdenum is lower than both the drinking water goal and the

surface water goal for this metal. The development of these goals was not reviewed for preparation of the ESL document.

3

Soil Screening Levels

3.1 Introduction - Shallow Versus Deep Soils

Residents and commercial or industrial workers may regularly be exposed to contaminated, vadose-zone soils or dust derived from these soils (Regular exposure to contaminated soils below the water table is not generally considered except for construction workers.) A depth of three meters (approximately 10 feet) is used to delineate between shallow, "surface" soils where regular exposure to residents and/or workers is assumed and deeper, "subsurface" soils where only periodic contact during construction and utility maintenance work is assumed (refer also to Section 2.5 of Volume 1). A depth of three meters is consistent with guidance presented in the CalEPA document *Supplemental Guidance For Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities* (CalEPA 1996). This is regarded as the maximum, likely depth that impacted soil could at some point in the future be excavated and left exposed at the surface. The potential for deeper soils to be brought to the surface during large-scale redevelopment activities should be evaluated on a site-by-site basis.

Environmental concerns specifically considered for shallow versus deep soil ESLs are summarized in Table 3-1. For shallow soils, the final ESL represents the lowest of a chemicals screening level for ecotoxicity, human direct-exposure (residential and commercial/industrial land use), vapor intrusion, leaching and the chemicals maximum ceiling level (nuisance concerns etc.). For deep soils, the final ESL represents the lowest of a chemicals screening level for human direct-exposure (trench/construction worker exposure), vapor intrusion, leaching and an alternative ceiling level. Screening levels for terrestrial biota concerns are not considered for deep soils.

Final ESLs for relatively non-mobile chemicals are generally less stringent for deep soils in comparison to shallow soils (e.g., compare final ESLs for polychlorinated biphenyls in Tables A-1 and C-1). A few exceptions are noted in Section 3.2. For chemicals that are highly mobile in the subsurface and easily leached from soil or emitted as vapors to the ground surface, groundwater protection and vapor intrusion concerns usually drive risk regardless of the depth of the impacted soil (e.g., chlorinated solvents). Final shallow and

deep soil ESLs for these chemicals are therefore identical (e.g., compare benzene and vinyl chloride ESLs in Tables A-1 and C-1).

3.2 Soil Screening Levels for Direct-Exposure Concerns

3.2.1 Target Risks

The USEPA Region IX PRGs are intended to be protective of residents and workers who may be exposed to chemicals in shallow soils on regular basis via incidental ingestion, dermal absorption, and inhalation of vapors and particulate matter. The goals are calculated based on a target risk of $1x10^{-6}$ (one-in-a-million) for chemicals with carcinogenic health effects and a target Hazard Quotient of 1.0 for chemicals with noncarcinogenic health effects. With the exceptions noted below, this approach was retained for residential and commercial/industrial action levels provided in this document. Due to the short, assumed exposure duration for construction/trench workers, direct-exposure action levels are based on a target excess cancer risk of 10^{-5} (see Appendix 2).

For most carcinogens, the residential and commercial/industrial action levels for direct exposure concerns are based on a target excess cancer risk of 10^{-6}. Exceptions include the direct-exposure soil action levels for PAHs, PCBs and TCE. Low levels of PAHs in soil are ubiquitous in urban environments due to auto exhaust and the use of asphalt. In general, ambient concentrations of PAHs in soil fall within a target risk range of 10^{-5} and 10^{-6} or less. In order to help identify sites with potentially significant levels of PAHs and avoid the need for a more detailed, site-specific evaluation at all sites, a target excess cancer risk of 10^{-5} was used to develop direct-exposure action levels for soil. A target hazard quotient of 1.0 for noncarcinogenic effects was retained. (Note that concentrations of PAHs in coal tar and older formulations of asphalt and can be orders of magnitude higher that direct-exposure action levels set at a target risk of 10^{-5}. Since asphalt is likewise ubiquitous in urban environments, cleanup of soil contaminated with small particles of asphalt that was used in its intended manner is generally not warranted. This exception would not apply to sites where asphalt, coal tar or similar materials was manufactured or disposed of as waste.)

A similar approach was taken for PCBs. Use of PCBs in transformers, capacitors and other electrical equipment was widespread in the 1960s and 1970s. Although less widespread than PAHs, ambient levels in soil often fall within a target risk range of 10^{-5} and 10^{-6}. In order to again help focus attention on sites where significant releases of PCBs occurred, a target excess cancer risk of 10^{-5} was used to develop direct-exposure action levels for soil. A target hazard quotient of 1.0 for noncarcinogenic effects was retained. Note that noncarcinogenic effects drives human health concerns for PCBs in soils under a residential exposure scenario (refer to Table K-1).

In the current edition of their Preliminary Remediation Goals (PRGs) document, USEPA Region IX incorporates more stringent cancer slope factors for development of PRGs for trichlorethylene (TCE) than those used in the past (USEPA 2004, refer to Table J). Due to ongoing uncertainties and debate over use of the slope factors, a target excess cancer risk of 10^{-5} was used to develop the soil, groundwater and indoor-air action levels for TCE presented in this document. Resulting action levels are an order of magnitude higher than those presented in the PRG document. This issue will be further evaluated in future updates of this document.

In general, direct-exposure soil action levels generated for the residential land use exposure scenario are more stringent (lower) than action levels developed for the commercial/industrial and construction/trench worker exposure scenarios. This is due to the increasingly shorter assumed exposure duration (years) and frequency (days per year) for the latter two scenarios and the assumption that children will not be regularly present under these scenarios (see Appendix 2). Exceptions include the direct-exposure action level developed for cobalt, which is more stringent under the construction/trench worker exposure scenario than under the residential exposure scenario (see Table K-1). The same is true for direct-exposure action levels for barium, beryllium, cadmium, chromium VI and cobalt under the commercial/industrial worker exposure scenario (see Table K-2). This is due to the combined high oral and/or inhalation toxicity of these chemicals and the assumed higher soil ingestion rate and higher level of air-born dust under the construction/trench worker exposure scenario. As noted in Tables K-1 and K-2, commercial/industrial and residential land use direct-exposure action levels for these chemicals were replaced with construction/trench worker action levels for use in the lookup tables if less stringent.

3.2.2 Shallow Soils

Direct-exposure screening levels for exposure to shallow soils are summarized in Tables K-1 (residential land use exposure scenario) and K-2 (commercial/industrial exposure scenario). Equations and exposure assumptions used in each scenario are summarized in Appendix 2. For the purposes of this document, residential action levels for direction exposure concerns were carried forward for use in the Tier 1 lookup tables. Direct-exposure screening levels for commercial/industrial and construction/trench worker exposure scenarios may be useful in site-specific environmental risk assessments.

The direct-exposure action levels are based on residential and commercial/industrial *Preliminary Remediation Goals* ("PRGs") developed by the USEPA Region IX (USEPA 2004). Equations and assumptions used in the PRGs are provided in Appendix 2. Assumptions used to develop direct-exposure action levels for a construction/trench worker exposure scenario are based on information compiled by the San Francisco Bay Regional Water Quality Control Board of the California EPA (RWQCBSF 2005, refer to Appendix 2).

Toxicity-based screening levels for total chromium are based on an assumed 1:6 ratio of Cr VI (highly toxic) to Cr III (minimally toxic), after methods presented in the USEPA Region IX Preliminary Remediation Goals (USEPA 2004). USEPA Region IX residential cancer slope factors for vinyl chloride were used to calculate both residential and commercial/industrial direct-exposure ESLs (USEPA 2004, refer to Table J). Standard exposure assumptions were otherwise retained for calculation of Tier 1 screening levels. Adjustment of the slope factors for commercial/industrial sites can be made on a site-specific basis as needed under a Tier 2 risk assessment.

3.2.3 Deep Soils

Direct-exposure screening levels for deep soils are summarized in Table K-3 (construction/utility workers exposure scenario). Only construction workers and utility trench workers are assumed to come into periodic contact with contaminants in deep soils. Exposure assumptions selected for this scenario are based on guidance presented in the USEPA Exposure Factor handbook (USEPA 1997), trench-worker risk assessment guidance developed by the Massachusetts Department of Environmental Protection (MADEP 1994), general direct-exposure assumptions included in the USEPA Region IX PRG document, and professional judgment (see Appendix 2, Table 1). As discussed above, screening levels were calculated using a target risk of 1x10-5 for chemicals with carcinogenic health effects and a target Hazard Quotient of 0.2 for chemicals with noncarcinogenic health effects (0.5 for TPH). A more detailed summary of exposure assumptions and selected parameter values is included in Appendix 2.

In general, direct-exposure soil screening levels generated for the residential land use exposure scenario are more stringent (lower) than screening levels developed for the commercial/industrial and construction/trench worker exposure scenarios. This is due to the increasingly shorter assumed exposure duration (years) and frequency (days per year) for the latter two scenarios and the assumption that children will not be regularly present under these scenarios (see Appendix 2). Exceptions include direct-exposure screening levels developed for barium, beryllium, total chromium, chromium VI, cobalt and nickel under the construction/trench worker scenario. Screening levels for these chemicals are more stringent under the construction/trench worker exposure scenario than under the commercial/industrial exposure scenario (see Table K-2). For cobalt, the construction/trench worker screening level is similarly lower than the residential land use screening level (see Table K-1). This is due to the combined high oral and/or inhalation toxicity of these chemicals and the assumed higher soil ingestion rate and higher level of air-born dust under the construction/trench worker exposure scenario. As noted in Tables K-1 and K-2, commercial/industrial and residential land use direct-exposure screening levels for these chemicals were replaced with construction/trench worker screening levels for use in the lookup tables if less stringent.

3.3 Soil Screening Levels for Potential Vapor Intrusion Concerns

Soil screening levels for the evaluation of potential vapor intrusion concerns are presented in Table E-1a and referenced in the Table A-D series. As discussed in Chapter 4, the use of soil gas data and screening levels to evaluate this concern is preferred.

A spreadsheet included with guidance published by the U.S. Environmental Protection Agency (USEPA 2003a) was used to generate soil screening levels for potential vapor intrusion concerns. A summary of these screening levels is provided in Table E-1b. Correlative soil gas screening levels are provided in Table E-2. Target indoor air goals are provided in Table E-3.

The spreadsheet is based on a model presented in the document *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors Into Buildings* (Johnson and Ettinger, 1991). The model considers both diffusive and convective flow of subsurface vapors into buildings. Summary text from the guidance document accompanying the spreadsheet is provided in Appendix 3, as is a sensitivity evaluation of the Johnson and Ettinger model. Example printouts of the model as used to calculate screening levels for this document are included in Appendix 4. A more detailed discussion of models is provided in Section 2.4 for correlative groundwater screening levels.

Input parameter values used in the soil models are noted in the example spreadsheets in Appendix 4 (see front pages). Parameter values assumed for, building characteristics and human exposure were consistent with values used in the soil vapor intrusion models. The aerial extent of impacted soil is assumed to be equal to the footprint of the building. The thickness of impacted soil was assumed to be 200 cm (approximately 6 feet). The soil type was assumed to be a highly permeable sand (intrinsic permeability = 1.0E-07 cm^2). This generated a soil vapor flow rate into the building of 67 cm^3/second or 4 liters/minute. The base of the floor was assumed to immediately over impacted soil (depth to top of soil equals thickness of floor). The model is not significantly sensitive to the input "Depth To Top of Contamination" for impacted soil situated within a few meters of the ground surface.

For nonchlorinated VOCs, field experience suggests that the vapor intrusion model typically overestimates in vapor-phase concentrations of these chemicals by an order of magnitude or more, due in part to high rates of natural biodegradation. Evaluation of this issue is ongoing. To address this in the lookup tables, soil screening levels generated with the model were adjusted upwards by a factor of ten (see Table E-1b). Collection of soil gas data and concurrent use of soil gas screening levels for vapor intrusion concerns is strongly recommended for sites where this pathway may be of significant concern.

The spreadsheet calculates the theoretical emission rate of a chemical at the ground surface based on the properties of the chemical and the soil type. For highly volatile

chemicals (e.g., vinyl chloride), however, an unrealistic mass of the chemical per unit area would have to be present at depth to maintain the theoretical emission rates over the assumed exposure duration. To compensate, the model spreadsheet calculates a second, a mass-balanced emission rate by dividing the total mass of the chemical in the soil per unit area by the input exposure duration. This conservatively assumes that the entire mass of the chemical directly beneath the building will ultimately be emitted into the building over the assumed exposure duration. For chemicals where the mass-balanced vapor emission rate is lower than the theoretical emission rate, the mass-balanced emission rate is used to generate a screening level (or calculate risk).

For chemicals that are liquids under ambient conditions, upper limits on screening levels are set at the given chemicals theoretical soil saturation limit. This conforms to assumptions used in the USEPA Region IX PRGs (USEPA 2004).

The same set of screening levels developed for shallow soils were applied to deep soils (see Tables C and D of this appendix). While conservative, the parameter for depth to impacted soil does not significantly control calculated screening levels for soils within five to ten meters of the ground surface. The need to re-evaluate the use of these screening levels should be made on a site-by-site basis.

3.4 Soil Screening Levels for Groundwater Protection

Soil screening levels for groundwater protection concerns are summarized in Table G and included in summary lookup tables for both shallow and deep soils (refer to Tables A through D of this appendix). These screening levels are intended to address potential leaching of chemicals from vadose-zone soils and subsequent impact on groundwater. The soil screening levels are back calculated based on target groundwater screening levels. Target groundwater screening levels are summarized in the Table F series and discussed in Chapter 2.

The majority of the screening levels were calculated based on an empirical equation presented in guidance published by the Massachusetts DEP (MADEP 1994):

$$C_{soil} = DAF \times C_{gw} \times 0.001 \text{ mg/ug}$$

$$DAF = (6207 \times H) + (0.166 \times Koc)$$

where: DAF = SESOIL-based dilution/attenuation factor;
H = Henry's Law Constant (atm-m3/mol);
Koc = organic carbon partition coefficient (cm^3/g);
C_{soil} = leaching based soil concentration (mg/kg);
C_{gw} = target groundwater screening level (ug/L).

The algorithm was originally developed by the state of Oregon (Anderson 1992), slightly modified for use by the Massachusetts DEP (MADEP 1994) and then incorporated into the Ontario MOEE lookup table guidance (MOEE 1996). The algorithm is bsaed on a combined use of the computer applications SESOIL and AT123D. These applications model leaching of chemicals from the vadose zone and subsequent migration of the leachate to groundwater, respectively.

SESOIL models the generation and downward migration of leachate in the vadose zone. The AT123D application models the mixing of leachate with groundwater immediately below the impacted area. A more detailed discussion of the derivation and application of the SESOIL/AT123D algorithm as modified by the Massachusetts DEP and adopted for use by the Ontario MOEE is provided in Appendix 5. The algorithm is based on a three-meter thick vadose zone characterized by one meter of impacted soil sandwiched between two one-meter thick layers of clean soil. The lower layer immediately overlies groundwater. All vadose-zone soil is conservatively assumed to be very permeable sand that freely allows the migration of leachate to groundwater. The organic carbon content of the soil is assumed to be 0.1%. (Note that this is more conservative than the 0.6% organic carbon content assumed in the direct-exposure models.) Mixing with groundwater is modeled over a ten-meter by ten-meter area. Use of a thicker assumed sequence of impacted soil would not significantly alter the results of the model given the assumed one-meter depth to groundwater.

The model assumes an annual rainfall of 1,100 mm (approximately 43 inches). A total of 720 mm (28 inches) of the total rainfall is assumed to infiltrate the ground surface and reach groundwater (assumed to be conservative for most areas of the CNMI). Biodegradation during migration of leachate to groundwater is not considered. This could cause the model to be especially over conservative for non-chlorinated, petroleum compounds. The model does, however, allow for resorption and revolatilization of chemicals from the leachate during migration based on the physio-chemical properties of the chemical and the assumed soil properties. Groundwater is assumed to flow at a moderate rate of approximately 73 meters (240 feet) per year. The concentration of a chemical in leachate is assumed to be further reduced upon mixing of the leachate with groundwater (dilution factor approximately 3).

For moderately volatile and sorptive chemicals (e.g., benzene), screening levels developed using the SESOIL-derived algorithm are similar to screening levels generated using the full SESOIL application under a scenario where impacted soil is within a few meters of groundwater (e.g., HIDOH 1995, carried out by the principal editor of this document). Comparison to screening levels developed by full but still conservative use of SESOIL suggests, however, that the simplified algorithm may be excessively conservative in the following cases:

- Leaching of highly volatile chemicals (e.g., vinyl chloride);
- Leaching of highly sorptive chemicals (e.g., polynuclear aromatic hydrocarbons);

- Leaching of highly biodegradable chemicals (e.g., common petroleum compounds);
- Sites where the depth to groundwater is greater than ten meters below the base of the impacted soil.

The depth-to-groundwater factor is particularly important for chemicals that exhibit one or more of the above noted characteristics. As the distance between the base of impacted soil and the top of groundwater increases, there is additional time and area for chemicals to volatilize out of the leachate, resorb to soil particles or degrade by naturally occurring biological processes. Site-specific evaluation of the potential for leaching of chemicals from soil may be warranted in such cases (including more rigorous modeling, laboratory leaching tests, groundwater monitoring, etc.).

SESOIL modeling carried out by the Hawai'i Department of Health (HIDOH 1995) suggests that chemicals with sorption coefficients greater than 30,000 cm^3/g will be essentially immobile in the surface under normal soil conditions and not likely to impact groundwater. The SESOIL models were run conservatively assuming an annual rainfall of 400 cm/year (158 inches/year), an infiltration rate of 144 cm/year (57 inches/year) and very permeable soil overlying fractured bedrock.

Based on modeling studies as well as field experience in general, screening levels for chemicals with sorption coefficients greater than 30,000 cm^3/g were therefore set at the theoretical soil saturation level for that chemical if higher than the screening level generated by use of the SESOIL algorithm (refer to Table G). The equation and assumptions used to calculate the saturation levels is presented and discussed in Appendix 2. Exceptions to this approach were the chemicals pentachlorophenol and bis(2-ethylhexyl)phthalate, both of which have a solubility significantly higher than the remainder of the highly sorptive chemicals (see Table J). Leaching based screening levels for these chemicals were developed using only the SESOIL algorithm described above (see Table G).

The majority of PCBs releases are related to 1242 to 1260 range Arochlors or similar mixtures. The default koc of 33,000 cm3/g presented in Table J was considered to be adequately conservative for this range and used in the leaching model. For less chlorinated PCB mixtures, a site-specific evaluation of potential leaching concerns and even possible vapor emission concerns is required.

Leaching based screening levels were generated only for chemicals considered to be significantly soluble and mobile in groundwater under normal, ambient conditions (e.g., pH 5.0 to 9.0 and normal redox conditions). Leaching based soil screening levels were not developed for metals. Leaching of metals from soil is highly dependent on the species of the metal present and the geochemical nature of the soil. At sites where physio-chemical conditions may promote enhanced leaching of metals and other chemicals from soils or waste piles (e.g., mining related wastes), the use of laboratory-based leaching tests is recommended (refer to Section 3.3.3 in Volume 1).

Leaching based soil screening levels were developed for perchlorate (ClO4). Perchlorate, a salt, is not significantly sorptive, volatile or biodegradable under normal conditions. Use of the SESOIL/AT123D algorithm was therefore not considered appropriate. As an alternative, a simple, chemical partitioning model presented in the USEPA Soil Screening Level Guidance document was referred to (USEPA 1996a, 2001):

$$Csoil = Cwater \times \left((Koc \times foc) + \left(\frac{\theta w + (\theta a \times H')}{\rho b} \right) \right) \times DAF$$

where: C_{soil} = Soil screening level for leaching concerns;
C_{water} = Target dissolved-phase concentration of chemical;
Koc = Sorption coefficient;
foc = fraction organic carbon in soil;
$Theta_w$ = water-filled porosity;
$Theta_a$ = air-filled porosity;
H' = Dimensionless Henry's Number constant;
p_b = Soil bulk density;
DAF = Dilution/Attenuation Factor

This model can be used to backcalculate the total soil concentration of a chemical based on a target dissolved-phase concentration of the chemical in the soil (i.e., concentration in leachate). For perchlorate, koc and H' are presumed to be zero and the equation reduces to:

$$Csoil = Cwater \times \left(\frac{\theta w}{\rho b} \right) \times DAF$$

The default water-filled porosity in the models is 0.15 and the default soil bulk density is 1.5. Based on groundwater screening levels for perchlorate of 3.6 ug/L for drinking water resources and 600 ug/L for non-drinking water resources (refer to Tables F-1a and F-1b), leaching based soil screening levels of 0.00036 mg/kg and 0.06 mg/kg are generated, respectively. A dilution/attenuation factor of 20 was incorporated to account for mixing of leachate with groundwater (USEPA 1996a, 2001). This yielded final soil screening levels for leaching concerns for perclorate of 0.007 mg/kg and 1.2 mg/kg (refer to Table G). Laboratory-based tests are recommended for more site-specific analysis of potential leaching of perchlorate from soil.

3.5 Soil Screening Levels for Terrestrial Habitats

Soil screening levels for the protection of terrestrial flora and fauna are included in summary ESL tables for shallow soils in both the “Residential” and

"Commercial/Industrial Only" land-use scenarios (Tables A-1, A-2, B-1 and B-2 of this appendix). The screening levels were taken directly from guidance developed by the Ontario Ministry of Environment and Energy (MOEE 1996). Screening levels were available for heavy metals and some high-molecular-weight organic compounds and pesticides.

The MOEE guidance is primarily a compilation of criteria published by environmental agencies in Canada and elsewhere and is an update to previous guidance (e.g., MOEE 1991; CCME 1994). Ecological effects-based soil values developed by the Dutch government (Vegter 1993; van den Berg 1993) were in particular reviewed for inclusion in the MOEE guidance. The Netherland "C" values referenced are intended to represent the concentration of a chemical in soil at which the No Observed Effects Concentration for 50% of the target ecological species would be exceeded. Earlier versions of the Canadian and Dutch guidance are presented in the U. S. Fish and Wildlife Service document *Evaluation of Soil Contamination* (USFWS 1990). Pertinent sections from the MOEE guidance are presented in Appendix 6.

Soil screening levels for terrestrial ecological concerns can be highly specific to the species of fauna or flora potentially impacted as well as the specific form of the metal present and the geochemistry of the soil. The Ontario MOEE intended use of the screening levels over a broad range of land-use scenarios, including residential land use, agricultural and parkland. For the purposes of consideration in the Tier 1 lookup tables, however, the screening levels are considered to be adequate only for general screening purposes in and around developed, urban areas.

The screening levels are not intended for use in areas where a significant risk to endangered or threatened species may exist or where there is a potentially significant threat to terrestrial ecological receptors that extends beyond the general boundary of a subject site. This could include sites that are adjacent to wetlands, streams, rivers, lakes, ponds or marine shoreline or sites that otherwise contain or border areas where protected or endangered species may be present. Potential impacts to sediment are also not addressed. The need for a detailed risk assessment should be evaluated on a site-by-site basis for areas where significant ecological concerns may exist.

3.6 Soil Ceiling Levels For Gross Contamination Concerns

Ceiling levels for gross contamination concerns are presented in each of the ESL summary tables for soil. These screening levels are intended to be protective against odor and other nuisance and aesthetic concerns, as well as restrict the presence of potentially mobile, free product and limit the overall degradation of soil quality (i.e., "gross contamination"). The selection of soil ceiling levels was based on methods originally published by the Massachusetts DEP (MADEP 1994) and also used by the Ontario MOEE (MOEE 1996), as described in the Table H series of this appendix.

Odor Thresholds presented in the Table H series are intended to represent the concentration of a chemical in air at which 50% of the population can detect a chemical odor. An "Odor Index" for a chemical is calculated by dividing the chemicals vapor pressure (in Torr, at 20-30 degrees Celsius) by its odor threshold (in ppm-volume, see Tables H-2 and H-3). This provides a relative ranking of chemicals for potential nuisance concerns. As summarized in H-2 (shallow soils) and H-3 (deep soils), ceiling levels were then selected based a comparison of a chemicals vapor pressure and odor index to a table of generic screening levels (Tables H-1). For chemicals that are liquids under ambient conditions, the final ceiling level was selected as the lowest of the generic level from Table H-1 and the chemicals theoretical saturation level in soil (see Appendix 2). This was intended to prevent the presence of mobile, free product in the subsurface.

TABLE 3-1. ENVIRONMENTAL CONCERNS CONSIDERED IN SOIL ESLs.

Category	Human Health (Direct-Exposure)	Human Health (Vapor Intrusion)	*Groundwater Protection (Drinking Water Resource Threatened)	*Groundwater Protection (Drinking Water Resource NOT Threatened)	Ecological Concerns (Terrestrial Receptors)	Ceiling Levels
Table A						
Residential Land Use	X	X	X	X	X	X
Commercial/Industrial Land Use Only	X	X	X	X	X	X
Table B						
Residential Land Use	X	X		X	X	X
Commercial/Industrial Land Use Only	X	X		X	X	X
Table C						
Residential Land Use	X	X	X	X		X
Commercial/Industrial Land Use Only	X	X	X	X		X
Table D						
Residential Land Use	X	X		X		X
Commercial/Industrial Land Use Only	X	X		X		X

*Groundwater protection concerns not related to drinking water include discharge to surface water, vapor intrusion (impacts to indoor air in overlying buildings), and gross contamination ceiling levels (nuisance concerns, etc.).

Table A - Shallow Soils Overlying Drinking Water Resource

Table B - Shallow Soils NOT Overlying Drinking Water Resource

Table C - Deep Soils Overlying Drinking Water Resource

Table D - Deep Soils NOT Overlying Drinking Water Resource

4

Indoor Air and Soil Gas Screening Levels

4.1 Introduction

The USEPA spreadsheet version of the Johnson & Ettinger model for soil gas intrusion into buildings (USEPA 2003a) was used to develop indoor air and soil gas screening levels for volatile chemicals. Example printouts of the model are included in Appendix 4. The model can be condensed into three simple steps: 1) calculation of a target indoor-air goal based on input exposure assumptions and chemical toxicity factors; 2) calculation of soil gas-to-indoor air attenuation factors based on a comparison of vapor flow rates into a building and air flow rates through the building and 3) calculation of a soil gas screening level. A summary of these steps is provided below. A more detailed discussion of the model is provided in Appendix 3.

4.2 Indoor Air Screening Levels

Indoor air screening levels were calculated using the following equation incorporated in the model:

<u>Carcinogens</u>:

$$\text{Cia} = \left(\frac{\text{TR} \times \text{ATc} \times 365\ \text{days/yr}}{\text{URF} \times \text{EF} \times \text{ED}} \right)$$

<u>Noncarcinogens</u>:

$$\text{Cia} = \left(\frac{\text{THQ} \times \text{ATnc} \times 365\ \text{days/yr}}{\left(\frac{1}{\text{RfC}} \right) \times \text{EF} \times \text{ED}} \right)$$

where:

Cia = Target indoor air concentration;

TR = Target risk (carcinogens);

THQ = Target hazard quotient (noncarcinogens);

ATc = Averaging time for carcinogens;

ATnc = Averaging time for noncarcinogens;

URF = Unit risk factor for carcinogens (carcinogens);

RfC = Reference concentration (noncarcinogens);

EF = Exposure frequency;

ED = Exposure duration.

A summary of the indoor-air goals calculated is provided in Table E-3. With the exception of TCE, a target excess cancer risk was of 10^{-6} was used for carcinogenic VOCs. A target risk of 10^{-6} was used for TCE due to the provisional nature of the cancer slope factors used (refer to Section 3.2.1). A noncancer, target Hazard Quotient of 0.2 was used for all chemicals except TPH, where a hazard Quotient of 0.5 was used (refer also to Section 1.3). Inhalation toxicity factors for volatile chemicals are summarized in Appendix 4 (VLOOKUP worksheet). Input exposure assumptions were identical to those assumed for direct-exposure models (refer to summary in Appendix 2 and DATAENTER worksheets in Appendix 4).

4.3 Soil Gas Screening Levels

Building design parameter values used in the groundwater and soil vapor-emission models were retained for use in the soil gas model (one story, $100m^2$ foundation area; refer to Section 2.4 and DATAENTER worksheets in Appendix 4). The spreadsheet models the intrusion of soil gas situated immediately beneath the slab-on-grade foundation into the overlying building ("Soil Gas Sampling Depth Below Grade" = 15 cm). Soil underlying the building was assumed to be a very permeable fill material. Default parameter values for a "sand" soil type were used in the model.

Based on the input building characteristics and soil type, a vapor emission rate of 67 cm^3/sec was generated (Qsoil, equivalent to 4.0 liters/minute). Indoor-air exchange rates of 1.0 times-per-hour and 2.0 times-per-hour were assumed for residences and commercial/industrial buildings, respectively. Given the assumed dimensions of 10m x 10m x 2.44 m for the modeled buildings, indoor-air "flow rates" of approximately 4,000 L/minute for residences and 8,000 L/minute for commercial/industrial buildings were generated.

Calculation of a soil gas-to-indoor air attenuation factor (AF) essentially reduces to:

$$AF = \left(\frac{\text{vapor intrusion rate}}{\text{vapor intrusion rate} + \text{indoor air flow rate}} \right).$$

For residences, a soil gas-to-indoor air attenuation factor of approximately 0.001 (1/1000) was calculated. For commercial/industrial buildings, a soil gas-to-indoor air attenuation factor of approximately 0.0005 (1/2000) was calculated. The shallow, assumed depth to soil gas and predominance of advective flow over diffusive flow effectively negates small differences in the fate and transport of individual chemicals. This allows the calculated attenuation factors to be used in a generic fashion for all volatile chemicals. Soil-gas screening levels (C_{sg}) are subsequently calculated as:

$$Csg = \left(\frac{\text{Indoor Air Goal}}{AF} \right).$$

A summary of soil-gas screening levels for volatile chemicals is provided in Tables E-2.

Note that soil-gas screening levels do not take into account the actual mass of the chemical present and could be overly conservative for the evaluation of long-term impacts to indoor air. At sites where a limited amount of impacted soil or groundwater is present, the concentration of the chemical in soil gas can be expected to decrease over time as the supply of the chemical is depleted. This would lead to steadily decreasing impacts to indoor air. Thus, while impacts to indoor air may initially exceed target goals, average, long-term impacts could conceivably fall below these goals.

This issue should be evaluated on a site-by-site basis as needed. As a conservative measure, and for the purpose of this screening levels document, it is recommended that indoor-air goals be used as "not-to-exceed" criteria and adjustment of models and soil gas to address potential mass-balance not be carried out in the absence of strong site data. This issue is currently under reviewed. Additional information will be incorporated into the ESL document as available.

5

Soil And Groundwater Screening Levels For TPH

5.1 Introduction

The selection of Total Petroleum Hydrocarbons (TPH) soil and groundwater screening levels for use in this document is described below. As discussed in the Volume 1, the use of ESLs as final “cleanup levels” for petroleum-related compounds that are known to be highly biodegradable may be unnecessarily conservative. This is especially true for leaching based soil screening levels for TPH and petroleum-related compounds. Final cleanup levels should be evaluated on a site-specific basis and in conjunction with guidance from the overseeing regulatory agency.

Petroleum is a complex mixture of hundreds of different compounds composed of hydrogen and carbon (i.e., "hydrocarbon" compounds). For the purposes of this document, petroleum mixtures are subdivided into "gasolines", "middles distillates" and "residual fuels", following the methodology used by the American Petroleum Institute (API 1994). **Gasolines** are defined as petroleum mixtures characterized by a predominance of branched alkanes and aromatic hydrocarbons with carbon ranges of C6 to C12 and lesser amounts of straight-chain alkanes, alkenes and cycloalkanes of the same carbon range. **Middle distillates** (e.g., kerosene, diesel fuel, home heating fuel, jet fuel, etc.) are characterized by a wider variety of straight, branched and cyclic alkanes, polynuclear aromatic hydrocarbons (PAHs, especially naphthalenes an methyl naphthalenes) and heterocyclic compounds with carbon ranges of approximately C9 to C25. **Residual fuels** (e.g., fuel oil Nos. 4, 5, and 6, lubricating oils, "waste oils", “oil and grease,” asphalts, etc.) are characterized complex, polar PAHs, naphthenoaromatics, asphaltenes and other high-molecular-weight, saturated hydrocarbon compounds with carbon ranges that in general fall between C24 and C40.

Laboratory analysis for TPH as gasolines and middle distillates is commonly carried out using EPA Method 8015 (or equivalent) modified for "gasoline-range" organics ("Volatile Fuel Hydrocarbons") and "diesel-range" organics ("Extractable Fuel

Hydrocarbons"), respectively. Analysis for TPH as residual fuels up to the C40 carbon range can generally be carried out by gas chromatograph methods (e.g., Method 8015 modified for "motor oil" and "waste oil" range organics) but can also include the use of infrared or gravimetric methods. More detailed information on analytical methods for TPH and other chemicals can be obtained from environmental laboratories or the overseeing regulatory agency.

Laboratory measurement and assessment of each individual compound within a petroleum mixture is technically complex and generally not feasible or appropriate under most circumstances. More importantly, data regarding the physio-chemical and toxicity characteristics of the majority of petroleum compounds are lacking. Impacts to soil and water from petroleum mixtures are instead evaluated in terms of both TPH and well characterized "indicator chemicals" (e.g., benzene, toluene, ethylbenzene, xylenes and targeted PAHs). Indicator chemicals typically recommended for petroleum mixtures include (after CalEPA 1996):

Monocyclic Aromatic Compounds (primarily gasolines and middle distillates)

- benzene
- ethylbenzene
- toluene
- xylene

Fuel additives (primarily gasolines)

- MTBE
- other oxygenates as necessary

Polycyclic Aromatic Compounds (primarily middle distillates and residual fuels)

- methylnaphthalene (1- and 2-)
- acenaphthene
- acenaphthylene
- anthracene
- benzo(a)anthracene
- benzo(b)fluoranthene
- benzo(g,h,i)perylene
- benzo(a)pyrene
- benzo(k)fluoranthene
- chrysene
- dibenzo(a,h)anthracene
- fluoranthene
- fluorene
- indeno(1,2,3)pyrene
- naphthalene
- phenanthrene
- pyrene

The TPH ESLs should be used in conjunction with ESLs for these chemicals. Note that volatile chemicals such as butylbenzene, isopropyl benzene, isopropyl toluene and trimethylbenzenes are often reported in analyses of gasoline and other light-end

petroleum products. These chemicals are collectively addressed under screening levels for "TPH" and generally do not need to be evaluated separately.

Soil and groundwater impacted by releases of waste oil may also require testing for heavy metals and chemicals such as chlorinated solvents and PCBs. Screening levels for these chemicals are included in the lookup tables.

5.2 TPH Screening Levels For Groundwater

Regulatory drinking water standards for TPH and petroleum in general have not been developed. Toxicity-based drinking water goals of 100 ug/L for gasoline and diesel and 1,000 ug/L for residual fuels presented in Table 3 were developed using on the USEPA Region IX PRG tapwater model and the above-noted toxicity factors (refer to Table F-3). Screening levels for benzene and related light-weight hydrocarbon compounds are considered to provide adequate additional protection of drinking water concerns for gasoline-impacted groundwater when used in conjunction with the TPH screening level of 100 ug/L. A TPH-diesel taste and odor threshold of 100 ug/L referenced in the technical document *A Compilation of Water Quality Goals* (RWQCBCV 2000) was referred to as a substitute secondary MCL for all categories of TPH (see Tables F-1a and I-1).

For the protection of aquatic life, a screening level of 500 ug/L was selected for TPH-gasoline in freshwater and 3,700 ug/L in saltwater (see Table F-4b). A single screening level of 640 ug/L was selected for TPH-diesel and TPH-residual fuels in both freshwater and saltwater. The freshwater screening level for TPH-gasoline is based on a summary of available eco-toxicity data compiled for use at the Presidio of San Francisco under Regional Water Board Order 96-070 (RWQCBSF 1998b, Montgomery Watson 1999). The TPH-gasoline criteria for saltwater and the TPH criteria for diesel and residual fuels in general are based on screening levels developed for use at the San Francisco Airport under Regional Water Board Order No. 99-045 (RWQCBSF 1999a).

The groundwater nuisance and odor concerns screening level of 5,000 ug/L for TPH (all categories) noted in the Table I series for nondrinking water was taken directly from Massachusetts DEP risk assessment guidance (MADEP 1997a,b). This also corresponds with the approximate solubility of diesel fuel and light motor oil in fresh water (ATSDR 2001a) and is intended to address potential nuisance issues (odors, etc.) if discharged to surface water. The TPH ceiling levels for gross contamination concerns are based on 1/2 the solubility of the respective TPH categories (refer to Table I series). The solubility of gasoline in freshwater is approximately 150,000 ug/L. The solubility of diesel range and heavier fuels is assumed to be approximately 5,000 ug/L. These screening levels are intended to highlight the potential presence of free product on groundwater.

5.3 TPH Screening Levels For Soil

5.3.1 TPH (gasolines, middle distillates)

Soil screening levels for lighter fractions of petroleum (gasolines, middle distillates) were selected based on a "surrogate" approach developed by the Massachusetts Department of Environmental Protection (Hutchinson et. al 1996; MADEP 1997a,b). The Massachusetts approach is similar to guidance developed by the Total Petroleum Hydrocarbon Working Group (TPHCWG 1998).

Massachusetts used six distinct groups of petroleum hydrocarbon compounds with similar carbon makeups and similar physio-chemical and toxicity characteristics to collectively describe the spectrum of all possible petroleum product mixtures (referred to as “carbon ranges”). For example, petroleum-related aromatic compound with five to 22 carbon atoms are grouped in the C11-C22 aromatic carbon range. Surrogate toxicity factors and physio-chemical constants were chosen for each carbon range group. These constants were then used to develop environmental soil and groundwater screening levels for each carbon range in the same manner as done for individual chemicals (see Chapters 2 and 3).

Due to the relatively high mobility of compounds included within the C11-C22 aromatics range fraction and the general predominance of these compounds in lighter-weight fuels, Massachusetts elected to use toxicity factors and physio-chemical constants for this carbon range as a "surrogate" for TPH in general. The same approach was adopted for use in this document. This could be potentially under conservative for gasoline-range mixtures with a predominance of more lighter and more mobile compounds. The use of conservative target indicator compounds (e.g., BTEX) in conjunction with the TPH screening level is assumed to adequately address this issue, however.

Massachusetts selected an oral reference dose (RfD) of 0.03 mg/kg-d and an inhalation reference dose of 0.14 mg/kg-d for the C11-C22 aromatics fraction, based in part on comparison to the Massachusetts RfDs for pyrene. An oral RfD of 0.03 mg/kg-d is also used in the USEPA PRGs for pyrene (see table J). The TPH Working Group selected a slightly less conservative oral RfD of 0.04 mg/kg-d and inhalation RfD of 0.06 mg/kg-d (based on Reference Concentration of 0.20 mg/m^3) for the same carbon range group (THPCWG 1998). In this document, the reference doses developed by MADEP were ultimately used to generate direct-exposure soil screening levels for TPH (refer to Tables K-1, K-2 and K-3). The screening levels are based on a target hazard quotient of 0.5 (see Section 1.3).

Massachusetts developed generic physio-chemical constants for the C11-C22 aromatics carbon range fraction based on a review of compounds included within this fraction. These constants were adopted in this document to develop a soil leaching screening level for TPH as gasolines and middle distillates (see Table G). The TPH soil screening level

calculated for protection of drinking water (rounded to 100 mg/kg) is coincidental with screening levels presented in other technical documents prepared by local regulatory agencies in California (e.g., RWQCBSF 1990; RWQCBLA 1996). Similarly, the soil screening level calculated for protection of surface water habitats (rounded to 400 mg/kg (gasolines) and 500 mg/kg (middle distillates)) is coincidental with the screening level developed for use in the CalEPA Board Order for the San Francisco Airport (RWQCB SF 1999a).

Toxicity-based drinking water goals for TPH presented into the ESL lookup tables are based on screening levels presented in the San Francisco Bay Regional Water Quality Control Board for this concern (RWQCBSF 2005, refer to Table F-3 and Equations 12 and 13 in Appendix 2) The screening levels were derived using oral reference dose noted above and the California Department of Health Services.

Ceiling levels for nuisance and other gross contamination concerns developed by Massachusetts for TPH as gasoline and diesel (latter included under "middle distillates") were modified for use in this document (MADEP 1997a,b, refer to Table H series). Based on calculated “odor indexes”, a shallow soil ceiling level of 100 mg/kg was selected for residential land-use scenarios and a ceiling level of 500 mg/kg was selected for commercial/industrial land-use (both categories of TPH). For deep soils, a ceiling level of 5,000 mg/kg was retained (primarily intended to prevent the presence of potentially mobile free product in soil).

5.3.2 TPH (residual fuels)

Direct-exposure screening levels developed for TPH as gasoline and as middle distillates were retained for use with TPH as residual fuels (refer to Table K-1). Following Massachusetts DEP guidance (MADEP 1997a,b), ceiling levels for gross contamination concerns of 500 mg/kg and 2,500 mg/kg were selected for residential and commercial/industrial shallow soils, respectively. The Massachusetts DEP ceiling level of 5,000 mg/kg was used for deep soils.

The Massachusetts DEP did not develop specific screening levels for leaching of heavy hydrocarbons from soil (refer to C19-C36 carbon range summary in Appendix 7). Residual fuels are by definition characterized by a predominance hydrocarbon compounds with carbon ranges greater than C24. These compounds are considered to be substantially less mobile in the subsurface that hydrocarbon compounds that make up the lighter-weight petroleum mixtures. For TPH that is characterized by a predominance of C23-C32 carbon range compounds, the California EPA Los Angeles Regional Water Board proposes a screening level of 1,000 mg/kg for protection of drinking water resources (RWQCBLA 1996). This screening level was adopted for use in this document (refer to Table G). The target TPH screening level for groundwater was not specifically stated but is presumably 100 ug/L or less.

The Los Angeles Regional Water Board did not present a similar screening level for potential leaching of TPH from soil and subsequent discharge of impacted groundwater to a body of surface water. Although conservative, the Los Angeles TPH soil leaching screening level 1,000 mg/kg was retained for this purpose (see Table G, refer also to Section 3.4).

5.3.3 Ethanol

Gasoline formulations are anticipated to include an increasing proportion of ethanol in the near future. Soil, soil gas, indoor air and groundwater screening levels for ethanol have therefore been added to the ESL document. Human-health, chronic toxicity factors for ethanol have not been developed. Ethanol is not considered to pose chronic health risks at the low doses posed by exposure to contaminated soil and groundwater. The screening levels are therefore based only on nuisance and gross contamination concerns. "Ceiling Levels" for these concerns are presented in Tables H (soil and indoor air) and I (groundwater and surface water). The final screening level for each of the groundwater categories is based on an "Upper Limit" of 50 mg/L (Table I series, see also Tables F-1a and F-1b). The final soil screening level presented in each of the soil categories of 45 mg/kg is based on the protection of groundwater to the noted target groundwater screening level (Table G, see also Table A-D series). The leaching based screening level was adjusted upwards by a factor of ten to take into account the high, anticipated biodegradation rate of ethanol in the environment. The adequacy of this screening level should be further evaluated in the field as appropriate (e.g., sites near producing water wells or bodies of surface water). The indoor air screening level of 19,200 ug/m^3 (10 ppmv) is based on the published odor threshold potential for ethanol (Table H series, see also Table E-3). This concentration is well below the OSHA Permissible Exposure Limit of 1,000 ppmv for workers.

Although highly mobile in the environment, ethanol is also highly biodegradable, not significantly toxic in low dose, and is likely to only persist in the presence of other, more toxic components of gasoline, including benzene (Ulrich 1999). An assessment and cleanup of contaminated soil and groundwater to address health threats posed by associated compounds is expected to address any potential health concerns posed by exposure to residual ethanol in soil, air or water.

6

Other Issues

6.1 Laboratory Reporting Levels and Background Concentrations

Laboratory method reporting limits and background concentrations of chemicals were not directly considered in development of the lookup tables. As discussed in Volume 1 of this document, however, reporting limits approved by the overseeing regulatory agency should be used in place of the ESLs presented in this document when higher. An ESL should similarly be replaced with the natural background concentration of the chemical if the background value is higher.

Naturally occurring, background concentrations of some metals may exceed risk-based screening levels for some chemicals. This is especially true for arsenic. The risk-based screening level for arsenic in residential soils is 0.39 mg/kg (refer to Table K-1). Background concentrations of arsenic in soils typically range from 5 mg/kg to 20 mg/kg (e.g., UCR 1996, LBNL 2002). Concentrations of arsenic in soil tend to be higher in soils associated with silicic volcanic rocks and hydrothermally altered rocks. A background concentration of 20 mg/kg arsenic was incorporated into the lookup tables to help identify and prioritize sites that may have been contaminated with arsenic due to human-related activities.

In some areas, background concentrations of total chromium and other metals in soil may also exceed risk-based screening levels presented in the ESL lookup tables. This issue should be evaluated on a site-by-site basis as needed using published data for the subject area or sample data from presumably uncontaminated areas of the site. If reported levels of total chromium appear to exceed anticipated background concentrations, then soil samples should be tested for Cr VI and Cr III and the data compared to screening levels for these specific species of chromium.

6.2 Reporting of Soil Data

Soil data are calculated by dividing the mass of the chemical of concern detected in the soil by the total weight of the soil. The weight of a soil sample can be measured on either a dry-weight basis (i.e., excluding the weight of water in the soil sample) or a wet-weight basis (i.e., including the weight of water in the soil sample). For a typical soil sample, the inclusion of soil moisture in calculation of chemical concentrations can effectively reduce the reported concentrations by 10-20% or greater, simply because the measured total weight of the sample is greater.

From a site-investigation and risk assessment-standpoint, a difference in the reported concentration of a chemical of 10-20% is not necessarily significant. **For consistency and for comparison to soil ESLs presented in this document, however, soil data should be reported on dry-weight basis.** This is in part because soil ingestion rates assumed in direct-exposure models (see Appendices 1 and 2) are based on dry-weight studies (USEPA 1997). Comparison of wet-weight data to direct-exposure screening level would technically require adjustment of the direct-exposure screening levels to reflect wet weight-based soil ingestion rates. A site-specific consideration of wet-weight soil data will be dependent on assumptions in the model(s) being used to evaluate risk or generate environmental screening levels. Existing wet-weight soil data may not necessarily need to be adjusted prior to comparison to the ESLs unless the introduced bias is considered to be a potentially significant factor at the site. (Note that sediment data should also be reported on a dry-weight basis.)

6.3 Additional Soil Parameters

For surface soils, screening levels are also presented for Electrical Conductivity and Sodium Absorption Ratio (after MOEE 1996). Both parameters are intended primarily for evaluation of soils impacted by brines (e.g., from former salt ponds and discharges of brackish groundwater). The Sodium Absorption Ratio reflects the amount of sodium present in the soil with respect to other major cations. An overabundance of sodium can inhibit plant uptake of nutrients, reduce soil cohesion and cause excessive erosion of topsoil. The electrical conductivity of a soil reflects the total concentration of soluble salts in the soil solution. A high concentration of salts can have a significant influence on osmotic processes involved in plant growth. (NOTE: The Electrical Conductivity screening levels assumes a fixed 2:1 water:soil solution in the laboratory method. The USEPA Laboratory Method 120.1(Mod) normally calls for a 1:1 dilution ratio, i.e., extract from a saturated sample. The laboratory should be notified of the need for a 2:1 dilution ratio prior to analysis.)

6.4 Degradation to Daughter Products

Consideration of the degradation of a chemical to more toxic daughter products, such as the breakdown of tetrachloroethylene to vinyl chloride, is an important part of site investigations. Tier 1 lookup tables generated by some regulatory agencies incorporate a

very conservative assumption that the entire mass of a parent chemical will be eventually be transformed to the daughter product at the same initial concentration (e.g., MADEP 1994, MOEE 1996). They in turn reduce the initially derived screening levels for these parent compounds to reflect the screening levels for the more toxic daughter product, without taking into account issues such as the lower molecular weights (and lower ultimate masses) of the daughter products. While the need to monitor for degradation byproducts is well founded, it is felt that the above approach is overly conservative in most cases and not reflective of naturally occurring conditions. In the case of tetrachlorethylene, for example, degradation to vinyl chloride and further degradation of vinyl chloride to non-toxic ethene gas (and ultimately carbon dioxide and water) can be expected to be a steady-state process at sites where degradation is occurring, removing a portion of the vinyl chloride as it is generated. At most release sites this process has already been initiated, and the already conservative screening levels for individual, primary compounds are considered to be adequately protective of human health and the environment. The need to reconsider this assumption should be evaluated on a site-by-site basis.

This issue is currently be evaluated in more detail. It should be pointed out that at some sites degradation of chlorinated solvents in groundwater is minimal (e.g., PCE) but levels of daughter products in soil gas are very elevated (e.g., vinyl chloride). This emphasizes the need to collect soil gas data at sites where vapor intrusion is of potential concern.

7

References

Anderson, M., 1992, Development of Generic Soil Clean-up Levels Based on Analysis of Leachate Pathway: Environmental Clean-up Division, Department of Environmental Quality, State of Oregon, May, 1992.

API, 1994, *Transport and Fate of Non-BTEX Petroleum Chemicals in Soils and Groundwater*: American Petroleum Institute, Health and Environmental Sciences Department, Publication No. 4593.

ATSDR, 2001a, Toxicological Profiles (CD-ROM): Agency For Toxic Substances and Disease Registry, U.S. Public Health Service, published by CRC Press.

CalEPA, 1996, *Supplemental Guidance For Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities*: California Department of Environmental Protection, Department of Toxics Substances Control, August, 1996, www.dtsc.ca.gov/ScienceTechnology/index.html.

CalEPA, 1999a, *Public Health Goal for Methyl Tertiary Butyl Ether (MTBE) in Drinking Water:* California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, March 1999, www.oehha.ca.gov/water/phg/allphgs.html

CalEPA, 1999b, Expedited Evaluation of Risk Assessment for Tert Butyl Alcohol (TBA) in Drinking Water: California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, June 2, 1999, www.oehha.org/water/pals/tba.html.

CCME, 1994, *A Protocol for the Derivation of Ecological Effects Based and Human Health Based Soil Quality Criteria for Contaminated Sites*: Canadian Council of Ministers of the Environment, Subcommittee on Environmental Quality Criteria for Contaminated Sites, December 1994.

CNMI, 2002, *Water Quality Standards*: Commonwealth of the Northern Mariana Islands.

CNMI, 2005, *Drinking Water Regulations*, Commonwealth of the Northern Islands.

Cole, S., Codling, I.D., Parr, W. and Zabel, T., 1999, Guidelines for managing water quality impacts within UK European marine sites: Prepared for the United Kingdom Marine Special Areas of Conservation (SAC) Project, Task Manager: Neil Hailey, English Nature, http://www.ukmarinesac.org.uk/pdfs/ water_quality.pdf.

Fetter, C. W., 1992, *Contaminant Hydrogeology*: Macmillan Publishing Company, New York, New York, 458.

Fitzpatrick, N.A. and J.J Fitzgerald, 1997, An Evaluation of Vapor Intrusion Into Buildings Through A Study of Field Data: Massachusetts Department of Environmental Protection, *in*: Soil Vapor Transport to Indoor Air Workshop, Feb. 6-7, 1997, Brea, California.

HIDOH, 1995, *Risk-Based Corrective Action and Decision Making at Sites With Contaminated Soil and Groundwater*: State of Hawai'i, Department of Health, December, 1995 (revised June, 1996).

HIDOH, 2005, *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (January 2005, 3rd edition): Hawai'i Department of Health, Honolulu, www.state.hi.us/doh/eh/shwb/ust/ index.html.

Hutchinson, M.S., Pedersen, D., Anastas, N.D., Fitzgerald, J., and D. Silverman, 1996, Beyond TPH: Health-Based Evaluation of Petroleum Hydrocarbon Exposures: Regulatory Toxicology and Pharmacology, Vol. 24, p. 85-101.

Johnson, P. C. and R. A. Ettinger, 1991, Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors Into Buildings: Environmental Science Technology, Vol. 25, p. 1445-1452.

LBNL, 2002, *Analysis of Background Distributions of Metals in the Soil at Lawrence Berkeley National Laboratory*: Lawrence Berkeley National Laboratory, Environmental Restoration Program, June 2002.

MADEP, 1994, *Background Documentation for the Development of the MCP Numerical Standards:* Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards, April 1994, www.state.ma.us/dep/ors/orspubs.htm.

MADEP, 1997a, Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach (and supporting spreadsheet, May 25, 1999): Massachusetts Department of Environmental Protection.

MADEP, 1997b, Revisions to the Massachusetts Contingency Plan, 310 CMR 40.000, Massachusetts Department of Environmental Protection, Bureau of Waste Site

Cleanup and Office of Research and Standards, November 7, 1997, www.state.ma.us/dep/bwsc/vph_eph.htm.

MADEP, 2002, Characterizing Risks Posed By Contaminated Sites: Implementation of the MADEP VPH/EPH Approach: Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup, October 31, 2002, www.state.ma.us/dep/bwsc/vph_eph.htm.

Meillier, L., 2004, Environmental Screening Levels Surfer: San Francisco Bay Regional Water Quality Control Board, California Environmental Protection Agency (updated in February 2005, supplement to RWQCBSF 2005).

MOEE, 1991, *Soil Clean-up Guidelines for Decommissioning of Industrial Lands, Background and Rationale for Development*: Ontario Ministry of Environment, ARB-207-88-PHYTO.

MOEE, 1996, *Rational for the Development and Application of Generic Soil, Groundwater and Sediment Criteria for Use at Contaminated Sites in Ontario*: Ontario Ministry of Environment and Energy, Standards Development Branch, December, 1996, www.ene.gov.on.ca/.

Mohr, T.K. 2001, Solvent Stabilizer White Paper: Santa Clara Valley Water District, San Jose, California, June 14, 2001.

Montgomery Watson, 1999, Development of Point of Compliance Concentrations for Gasoline in Surface Waters and Sediments of the Proposed Freshwater Stream, Presidio of San Francisco, California: prepared by Montgomery Watson consultants for Presidio of San Francisco (Board Order No. 96-070), May 1999.

NIST, 2003, NIST Chemistry WebBook: National Institute of Standards and Technology, NIST WebBook web page, http://webbook.nist.gov/chemistry/.

NLM, 2005, *Hazardous Substances Database*: National Library of Medicine (Toxnet), http://toxnet.nlm.nih.gov/.

Oakland, 2000, *Oakland Environmental Corrective Action: Technical Background Document*: City of Oakland, Environmental Services Division, (prepared by L.R. Spence. Spence Environmental Engineering and M. Gomez, City of Oakland), January, 2000 (and updates), www.oaklandpw.com/ulrprogram/index.htm.

RWQCBCV, 2000, *A Compilation of Water Quality Goals*: California Environmental Protection Agency, Regional Water Quality Control Board, Central Valley Region, August, 2000 (and updates), www.swrcb.ca.gov/rwqcb5/wq_goals.

RWQCBLA, 1996, *Interim Site Assessment and Cleanup Guidebook*: California Environmental Protection Agency, Regional Water Quality Control Board, Los Angeles Region, May, 1996.

RWQCBSF, 1990, *Tri-regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites*: California

Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, August, 1990.

RWQCBSF, 1998a, Recommended Interim Water Quality Objectives (or Aquatic Life Criteria) for Methyl tertiary-Butyl Ether: California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, Internal Memo dated September 30, 1998.

RWQCBSF, 1998b, Fresh Water Bioassay Study and Development of Freshwater Point-of-Compliance Concentrations, Presidio of California: California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, Board Order No. 96-070, Technical Memorandum, October 20, 1998.

RWQCBSF, 1999a, Adoption of Revised Site Cleanup Requirements - San Francisco International Airport: California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, Board Order No. 99-045.

RWQCBSF, 2001, Assessment and Management of MtBE Impacted Sites: California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, Winter 2001 (prepared by R. Arulanantham, M. Lauffer, T. Buscheck, and M. Einarson).

RWQCBSF, 2003, Completion of Peer Review of December 2001 Risk-Based Screening Levels Document: California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, April 16, 2003 (memo to James Giannopoulos, Assistant Chief, Division of Clean Water Programs, State Water Resources Control Board).

RWQCBSF, 2005, *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (February 2005): California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region, www.swrcb.ca.gov/~rwqcb2/ESL.htm.

TPHCWG, 1998, *Analysis of Petroleum Hydrocarbons in Environmental Media*: Total Petroleum Hydrocarbon Working Group (ed. Wade Weisman), Amherst Scientific Publishers, Amherst, Massachusetts, ISBN 1-884-940-14-5, www.aehs.com.

Ulrich, G., 1999, The Fate and Transport of Ethanol-Blended Gasoline in the Environment: Governor's Ethanol Coalition, Lincoln, Nebraska, (October 1999), 109p, http://www.ethanol-gec.org/coalitionstudies.htm

UCR, 1996, *Background Concentrations of Trace and Major Elements in California Soils*: University of California (Riverside), Division of Agriculture and Natural Resources, March 1996.

USCG, 1999, Chemical Hazards Response Information System (CHRIS): U.S. Coast Guard database, http://www.chrismanual.com/findsyno.htm.

USDHHS, 2001, National Toxicology Program (NTP): U.S. Department of Health and Human Services, National Institutes of Health's National Institute of Environmental Health Sciences (NIEHS).

USDOE, 1997, *Preliminary Remediation Goals for Ecological Endpoints*: U.S. Department of Energy, Office of Environmental Management (prepared by R.A. Efroymson, G.W. Suter II, B.E. Sample and D.S. Jones), August 1997, ES/ER/TM-162/R2, www.esd.ornl.gov/programs/ecorisk/tools.html.

USEPA, 1989a, *Risk Assessment Guidance for Superfund. Volume I, Human Health Evaluation Manual (Part A)*: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Publication EPA/540/1-89/092.

USEPA, 1989b, *Risk Assessment Guidance for Superfund. Volume II, Environmental Evaluation Manual*: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Publication EPA/540/1-89/001.

USEPA, 1992, *Water Quality Standards,; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance Final Rule* (National Toxics Rule): U.S. Environmental Protection Agency, Code of Federal Regulations, Title 40, Part 131.

USEPA, 1994, *National Oil and Hazardous substances Pollution Contingency Plan, Subpart E - Hazardous Substance Response*: U.S. Environmental Protection Agency, Code of Federal Regulations, Title 40, Part 300.430(e)(2), www.access.gpo.gov/nara/cfr/.

USEPA, 1995, *Final Water Quality Guidance for the Great Lakes System*, U.S. Environmental Protection Agency, Code of Federal Regulations, Title 40, Parts 9, 122, 123, 131 and 132, www.access.gpo.gov/nara/cfr/.

USEPA, 1996a, *Soil Screening Guidance: Technical Background Document*: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Publication 9355.4-17A, May, 1996.

USEPA, 1996b, Ecotox Thresholds: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, January, 1996, EPA 540/F-95/038, www.epa.gov/superfund/resources/ecotox/.

USEPA, 1997, *Exposure Factors Handbook*: U.S. Environmental Protection Agency, Office of Research and Development, Publication EPA/600/P-95/002Fa, August 1997.

USEPA, 1998, Perchlorate *Environmental Contamination: Toxicological Review and Risk Characterization Based on Emerging Information* (draft): U.S. Environmental Protection Agency, Office of Research and Development, NCEA-1-0503 December 31, 2001.

USEPA, 2000, *Water Quality Standards; Establishment of Numerical Criteria for Priority Toxic Pollutants for the State of California; Rule*: U.S. Environmental Protection Agency, Federal Register, 40 CFR Part 131, Thursday, May 18, 2000.

USEPA, 2001, *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, March 2001.

USEPA, 2002, National Recommended Water Quality Criteria: 2002: U.S. Environmental Protection Agency, Office of Water, EPA-822-R-02-047.

USEPA, 2003a, *User's Guide For Subsurface Vapor Intrusion Into Buildings*: U.S. Environmental Protection Agency Office of Emergency and Remedial Response, March 2003, www.epa.gov/oerrpage/superfund/.

USEPA, 2003b, ECOTOX database (data for tert Butyl Alcohol): U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, www.epa.gov/ecotox/ (accessed 7/9/03).

USEPA, 2004, *Preliminary Remediation Goals*: U.S. Environmental Protection Agency, Region IX, October 2004, www.epa.gov/region09/waste/sfund/prg/index.htm.

USFWS, 1990, *Evaluation of Soil Contamination*: U.S. Fish and Wildlife Service, U.S. Department of Interior, Biological Report 90(2).

van den Berg, R., Denneman, C. A. J., and Roels, J.M., 1993, Risk Assessment of Contaminated Soil: Proposals for Adjusted, Toxicologically Based Dutch Soil Clean-up Criteria: in *Contaminated Soil '93* (eds., Arendt, F., Annokkee, G.J., Bosman, R., van den Brink, W.J.), Kluwer Academic Publishers, Dordrecht, pp. 349-364.

Vegter, J., T., 1993, Development of Soil and Groundwater Clean Up Standards in the Netherlands: IN: Developing Cleanup Standards for Contaminated Soil, Sediment, and Groundwater - How Clean is Clean?, Specialty conference Series Proceedings, Water Environment Federation, January, 1993, Washington, D.C., pp. 81-92.

FIGURES

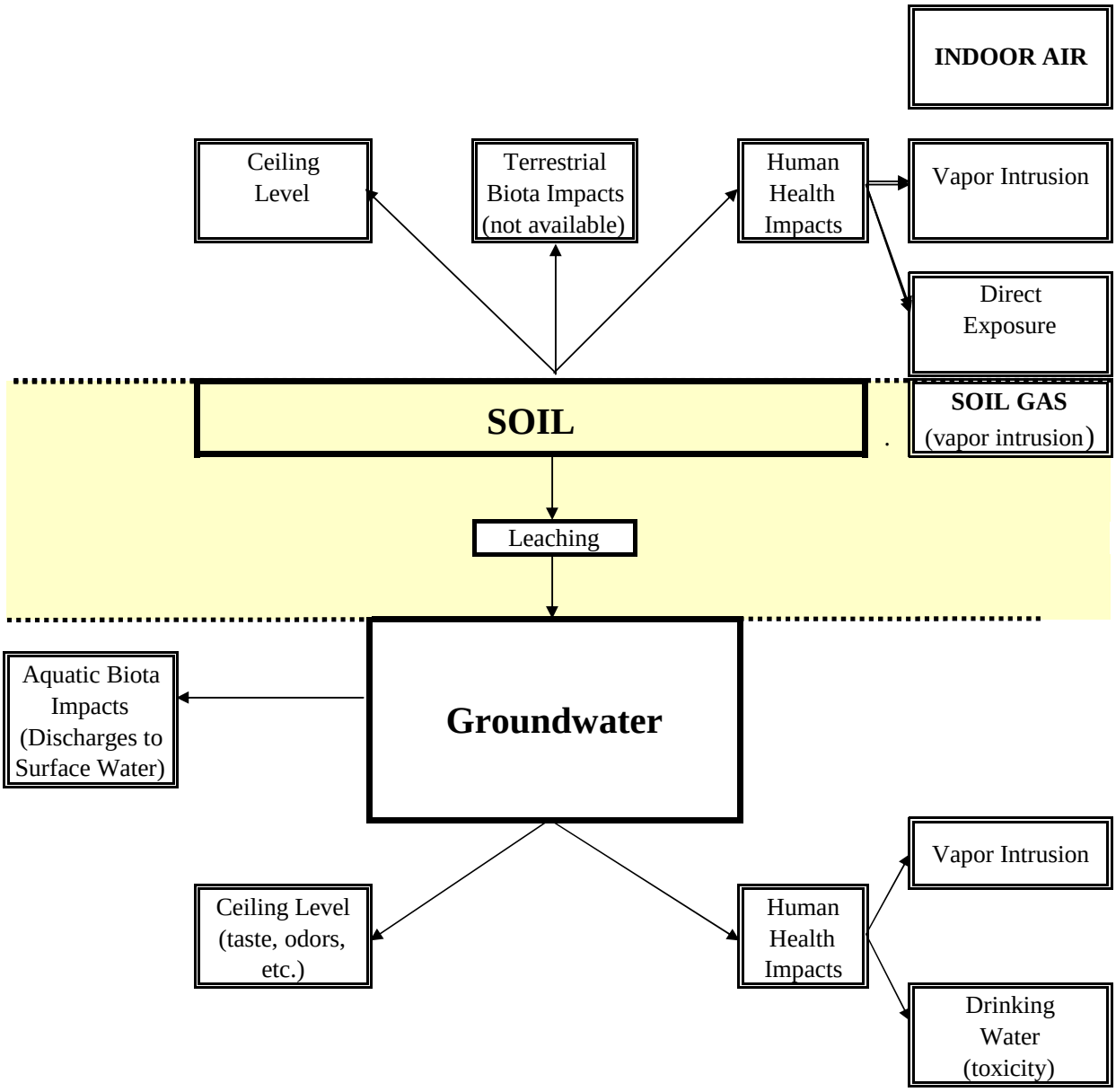

Figure 1. Summary of human health and environmental concerns considered in screening levels. Additional site-specific considerations include groundwater beneficial use, depth to impacted soil, soil type and land use. This figure is intended for Tier 1 and Tier 2 assessments only. Evaluation of environmental concerns not shown requires site-specific assessment.

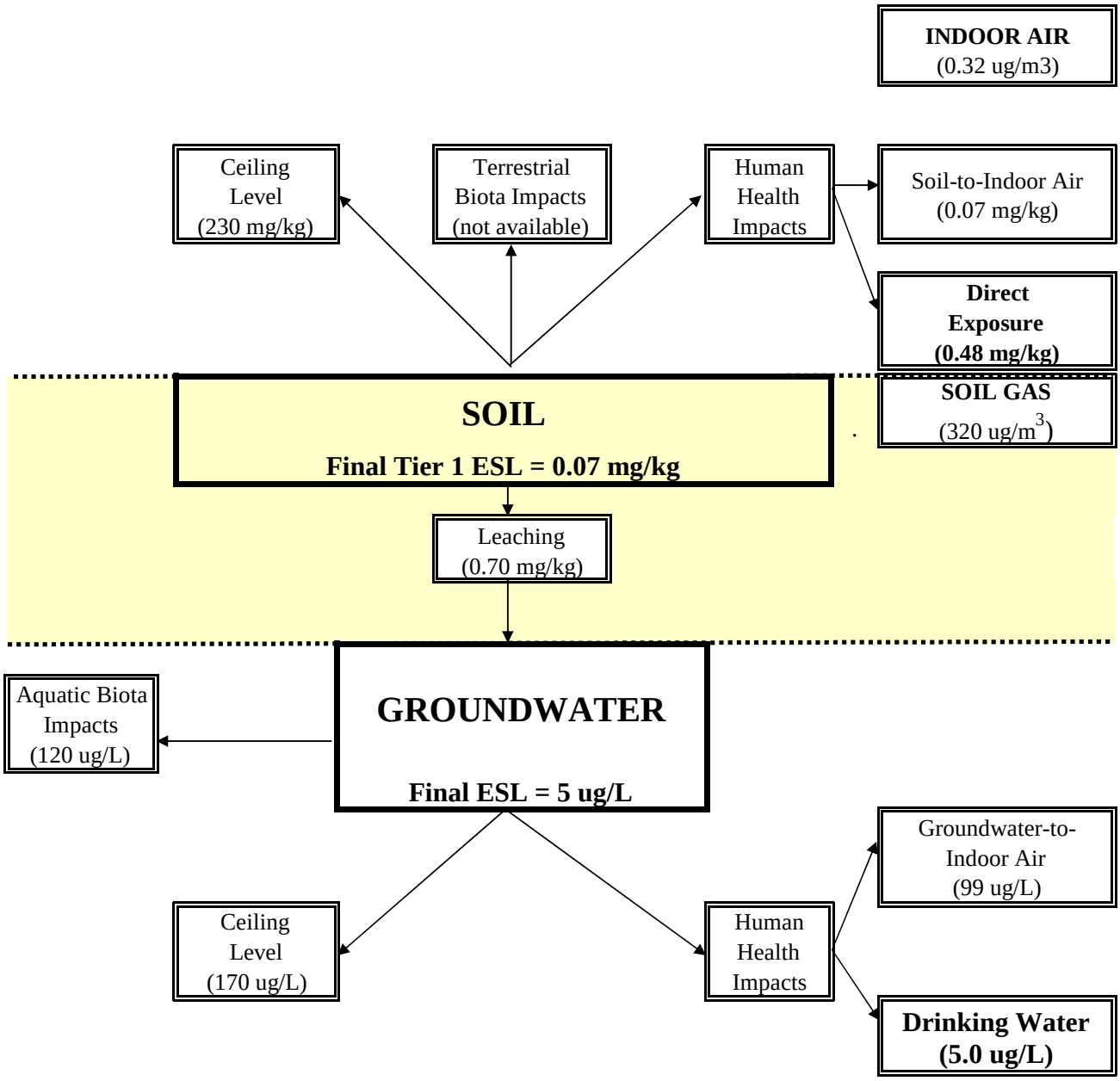

Figure 2. Summary of individual screening levels used to select final, Tier 1 ESLs for tetrachloroethylene in soils situated within ten feet of the ground surface and in groundwater that is a current or potential source of drinking water, based on a residential land-use scenario. Final ESLs presented in Volume 1 summary tables are the lowest of the individual screening levels. Vapor intrusion concerns drive selection of the final soil ESL (0.07 mg/kg). For groundwater, drinking water toxicity concerns drive selection of final ESL (5.0 ug/L).

TABLES

TABLE A-1. [1]SHALLOW SOIL SCREENING LEVELS (≤3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area Ecotoxicity Criteria		Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2		Background	Table K-1	Table E-1b	Table G
ACENAPHTHENE	1.6E+01	1.0E+03	-		7.3E+02	1.3E+02	1.6E+01
ACENAPHTHYLENE	1.3E+01	5.0E+02	-		2.6E+02	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	5.0E+02	-		2.8E+03	1.1E+03	5.0E-01
ALDRIN	2.9E-02	1.0E+03	3.5E-01		2.9E-02		5.0E+00
ANTHRACENE	2.8E+00	5.0E+02	4.0E+01		4.4E+03	6.1E+00	2.8E+00
ANTIMONY	6.3E+00	1.0E+03	2.0E+01		6.3E+00		
ARSENIC	2.0E+01	1.0E+03	2.0E+01	20	3.9E-01		
BARIUM	7.5E+02	1.0E+03	7.5E+02		1.1E+03		
BENZENE	2.2E-01	5.0E+02	2.5E+01		6.4E-01	5.3E-01	2.2E-01
BENZO(a)ANTHRACENE	6.2E+00	5.0E+02	4.0E+01		6.2E+00		1.2E+01
BENZO(a)PYRENE	6.2E-01	5.0E+02	4.0E+01		6.2E-01		1.3E+02
BENZO(b)FLUORANTHENE	6.2E+00	5.0E+02	-		6.2E+00		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	5.0E+02	4.0E+01		4.6E+02		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	5.0E+02	4.0E+01		6.2E+01		3.7E+01
BERYLLIUM	4.0E+00	1.0E+03	4.0E+00		3.1E+01		
BIPHENYL, 1,1-	6.5E-01	5.0E+02	-		6.0E+02	(Use soil gas)	6.5E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-04	5.0E+02	-		2.0E-01	6.7E-03	1.2E-04
BIS(2-CHLOROISOPROPYL)ETHER	3.0E-03	5.0E+02	-		2.9E+00	(Use soil gas)	3.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	5.0E+02	-		3.5E+01		1.0E+02
BORON	1.6E+00	no criteria	1.6E+00		2.4E+03		
BROMODICHLOROMETHANE	3.4E-03	1.0E+03	-		8.2E-01	2.3E-02	3.4E-03
BROMOFORM	2.2E+00	5.0E+02	-		6.1E+01		2.2E+00
BROMOMETHANE	1.7E-01	5.0E+02	-		7.6E-01	1.7E-01	3.4E-01
CADMIUM	7.8E+00	1.0E+03	1.2E+01		7.8E+00		
CARBON TETRACHLORIDE	2.7E-02	5.0E+02	-		2.5E-01	2.7E-02	1.1E+00
CHLORDANE	1.6E+00	1.0E+03	-		1.6E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	1.0E+03	-		4.9E+01		5.3E-02
CHLOROBENZENE	1.5E+00	5.0E+02	3.0E+01		3.0E+01	2.1E+00	1.5E+00
CHLOROETHANE	2.7E-01	5.0E+02	-		3.0E+00	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	5.0E+02	-		2.2E-01	1.8E-02	1.8E+00
CHLOROMETHANE	3.2E+00	1.0E+02	-		9.2E+00	3.2E+00	2.4E+01
CHLOROPHENOL, 2-	1.2E-02	1.0E+02	1.0E+01		1.3E+01	6.7E-01	1.2E-02
CHROMIUM (Total)	2.1E+02	1.0E+03			2.1E+02		
CHROMIUM III	7.5E+02	1.0E+03	7.5E+02		2.3E+04		
CHROMIUM VI	8.0E+00	1.0E+03	8.0E+00		3.0E+01		
CHRYSENE	2.3E+01	1.0E+03	4.0E+01		6.2E+02	(Use soil gas)	2.3E+01
COBALT	4.0E+01	1.0E+03	4.0E+01		1.0E+02		

TABLE A-1. [1]SHALLOW SOIL SCREENING LEVELS (≤3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area Ecotoxicity Criteria		Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2		Background	Table K-1	Table E-1b	Table G
COPPER	2.3E+02	1.0E+03	2.3E+02		6.3E+02		
CYANIDE (Free)	1.0E+02	1.0E+02	-		2.4E+02	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	6.2E-01	5.0E+02	-		6.2E-01		9.9E+00
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	5.0E+02	-		4.2E-01	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	1.1E-02	1.0E+02	-		1.1E+00	1.7E-02	1.1E-02
DIBROMOETHANE, 1,2-	4.6E-04	5.0E+02	-		3.2E-02	7.2E-04	4.6E-04
DICHLOROBENZENE, 1,2-	1.1E+00	6.0E+02	3.0E+01		2.2E+02	7.0E+00	1.1E+00
DICHLOROBENZENE, 1,3-	7.4E+00	1.0E+02	3.0E+01		1.1E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	6.5E-02	5.0E+02	3.0E+01		3.4E+00	6.5E-02	5.9E-01
DICHLOROBENZIDINE, 3,3-	4.0E-02	5.0E+02	-		1.1E+00		4.0E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	5.0E+02	-		2.4E+00		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	5.0E+02	4.0E+00		2.4E+00		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	1.0E+03	4.0E+00		1.7E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	5.0E+02	-		9.8E+01	1.7E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.6E-02	5.0E+02	6.0E+01		2.7E-01	1.6E-02	4.5E-02
DICHLOROETHYLENE, 1,1-	1.2E+00	5.0E+02	-		2.4E+01	7.0E+00	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	1.2E+00	1.0E+02	-		8.5E+00	1.2E+00	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	2.5E+00	5.0E+02	-		1.4E+01	2.5E+00	6.7E+00
DICHLOROPHENOL, 2,4-	3.0E-01	5.0E+02	1.0E+01		3.7E+01		3.0E-01
DICHLOROPROPANE, 1,2-	2.1E-02	1.0E+02	-		3.4E-01	2.1E-02	1.2E-01
DICHLOROPROPENE, 1,3-	4.6E-02	5.0E+02	-		7.7E-01	1.0E-01	4.6E-02
DIELDRIN	2.3E-03	1.0E+03	4.0E+00		3.0E-02		2.3E-03
DIETHYLPHTHALATE	3.5E-02	5.0E+02	-		9.8E+03		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	1.0E+02	-		2.4E+02		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	5.0E+02	-		1.2E+05		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	5.0E+02	-		2.4E+01		2.1E-01
DINITROTOLUENE, 2,4-	2.5E-01	5.0E+02	-		2.4E+01		2.5E-01
DIOXANE, 1,4-	3.7E-03	5.0E+02	-		4.4E+01		3.7E-03
DIOXIN (2,3,7,8-TCDD)	3.9E-06	no criteria	-		3.9E-06		1.1E+06
ENDOSULFAN	4.6E-03	5.0E+02	-		7.3E+01		4.6E-03
ENDRIN	6.5E-04	5.0E+02	6.0E-02		3.7E+00		6.5E-04
ETHANOL	4.5E+00	5.0E+02					4.5E+00
ETHYLBENZENE	3.3E+00	4.0E+02	-		3.7E+02	3.6E+02	3.3E+00
FLUORANTHENE	4.0E+01	5.0E+02	4.0E+01		4.6E+02		6.0E+01
FLUORENE	8.9E+00	5.0E+02	-		5.5E+02	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	1.0E+03	-		1.1E-01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	1.0E+03	-		5.3E-02		1.4E-02

TABLE A-1. [1]SHALLOW SOIL SCREENING LEVELS (≤3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area Ecotoxicity Criteria		Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2		Background	Table K-1	Table E-1b	Table G
HEXACHLOROBENZENE	3.0E-01	5.0E+02	3.0E+01		3.0E-01		7.9E+02
HEXACHLOROBUTADIENE	3.7E+00	5.0E+02	-		3.7E+00		4.3E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	5.0E+02	2.0E+00		4.4E-01		4.9E-02
HEXACHLOROETHANE	1.2E+01	5.0E+02	-		1.2E+01		1.6E+01
INDENO(1,2,3-cd)PYRENE	6.2E+00	5.0E+02	4.0E+01		6.2E+00		2.4E+01
LEAD	2.0E+02	1.0E+03	2.0E+02		4.0E+02		
MERCURY	4.7E+00	5.0E+02	1.0E+01		4.7E+00		
METHOXYCHLOR	1.9E+01	5.0E+02	-		6.1E+01		1.9E+01
METHYL ETHYL KETONE	6.4E+00	5.0E+02	-		4.4E+03	3.8E+03	6.4E+00
METHYL ISOBUTYL KETONE	3.9E+00	1.0E+02	-		1.1E+03	3.8E+03	3.9E+00
METHYL MERCURY	1.2E+00	1.0E+02	1.0E+01		1.2E+00		
METHYL TERT BUTYL ETHER	2.3E-02	1.0E+02	-		3.1E+01	1.6E+00	2.3E-02
METHYLENE CHLORIDE	6.7E-02	5.0E+02	-		9.2E+00	9.0E-01	6.7E-02
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	5.0E+02	-		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	4.0E+01	1.0E+03	4.0E+01		7.8E+01		
NAPHTHALENE	1.2E+00	5.0E+02	4.0E+01		1.1E+01	3.6E+00	1.2E+00
NICKEL	1.5E+02	1.0E+03	1.5E+02		3.1E+02		
PENTACHLOROPHENOL	3.0E+00	5.0E+02	5.0E+00		3.0E+00		5.3E+00
PERCHLORATE	7.0E-03	1.0E+03	-		1.6E+00		7.0E-03
PHENANTHRENE	1.1E+01	5.0E+02	4.0E+01		5.7E+02	(Use soil gas)	1.1E+01
PHENOL	7.6E-02	5.0E+02	4.0E+01		3.7E+03		7.6E-02
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E-01	5.0E+02	-		2.2E-01		6.3E+00
PYRENE	8.5E+01	5.0E+02	-		4.6E+02	8.5E+01	8.5E+01
SELENIUM	1.0E+01	1.0E+03	1.0E+01		7.8E+01		
SILVER	2.0E+01	1.0E+03	2.0E+01		7.8E+01		
STYRENE	1.5E+00	5.0E+02	-		8.7E+02	3.6E+02	1.5E+00
tert-BUTYL ALCOHOL	2.3E-02	1.0E+02	-		7.0E+01	(Use soil gas)	2.3E-02
TETRACHLOROETHANE, 1,1,1,2-	7.6E-03	1.0E+02	-		3.1E+00	(Use soil gas)	7.6E-03
TETRACHLOROETHANE, 1,1,2,2-	9.9E-04	5.0E+02	-		4.1E-01	7.2E-03	9.9E-04
TETRACHLOROETHYLENE	6.9E-02	2.3E+02	-		4.8E-01	6.9E-02	7.0E-01
THALLIUM	1.0E+00	1.0E+03	-		1.0E+00		
TOLUENE	2.9E+00	5.0E+02	-		1.3E+02	1.4E+02	2.9E+00
TOXAPHENE	4.2E-04	5.0E+02	-		4.0E-01		4.2E-04
TPH (gasolines)	1.0E+02	1.0E+02	-		4.0E+02	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	1.0E+02	-		4.0E+02	(Use soil gas)	1.0E+02
TPH (residual fuels)	5.0E+02	5.0E+02	-		1.2E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	3.2E-01	5.0E+02	3.0E+01		1.2E+01	3.2E-01	7.6E+00

TABLE A-1. [1]SHALLOW SOIL SCREENING LEVELS (≤3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area Ecotoxicity Criteria		Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2		Background	Table K-1	Table E-1b	Table G
TRICHLOROETHANE, 1,1,1-	7.8E+00	5.0E+02	-		3.9E+02	7.8E+01	7.8E+00
TRICHLOROETHANE, 1,1,2-	2.6E-02	1.0E+02	-		7.2E-01	2.6E-02	7.0E-02
TRICHLOROETHYLENE	3.6E-02	5.0E+02	6.0E+01		5.2E-01	3.6E-02	4.6E-01
TRICHLOROPHENOL, 2,4,5-	1.8E-01	1.0E+02	1.0E+01		5.0E+02	1.9E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	5.0E+02	1.0E+01		1.2E+00		1.2E+00
VANADIUM	1.6E+01	1.0E+03	2.0E+02		1.6E+01		
VINYL CHLORIDE	2.0E-02	5.0E+02	6.0E+01		1.5E-01	2.0E-02	3.4E-01
XYLENES	2.3E+00	4.2E+02	-		5.4E+01	3.6E+01	2.3E+00
ZINC	6.0E+02	1.0E+03	6.0E+02		4.7E+03		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	-	-		-	-	-
Sodium Adsorption Ratio	5.0	-	-		-	-	-

Notes:

1. Shallow soils defined as soils situated <3 meters below ground surface.

2. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Final Environmental Screening Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching screening levels.

Assumes soil pH 5.0 to 9.0.

Soil data should be reported on dry-weight basis (see Section 6.2).

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE A-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
		Gross Contamination Ceiling Value (Odors, etc.)			Human Health		Groundwater Protection (Soil Leaching)
					Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Urban Area Ecotoxicity Criteria	Background	Table K-2	Table E-1b	Table G
ACENAPHTHENE	1.6E+01	2.5E+03	-		5.8E+03	1.3E+02	1.6E+01
ACENAPHTHYLENE	1.3E+01	1.0E+03	-		1.2E+03	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	1.0E+03	-		1.1E+04	3.3E+03	5.0E-01
ALDRIN	1.0E-01	2.5E+03	3.5E-01		1.0E-01		5.0E+00
ANTHRACENE	2.8E+00	1.0E+03	4.0E+01		4.8E+04	6.1E+00	2.8E+00
ANTIMONY	4.0E+01	2.5E+03	4.0E+01		8.2E+01		
ARSENIC	2.0E+01	2.5E+03	4.0E+01	2.0E+01	1.6E+00		
BARIUM	1.5E+03	2.5E+03	1.5E+03		2.5E+03		
BENZENE	2.2E-01	8.7E+02	2.5E+01		1.4E+00	1.9E+00	2.2E-01
BENZO(a)ANTHRACENE	1.2E+01	1.0E+03	4.0E+01		2.1E+01		1.2E+01
BENZO(a)PYRENE	2.1E+00	1.0E+03	4.0E+01		2.1E+00		1.3E+02
BENZO(b)FLUORANTHENE	2.1E+01	1.0E+03	-		2.1E+01		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	1.0E+03	4.0E+01		4.4E+03		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	1.0E+03	4.0E+01		2.1E+02		3.7E+01
BERYLLIUM	8.0E+00	2.5E+03	8.0E+00		9.8E+01		
BIPHENYL, 1,1-	6.5E-01	1.0E+03	-		4.6E+03	(Use soil gas)	6.5E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-04	1.0E+03	-		5.3E-01	2.8E-02	1.2E-04
BIS(2-CHLOROISOPROPYL)ETHER	3.0E-03	7.9E+02	-		7.3E+00	(Use soil gas)	3.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	1.0E+02	1.0E+03	-		1.2E+02		1.0E+02
BORON	2.0E+00	no critiera	2.0E+00		2.5E+04		
BROMODICHLOROMETHANE	3.4E-03	2.5E+03	-		1.8E+00	8.2E-02	3.4E-03
BROMOFORM	2.2E+00	1.0E+03	-		2.2E+02		2.2E+00
BROMOMETHANE	3.4E-01	1.0E+03	-		2.5E+00	5.1E-01	3.4E-01
CADMIUM	1.2E+01	2.5E+03	1.2E+01		1.0E+02		
CARBON TETRACHLORIDE	9.6E-02	1.0E+03	-		5.4E-01	9.6E-02	1.1E+00
CHLORDANE	6.5E+00	2.5E+03	-		6.5E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	2.5E+03	-		4.9E+02		5.3E-02
CHLOROBENZENE	1.5E+00	6.8E+02	3.0E+01		1.0E+02	6.2E+00	1.5E+00
CHLOROETHANE	2.7E-01	1.0E+03	-		6.4E+00	1.8E+00	2.7E-01
CHLOROFORM	6.3E-02	1.0E+03	-		4.6E-01	6.3E-02	1.8E+00
CHLOROMETHANE	9.5E+00	5.0E+02	-		3.1E+01	9.5E+00	2.4E+01
CHLOROPHENOL, 2-	1.2E-02	5.0E+02	1.0E+01		4.7E+01	2.3E+00	1.2E-02
CHROMIUM (Total)	2.2E+02	2.5E+03			2.2E+02		
CHROMIUM III	7.5E+02	2.5E+03	7.5E+02		3.1E+05		
CHROMIUM VI	8.0E+00	2.5E+03	8.0E+00		3.1E+01		
CHRYSENE	2.3E+01	2.5E+03	4.0E+01		2.1E+03	(Use soil gas)	2.3E+01
COBALT	8.0E+01	2.5E+03	8.0E+01		1.0E+02		
COPPER	2.3E+02	2.5E+03	2.3E+02		8.2E+03		

TABLE A-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
		Gross Contamination Ceiling Value (Odors, etc.)			Human Health		Groundwater Protection (Soil Leaching)
					Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Urban Area Ecotoxicity Criteria	Background	Table K-2	Table E-1b	Table G
CYANIDE (Free)	5.0E+02	5.0E+02	-		2.5E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	2.1E+00	1.0E+03	-		2.1E+00		9.9E+00
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	1.0E+03	-		2.0E+00	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	1.1E-02	5.0E+02	-		2.5E+00	2.2E-02	1.1E-02
DIBROMOETHANE, 1,2-	4.6E-04	1.0E+03	-		7.2E-02	2.5E-03	4.6E-04
DICHLOROBENZENE, 1,2-	1.1E+00	6.0E+02	3.0E+01		6.0E+02	2.1E+01	1.1E+00
DICHLOROBENZENE, 1,3-	7.4E+00	6.0E+02	3.0E+01		4.1E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	2.3E-01	1.0E+03	3.0E+01		7.8E+00	2.3E-01	5.9E-01
DICHLOROBENZIDINE, 3,3-	4.0E-02	1.0E+03	-		3.8E+00		4.0E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E+01	1.0E+03	-		1.0E+01		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.0E+00	1.0E+03	4.0E+00		1.0E+01		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	4.0E+00	2.5E+03	4.0E+00		7.0E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	1.0E+03	-		3.4E+02	5.1E+01	1.9E+00
DICHLOROETHANE, 1,2-	4.5E-02	1.0E+03	6.0E+01		6.0E-01	5.6E-02	4.5E-02
DICHLOROETHYLENE, 1,1-	1.2E+00	1.0E+03	-		8.2E+01	2.1E+01	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	2.2E+00	5.0E+02	-		2.9E+01	3.6E+00	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	6.7E+00	1.0E+03	-		4.6E+01	7.3E+00	6.7E+00
DICHLOROPHENOL, 2,4-	3.0E-01	1.0E+03	1.0E+01		3.7E+02		3.0E-01
DICHLOROPROPANE, 1,2-	7.5E-02	5.0E+02	-		7.3E-01	7.5E-02	1.2E-01
DICHLOROPROPENE, 1,3-	4.6E-02	1.0E+03	-		1.7E+00	3.6E-01	4.6E-02
DIELDRIN	2.3E-03	2.5E+03	4.0E+00		1.1E-01		2.3E-03
DIETHYLPHTHALATE	3.5E-02	1.0E+03	-		9.8E+04		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	5.0E+02	-		2.5E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	1.0E+03	-		1.0E+06		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	1.0E+03	-		2.5E+02		2.1E-01
DINITROTOLUENE, 2,4-	2.5E-01	1.0E+03	-		2.5E+02		2.5E-01
DIOXANE, 1,4-	3.7E-03	1.0E+03	-		1.6E+02		3.7E-03
DIOXIN (2,3,7,8-TCDD)	1.6E-05	no criteria	-		1.6E-05		1.1E+06
ENDOSULFAN	4.6E-03	1.0E+03	-		7.4E+02		4.6E-03
ENDRIN	6.5E-04	1.0E+03	6.0E-02		3.7E+01		6.5E-04
ETHANOL	4.5E+00	1.0E+03					4.5E+00
ETHYLBENZENE	3.3E+00	4.0E+02	-		4.0E+02	3.9E+02	3.3E+00
FLUORANTHENE	4.0E+01	1.0E+03	4.0E+01		4.4E+03		6.0E+01
FLUORENE	8.9E+00	1.0E+03	-		5.2E+03	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	2.5E+03	-		3.8E-01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	2.5E+03	-		1.9E-01		1.4E-02
HEXACHLOROBENZENE	1.1E+00	1.0E+03	3.0E+01		1.1E+00		7.9E+02
HEXACHLOROBUTADIENE	4.3E+00	1.0E+03	-		2.2E+01		4.3E+00

TABLE A-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
		Gross Contamination Ceiling Value (Odors, etc.)			Human Health		Groundwater Protection (Soil Leaching)
					Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Urban Area Ecotoxicity Criteria	Background	Table K-2	Table E-1b	Table G
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	1.0E+03	2.0E+00		1.7E+00		4.9E-02
HEXACHLOROETHANE	1.6E+01	1.0E+03	-		1.2E+02		1.6E+01
INDENO(1,2,3-cd)PYRENE	2.1E+01	1.0E+03	4.0E+01		2.1E+01		2.4E+01
LEAD	7.5E+02	2.5E+03	-		7.5E+02		
MERCURY	1.0E+01	1.0E+03	1.0E+01		6.1E+01		
METHOXYCHLOR	1.9E+01	1.0E+03	-		6.2E+02		1.9E+01
METHYL ETHYL KETONE	6.4E+00	1.0E+03	-		2.2E+04	1.3E+04	6.4E+00
METHYL ISOBUTYL KETONE	3.9E+00	5.0E+02	-		9.4E+03	1.3E+04	3.9E+00
METHYL MERCURY	1.0E+01	5.0E+02	1.0E+01		1.2E+01		
METHYL TERT BUTYL ETHER	2.3E-02	5.0E+02	-		7.0E+01	5.6E+00	2.3E-02
METHYLENE CHLORIDE	6.7E-02	1.0E+03	-		2.1E+01	3.2E+00	6.7E-02
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	1.0E+03	-		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	4.0E+01	2.5E+03	4.0E+01		1.0E+03		
NAPHTHALENE	1.2E+00	1.0E+03	4.0E+01		3.7E+01	1.2E+01	1.2E+00
NICKEL	1.5E+02	2.5E+03	1.5E+02		4.1E+03		
PENTACHLOROPHENOL	5.0E+00	1.0E+03	5.0E+00		9.0E+00		5.3E+00
PERCHLORATE	7.0E-03	2.5E+03	-		2.0E+01		7.0E-03
PHENANTHRENE	1.1E+01	1.0E+03	4.0E+01		5.8E+03	(Use soil gas)	1.1E+01
PHENOL	7.6E-02	1.0E+03	4.0E+01		3.7E+04		7.6E-02
POLYCHLORINATED BIPHENYLS (PCBs)	7.4E-01	1.0E+03	-		7.4E-01		6.3E+00
PYRENE	8.5E+01	1.0E+03	-		5.8E+03	8.5E+01	8.5E+01
SELENIUM	1.0E+01	2.5E+03	1.0E+01		1.0E+03		
SILVER	4.0E+01	2.5E+03	4.0E+01		1.0E+03		
STYRENE	1.5E+00	1.0E+03	-		1.5E+03	1.1E+03	1.5E+00
tert-BUTYL ALCOHOL	2.3E-02	5.0E+02	-		1.8E+02	(Use soil gas)	2.3E-02
TETRACHLOROETHANE, 1,1,1,2-	7.6E-03	5.0E+02	-		7.2E+00	(Use soil gas)	7.6E-03
TETRACHLOROETHANE, 1,1,2,2-	9.9E-04	1.0E+03	-		9.3E-01	2.5E-02	9.9E-04
TETRACHLOROETHYLENE	2.4E-01	2.3E+02	-		1.3E+00	2.4E-01	7.0E-01
THALLIUM	1.3E+01	2.5E+03	-		1.3E+01		
TOLUENE	2.9E+00	6.5E+02	-		4.4E+02	4.0E+02	2.9E+00
TOXAPHENE	4.2E-04	1.0E+03	-		1.4E+00		4.2E-04
TPH (gasolines)	1.0E+02	5.0E+02	-		1.9E+03	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	5.0E+02	-		1.9E+03	(Use soil gas)	1.0E+02
TPH (residual fuels)	1.0E+03	2.5E+03	-		1.5E+04		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.1E+00	1.0E+03	3.0E+01		4.3E+01	1.1E+00	7.6E+00
TRICHLOROETHANE, 1,1,1-	7.8E+00	1.0E+03	-		1.2E+03	2.3E+02	7.8E+00
TRICHLOROETHANE, 1,1,2-	7.0E-02	5.0E+02	-		1.6E+00	9.1E-02	7.0E-02
TRICHLOROETHYLENE	1.3E-01	8.2E+02	6.0E+01		1.1E+00	1.3E-01	4.6E-01

TABLE A-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
		Gross Contamination Ceiling Value (Odors, etc.)			Human Health		Groundwater Protection (Soil Leaching)
					Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Urban Area Ecotoxicity Criteria	Background	Table K-2	Table E-1b	Table G
TRICHLOROPHENOL, 2,4,5-	1.8E-01	5.0E+02	1.0E+01		2.2E+03	6.3E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	1.0E+03	1.0E+01		1.2E+01		1.2E+00
VANADIUM	2.0E+02	2.5E+03	2.0E+02		2.0E+02		
VINYL CHLORIDE	1.6E-01	1.0E+03	6.0E+01		3.8E-01	1.6E-01	3.4E-01
XYLENES	2.3E+00	4.2E+02	-		1.8E+02	1.1E+02	2.3E+00
ZINC	6.0E+02	2.5E+03	6.0E+02		6.1E+04		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	4.0	-	-		-	-	-
Sodium Adsorption Ratio	12	-	-		-	-	-

Notes:

1. Shallow soils defined as soils situated <3 meters below ground surface.

Final Environmental Screening Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching screening levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE B-1. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area Ecotoxicity Criteria		Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2		Background	Table K-1	Table E-1b	Table G
ACENAPHTHENE	1.9E+01	1.0E+03	-		7.3E+02	1.3E+02	1.9E+01
ACENAPHTHYLENE	1.3E+01	5.0E+02	-		2.6E+02	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	5.0E+02	-		2.8E+03	1.1E+03	5.0E-01
ALDRIN	2.9E-02	1.0E+03	3.5E-01		2.9E-02		5.0E+00
ANTHRACENE	2.8E+00	5.0E+02	4.0E+01		4.4E+03	6.1E+00	2.8E+00
ANTIMONY	6.3E+00	1.0E+03	2.0E+01		6.3E+00		
ARSENIC	2.0E+01	1.0E+03	2.0E+01	2.0E+01	3.9E-01		
BARIUM	7.5E+02	1.0E+03	7.5E+02		1.1E+03		
BENZENE	5.3E-01	5.0E+02	2.5E+01		6.4E-01	5.3E-01	2.0E+00
BENZO(a)ANTHRACENE	6.2E+00	5.0E+02	4.0E+01		6.2E+00		1.2E+01
BENZO(a)PYRENE	6.2E-01	5.0E+02	4.0E+01		6.2E-01		1.3E+02
BENZO(b)FLUORANTHENE	6.2E+00	5.0E+02	-		6.2E+00		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	5.0E+02	4.0E+01		4.6E+02		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	5.0E+02	4.0E+01		6.2E+01		3.7E+01
BERYLLIUM	4.0E+00	1.0E+03	4.0E+00		3.1E+01		
BIPHENYL, 1,1-	6.5E+00	5.0E+02	-		6.0E+02	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	6.7E-03	5.0E+02	-		2.0E-01	6.7E-03	7.8E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.6E-01	5.0E+02	-		2.9E+00	(Use soil gas)	6.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	5.0E+02	-		3.5E+01		5.3E+02
BORON	1.6E+00	no criteria	1.6E+00		2.4E+03		
BROMODICHLOROMETHANE	2.3E-02	1.0E+03	-		8.2E-01	2.3E-02	5.1E+00
BROMOFORM	6.1E+01	5.0E+02	-		6.1E+01		6.9E+01
BROMOMETHANE	1.7E-01	5.0E+02	-		7.6E-01	1.7E-01	6.4E+00
CADMIUM	7.8E+00	1.0E+03	1.2E+01		7.8E+00		
CARBON TETRACHLORIDE	2.7E-02	5.0E+02	-		2.5E-01	2.7E-02	2.1E+00
CHLORDANE	1.6E+00	1.0E+03	-		1.6E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	1.0E+03	-		4.9E+01		5.3E-02
CHLOROBENZENE	1.5E+00	5.0E+02	3.0E+01		3.0E+01	2.1E+00	1.5E+00
CHLOROETHANE	2.7E-01	5.0E+02	-		3.0E+00	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	5.0E+02	-		2.2E-01	1.8E-02	1.8E+00
CHLOROMETHANE	3.2E+00	1.0E+02	-		9.2E+00	3.2E+00	2.9E+02
CHLOROPHENOL, 2-	1.2E-01	1.0E+02	1.0E+01		1.3E+01	6.7E-01	1.2E-01
CHROMIUM (Total)	2.1E+02	1.0E+03			2.1E+02		
CHROMIUM III	7.5E+02	1.0E+03	7.5E+02		2.3E+04		
CHROMIUM VI	8.0E+00	1.0E+03	8.0E+00		3.0E+01		
CHRYSENE	2.3E+01	1.0E+03	4.0E+01		6.2E+02	(Use soil gas)	2.3E+01
COBALT	4.0E+01	1.0E+03	4.0E+01		1.0E+02		

TABLE B-1. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area Ecotoxicity Criteria		Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2		Background	Table K-1	Table E-1b	Table G
COPPER	2.3E+02	1.0E+03	2.3E+02		6.3E+02		
CYANIDE (Free)	1.0E+02	1.0E+02	-		2.4E+02	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	6.2E-01	5.0E+02	-		6.2E-01		1.4E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	5.0E+02	-		4.2E-01	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	1.7E-02	1.0E+02	-		1.1E+00	1.7E-02	1.3E+01
DIBROMOETHANE, 1,2-	7.2E-04	5.0E+02	-		3.2E-02	7.2E-04	1.5E-01
DICHLOROBENZENE, 1,2-	1.6E+00	6.0E+02	3.0E+01		2.2E+02	7.0E+00	1.6E+00
DICHLOROBENZENE, 1,3-	7.4E+00	1.0E+02	3.0E+01		1.1E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	6.5E-02	5.0E+02	3.0E+01		3.4E+00	6.5E-02	1.8E+00
DICHLOROBENZIDINE, 3,3-	1.1E+00	5.0E+02	-		1.1E+00		6.6E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	5.0E+02	-		2.4E+00		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	5.0E+02	4.0E+00		2.4E+00		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	1.0E+03	4.0E+00		1.7E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	5.0E+02	-		9.8E+01	1.7E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.6E-02	5.0E+02	6.0E+01		2.7E-01	1.6E-02	1.2E+00
DICHLOROETHYLENE, 1,1-	4.3E+00	5.0E+02	-		2.4E+01	7.0E+00	4.3E+00
DICHLOROETHYLENE, Cis 1,2-	1.2E+00	1.0E+02	-		8.5E+00	1.2E+00	1.8E+01
DICHLOROETHYLENE, Trans 1,2-	2.5E+00	5.0E+02	-		1.4E+01	2.5E+00	3.9E+01
DICHLOROPHENOL, 2,4-	3.0E+00	5.0E+02	1.0E+01		3.7E+01		3.0E+00
DICHLOROPROPANE, 1,2-	2.1E-02	1.0E+02	-		3.4E-01	2.1E-02	2.5E+00
DICHLOROPROPENE, 1,3-	1.0E-01	5.0E+02	-		7.7E-01	1.0E-01	1.4E+01
DIELDRIN	2.3E-03	1.0E+03	4.0E+00		3.0E-02		2.3E-03
DIETHYLPHTHALATE	3.5E-02	5.0E+02	-		9.8E+03		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	1.0E+02	-		2.4E+02		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	5.0E+02	-		1.2E+05		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	5.0E+02	-		2.4E+01		2.1E-01
DINITROTOLUENE, 2,4-	8.6E-01	5.0E+02	-		2.4E+01		8.6E-01
DIOXANE, 1,4-	3.0E+01	5.0E+02	-		4.4E+01		3.0E+01
DIOXIN (2,3,7,8-TCDD)	3.9E-06	no criteria	-		3.9E-06		1.1E+06
ENDOSULFAN	4.6E-03	5.0E+02	-		7.3E+01		4.6E-03
ENDRIN	6.5E-04	5.0E+02	6.0E-02		3.7E+00		6.5E-04
ETHANOL	4.5E+00	5.0E+02					4.5E+00
ETHYLBENZENE	3.2E+01	4.0E+02	-		3.7E+02	3.6E+02	3.2E+01
FLUORANTHENE	4.0E+01	5.0E+02	4.0E+01		4.6E+02		6.0E+01
FLUORENE	8.9E+00	5.0E+02	-		5.5E+02	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	1.0E+03	-		1.1E-01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	1.0E+03	-		5.3E-02		1.4E-02

TABLE B-1. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
CHEMICAL PARAMETER	Final ESL	Gross Contamination Ceiling Value (Odors, etc.) Table H-2	Urban Area Ecotoxicity Criteria	Background	Direct Exposure Table K-1	Vapor Intrusion Into Buildings Table E-1b	NON-Drinking Water Resource Table G
HEXACHLOROBENZENE	3.0E-01	5.0E+02	3.0E+01		3.0E-01		7.9E+02
HEXACHLOROBUTADIENE	3.7E+00	5.0E+02	-		3.7E+00		2.3E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	5.0E+02	2.0E+00		4.4E-01		4.9E-02
HEXACHLOROETHANE	1.2E+01	5.0E+02	-		1.2E+01		4.1E+01
INDENO(1,2,3-cd)PYRENE	6.2E+00	5.0E+02	4.0E+01		6.2E+00		2.4E+01
LEAD	2.0E+02	1.0E+03	2.0E+02		4.0E+02		
MERCURY	4.7E+00	5.0E+02	1.0E+01		4.7E+00		
METHOXYCHLOR	1.9E+01	5.0E+02	-		6.1E+01		1.9E+01
METHYL ETHYL KETONE	1.3E+01	5.0E+02	-		4.4E+03	3.8E+03	1.3E+01
METHYL ISOBUTYL KETONE	3.9E+00	1.0E+02	-		1.1E+03	3.8E+03	3.9E+00
METHYL MERCURY	1.2E+00	1.0E+02	1.0E+01		1.2E+00		
METHYL TERT BUTYL ETHER	1.6E+00	1.0E+02	-		3.1E+01	1.6E+00	8.4E+00
METHYLENE CHLORIDE	9.0E-01	5.0E+02	-		9.2E+00	9.0E-01	3.4E+01
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	5.0E+02	-		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	4.0E+01	1.0E+03	4.0E+01		7.8E+01		
NAPHTHALENE	3.6E+00	5.0E+02	4.0E+01		1.1E+01	3.6E+00	4.8E+00
NICKEL	1.5E+02	1.0E+03	1.5E+02		3.1E+02		
PENTACHLOROPHENOL	3.0E+00	5.0E+02	5.0E+00		3.0E+00		4.2E+01
PERCHLORATE	1.2E+00	1.0E+03	-		1.6E+00		1.2E+00
PHENANTHRENE	1.1E+01	5.0E+02	4.0E+01		5.7E+02	(Use soil gas)	1.1E+01
PHENOL	1.9E+01	5.0E+02	4.0E+01		3.7E+03		1.9E+01
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E-01	5.0E+02	-		2.2E-01		6.3E+00
PYRENE	8.5E+01	5.0E+02	-		4.6E+02	8.5E+01	8.5E+01
SELENIUM	1.0E+01	1.0E+03	1.0E+01		7.8E+01		
SILVER	2.0E+01	1.0E+03	2.0E+01		7.8E+01		
STYRENE	1.5E+01	5.0E+02	-		8.7E+02	3.6E+02	1.5E+01
tert-BUTYL ALCOHOL	7.0E+01	1.0E+02	-		7.0E+01	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	3.1E+00	1.0E+02	-		3.1E+00	(Use soil gas)	1.6E+01
TETRACHLOROETHANE, 1,1,2,2-	7.2E-03	5.0E+02	-		4.1E-01	7.2E-03	2.7E+00
TETRACHLOROETHYLENE	6.9E-02	2.3E+02	-		4.8E-01	6.9E-02	1.4E+01
THALLIUM	1.0E+00	1.0E+03	-		1.0E+00		
TOLUENE	9.3E+00	5.0E+02	-		1.3E+02	1.4E+02	9.3E+00
TOXAPHENE	4.2E-04	5.0E+02	-		4.0E-01		4.2E-04
TPH (gasolines)	1.0E+02	1.0E+02	-		4.0E+02	(Use soil gas)	4.0E+02
TPH (middle distillates)	1.0E+02	1.0E+02	-		4.0E+02	(Use soil gas)	5.0E+02
TPH (residual fuels)	5.0E+02	5.0E+02	-		1.2E+03		1.0E+03
TRICHLOROBENZENE, 1,2,4-	3.2E-01	5.0E+02	3.0E+01		1.2E+01	3.2E-01	7.6E+00

TABLE B-1. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area Ecotoxicity Criteria		Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2		Background	Table K-1	Table E-1b	Table G
TRICHLOROETHANE, 1,1,1-	7.8E+00	5.0E+02	-		3.9E+02	7.8E+01	7.8E+00
TRICHLOROETHANE, 1,1,2-	2.6E-02	1.0E+02	-		7.2E-01	2.6E-02	3.9E+00
TRICHLOROETHYLENE	3.6E-02	5.0E+02	6.0E+01		5.2E-01	3.6E-02	6.8E+00
TRICHLOROPHENOL, 2,4,5-	1.8E-01	1.0E+02	1.0E+01		5.0E+02	1.9E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	5.0E+02	1.0E+01		1.2E+00		1.6E+02
VANADIUM	1.6E+01	1.0E+03	2.0E+02		1.6E+01		
VINYL CHLORIDE	2.0E-02	5.0E+02	6.0E+01		1.5E-01	2.0E-02	1.9E+00
XYLENES	1.1E+01	4.2E+02	-		5.4E+01	3.6E+01	1.1E+01
ZINC	6.0E+02	1.0E+03	6.0E+02		4.7E+03		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	2.0	-	-		-	-	-
Sodium Adsorption Ratio	5.0	-	-		-	-	-

Notes:

1. Shallow soils defined as soils situated <3 meters below ground surface.

2. Sensitive land use based on residential land-use and exposure scenarios (see Chapter 1).

Final Environmental Screening Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching screening levels.

Assumes soil pH 5.0 to 9.0.

Soil data should be reported on dry-weight basis (see Section 6.2).

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE B-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)	Urban Area		Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-2	Ecotoxicity Criteria	Background	Table K-2	Table E-1b	Table G
ACENAPHTHENE	1.9E+01	2.5E+03	-		5.8E+03	1.3E+02	1.9E+01
ACENAPHTHYLENE	1.3E+01	1.0E+03	-		1.2E+03	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	1.0E+03	-		1.1E+04	3.3E+03	5.0E-01
ALDRIN	1.0E-01	2.5E+03	3.5E-01		1.0E-01		5.0E+00
ANTHRACENE	2.8E+00	1.0E+03	4.0E+01		4.8E+04	6.1E+00	2.8E+00
ANTIMONY	4.0E+01	2.5E+03	4.0E+01		8.2E+01		
ARSENIC	2.0E+01	2.5E+03	4.0E+01	2.0E+01	1.6E+00		
BARIUM	1.5E+03	2.5E+03	1.5E+03		2.5E+03		
BENZENE	1.4E+00	8.7E+02	2.5E+01		1.4E+00	1.9E+00	2.0E+00
BENZO(a)ANTHRACENE	1.2E+01	1.0E+03	4.0E+01		2.1E+01		1.2E+01
BENZO(a)PYRENE	2.1E+00	1.0E+03	4.0E+01		2.1E+00		1.3E+02
BENZO(b)FLUORANTHENE	2.1E+01	1.0E+03	-		2.1E+01		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	1.0E+03	4.0E+01		4.4E+03		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	1.0E+03	4.0E+01		2.1E+02		3.7E+01
BERYLLIUM	8.0E+00	2.5E+03	8.0E+00		9.8E+01		
BIPHENYL, 1,1-	6.5E+00	1.0E+03	-		4.6E+03	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	2.8E-02	1.0E+03	-		5.3E-01	2.8E-02	7.8E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.6E-01	7.9E+02	-		7.3E+00	(Use soil gas)	6.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	1.2E+02	1.0E+03	-		1.2E+02		5.3E+02
BORON	2.0E+00	no critiera	2.0E+00		2.5E+04		
BROMODICHLOROMETHANE	8.2E-02	2.5E+03	-		1.8E+00	8.2E-02	5.1E+00
BROMOFORM	6.9E+01	1.0E+03	-		2.2E+02		6.9E+01
BROMOMETHANE	5.1E-01	1.0E+03	-		2.5E+00	5.1E-01	6.4E+00
CADMIUM	1.2E+01	2.5E+03	1.2E+01		1.0E+02		
CARBON TETRACHLORIDE	9.6E-02	1.0E+03	-		5.4E-01	9.6E-02	2.1E+00
CHLORDANE	6.5E+00	2.5E+03	-		6.5E+00		1.5E+01
CHLOROANILINE, p-	5.3E-02	2.5E+03	-		4.9E+02		5.3E-02
CHLOROBENZENE	1.5E+00	6.8E+02	3.0E+01		1.0E+02	6.2E+00	1.5E+00
CHLOROETHANE	2.7E-01	1.0E+03	-		6.4E+00	1.8E+00	2.7E-01
CHLOROFORM	6.3E-02	1.0E+03	-		4.6E-01	6.3E-02	1.8E+00
CHLOROMETHANE	9.5E+00	5.0E+02	-		3.1E+01	9.5E+00	2.9E+02
CHLOROPHENOL, 2-	1.2E-01	5.0E+02	1.0E+01		4.7E+01	2.3E+00	1.2E-01
CHROMIUM (Total)	2.2E+02	2.5E+03			2.2E+02		
CHROMIUM III	7.5E+02	2.5E+03	7.5E+02		3.1E+05		
CHROMIUM VI	8.0E+00	2.5E+03	8.0E+00		3.1E+01		
CHRYSENE	2.3E+01	2.5E+03	4.0E+01		2.1E+03	(Use soil gas)	2.3E+01
COBALT	8.0E+01	2.5E+03	8.0E+01		1.0E+02		

TABLE B-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
CHEMICAL PARAMETER	Final ESL	Gross Contamination Ceiling Value (Odors, etc.) Table H-2	Urban Area Ecotoxicity Criteria	Background	Direct Exposure Table K-2	Vapor Intrusion Into Buildings Table E-1b	NON-Drinking Water Resource Table G
COPPER	2.3E+02	2.5E+03	2.3E+02		8.2E+03		
CYANIDE (Free)	5.0E+02	5.0E+02	-		2.5E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	2.1E+00	1.0E+03	-		2.1E+00		1.4E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	1.0E+03	-		2.0E+00	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	2.2E-02	5.0E+02	-		2.5E+00	2.2E-02	1.3E+01
DIBROMOETHANE, 1,2-	2.5E-03	1.0E+03	-		7.2E-02	2.5E-03	1.5E-01
DICHLOROBENZENE, 1,2-	1.6E+00	6.0E+02	3.0E+01		6.0E+02	2.1E+01	1.6E+00
DICHLOROBENZENE, 1,3-	7.4E+00	6.0E+02	3.0E+01		4.1E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	2.3E-01	1.0E+03	3.0E+01		7.8E+00	2.3E-01	1.8E+00
DICHLOROBENZIDINE, 3,3-	3.8E+00	1.0E+03	-		3.8E+00		6.6E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E+01	1.0E+03	-		1.0E+01		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.0E+00	1.0E+03	4.0E+00		1.0E+01		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	4.0E+00	2.5E+03	4.0E+00		7.0E+00		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	1.0E+03	-		3.4E+02	5.1E+01	1.9E+00
DICHLOROETHANE, 1,2-	5.6E-02	1.0E+03	6.0E+01		6.0E-01	5.6E-02	1.2E+00
DICHLOROETHYLENE, 1,1-	4.3E+00	1.0E+03	-		8.2E+01	2.1E+01	4.3E+00
DICHLOROETHYLENE, Cis 1,2-	3.6E+00	5.0E+02	-		2.9E+01	3.6E+00	1.8E+01
DICHLOROETHYLENE, Trans 1,2-	7.3E+00	1.0E+03	-		4.6E+01	7.3E+00	3.9E+01
DICHLOROPHENOL, 2,4-	3.0E+00	1.0E+03	1.0E+01		3.7E+02		3.0E+00
DICHLOROPROPANE, 1,2-	7.5E-02	5.0E+02	-		7.3E-01	7.5E-02	2.5E+00
DICHLOROPROPENE, 1,3-	3.6E-01	1.0E+03	-		1.7E+00	3.6E-01	1.4E+01
DIELDRIN	2.3E-03	2.5E+03	4.0E+00		1.1E-01		2.3E-03
DIETHYLPHTHALATE	3.5E-02	1.0E+03	-		9.8E+04		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	5.0E+02	-		2.5E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	1.0E+03	-		1.0E+06		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	1.0E+03	-		2.5E+02		2.1E-01
DINITROTOLUENE, 2,4-	8.6E-01	1.0E+03	-		2.5E+02		8.6E-01
DIOXANE, 1,4-	3.0E+01	1.0E+03	-		1.6E+02		3.0E+01
DIOXIN (2,3,7,8-TCDD)	1.6E-05	no criteria	-		1.6E-05		1.1E+06
ENDOSULFAN	4.6E-03	1.0E+03	-		7.4E+02		4.6E-03
ENDRIN	6.5E-04	1.0E+03	6.0E-02		3.7E+01		6.5E-04
ETHANOL	4.5E+00	1.0E+03					4.5E+00
ETHYLBENZENE	3.2E+01	4.0E+02	-		4.0E+02	3.9E+02	3.2E+01
FLUORANTHENE	4.0E+01	1.0E+03	4.0E+01		4.4E+03		6.0E+01
FLUORENE	8.9E+00	1.0E+03	-		5.2E+03	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	2.5E+03	-		3.8E-01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	2.5E+03	-		1.9E-01		1.4E-02

TABLE B-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
CHEMICAL PARAMETER	Final ESL	Gross Contamination Ceiling Value (Odors, etc.) Table H-2	Urban Area Ecotoxicity Criteria	Background	Direct Exposure Table K-2	Vapor Intrusion Into Buildings Table E-1b	NON-Drinking Water Resource Table G
HEXACHLOROBENZENE	1.1E+00	1.0E+03	3.0E+01		1.1E+00		7.9E+02
HEXACHLOROBUTADIENE	2.2E+01	1.0E+03	-		2.2E+01		2.3E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	1.0E+03	2.0E+00		1.7E+00		4.9E-02
HEXACHLOROETHANE	4.1E+01	1.0E+03	-		1.2E+02		4.1E+01
INDENO(1,2,3-cd)PYRENE	2.1E+01	1.0E+03	4.0E+01		2.1E+01		2.4E+01
LEAD	7.5E+02	2.5E+03	-		7.5E+02		
MERCURY	1.0E+01	1.0E+03	1.0E+01		6.1E+01		
METHOXYCHLOR	1.9E+01	1.0E+03	-		6.2E+02		1.9E+01
METHYL ETHYL KETONE	1.3E+01	1.0E+03	-		2.2E+04	1.3E+04	1.3E+01
METHYL ISOBUTYL KETONE	3.9E+00	5.0E+02	-		9.4E+03	1.3E+04	3.9E+00
METHYL MERCURY	1.0E+01	5.0E+02	1.0E+01		1.2E+01		
METHYL TERT BUTYL ETHER	5.6E+00	5.0E+02	-		7.0E+01	5.6E+00	8.4E+00
METHYLENE CHLORIDE	3.2E+00	1.0E+03	-		2.1E+01	3.2E+00	3.4E+01
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	1.0E+03	-		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	4.0E+01	2.5E+03	4.0E+01		1.0E+03		
NAPHTHALENE	4.8E+00	1.0E+03	4.0E+01		3.7E+01	1.2E+01	4.8E+00
NICKEL	1.5E+02	2.5E+03	1.5E+02		4.1E+03		
PENTACHLOROPHENOL	5.0E+00	1.0E+03	5.0E+00		9.0E+00		4.2E+01
PERCHLORATE	1.2E+00	2.5E+03	-		2.0E+01		1.2E+00
PHENANTHRENE	1.1E+01	1.0E+03	4.0E+01		5.8E+03	(Use soil gas)	1.1E+01
PHENOL	1.9E+01	1.0E+03	4.0E+01		3.7E+04		1.9E+01
POLYCHLORINATED BIPHENYLS (PCBs)	7.4E-01	1.0E+03	-		7.4E-01		6.3E+00
PYRENE	8.5E+01	1.0E+03	-		5.8E+03	8.5E+01	8.5E+01
SELENIUM	1.0E+01	2.5E+03	1.0E+01		1.0E+03		
SILVER	4.0E+01	2.5E+03	4.0E+01		1.0E+03		
STYRENE	1.5E+01	1.0E+03	-		1.5E+03	1.1E+03	1.5E+01
tert-BUTYL ALCOHOL	1.1E+02	5.0E+02	-		1.8E+02	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	7.2E+00	5.0E+02	-		7.2E+00	(Use soil gas)	1.6E+01
TETRACHLOROETHANE, 1,1,2,2-	2.5E-02	1.0E+03	-		9.3E-01	2.5E-02	2.7E+00
TETRACHLOROETHYLENE	2.4E-01	2.3E+02	-		1.3E+00	2.4E-01	1.4E+01
THALLIUM	1.3E+01	2.5E+03	-		1.3E+01		
TOLUENE	9.3E+00	6.5E+02	-		4.4E+02	4.0E+02	9.3E+00
TOXAPHENE	4.2E-04	1.0E+03	-		1.4E+00		4.2E-04
TPH (gasolines)	4.0E+02	5.0E+02	-		1.9E+03	(Use soil gas)	4.0E+02
TPH (middle distillates)	5.0E+02	5.0E+02	-		1.9E+03	(Use soil gas)	5.0E+02
TPH (residual fuels)	1.0E+03	2.5E+03	-		1.5E+04		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.1E+00	1.0E+03	3.0E+01		4.3E+01	1.1E+00	7.6E+00

TABLE B-2. [1]SHALLOW SOIL SCREENING LEVELS (<3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)						
					Human Health		Groundwater Protection (Soil Leaching)
CHEMICAL PARAMETER	Final ESL	Gross Contamination Ceiling Value (Odors, etc.) Table H-2	Urban Area Ecotoxicity Criteria	Background	Direct Exposure Table K-2	Vapor Intrusion Into Buildings Table E-1b	NON-Drinking Water Resource Table G
TRICHLOROETHANE, 1,1,1-	7.8E+00	1.0E+03	-		1.2E+03	2.3E+02	7.8E+00
TRICHLOROETHANE, 1,1,2-	9.1E-02	5.0E+02	-		1.6E+00	9.1E-02	3.9E+00
TRICHLOROETHYLENE	1.3E-01	8.2E+02	6.0E+01		1.1E+00	1.3E-01	6.8E+00
TRICHLOROPHENOL, 2,4,5-	1.8E-01	5.0E+02	1.0E+01		2.2E+03	6.3E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	1.0E+01	1.0E+03	1.0E+01		1.2E+01		1.6E+02
VANADIUM	2.0E+02	2.5E+03	2.0E+02		2.0E+02		
VINYL CHLORIDE	1.6E-01	1.0E+03	6.0E+01		3.8E-01	1.6E-01	1.9E+00
XYLENES	1.1E+01	4.2E+02	-		1.8E+02	1.1E+02	1.1E+01
ZINC	6.0E+02	2.5E+03	6.0E+02		6.1E+04		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	4.0	-	-	-	-	-	-
Sodium Adsorption Ratio	12	-	-	-	-	-	-

Notes:

1. Shallow soils defined as soils situated <3 meters below ground surface.

Final Environmental Screening Level is lowest of ceiling value (nuisance concerns etc.), ecotoxicity, direct-exposure, indoor-air impact, and leaching screening levels.
Assumes soil pH 5.0 to 9.0.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE C-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
ACENAPHTHENE	1.6E+01	2.5E+03		3.5E+04	1.3E+02	1.6E+01
ACENAPHTHYLENE	1.3E+01	1.0E+03		1.1E+04	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	1.0E+03		1.0E+05	1.1E+03	5.0E-01
ALDRIN	5.0E+00	2.5E+03		1.2E+01		5.0E+00
ANTHRACENE	2.8E+00	1.0E+03		2.1E+05	6.1E+00	2.8E+00
ANTIMONY	3.1E+02	2.5E+03		3.1E+02		
ARSENIC	1.5E+02	2.5E+03	2.0E+01	1.5E+02		
BARIUM	2.5E+03	2.5E+03		2.5E+03		
BENZENE	2.2E-01	8.7E+02		2.7E+02	5.3E-01	2.2E-01
BENZO(a)ANTHRACENE	1.2E+01	1.0E+03		2.4E+02		1.2E+01
BENZO(a)PYRENE	2.4E+01	1.0E+03		2.4E+01		1.3E+02
BENZO(b)FLUORANTHENE	4.6E+01	1.0E+03		2.4E+02		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	1.0E+03		1.4E+04		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	1.0E+03		2.4E+03		3.7E+01
BERYLLIUM	9.8E+01	2.5E+03		9.8E+01		
BIPHENYL, 1,1-	6.5E-01	1.0E+03		2.8E+04	(Use soil gas)	6.5E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-04	1.0E+03		1.6E+02	6.7E-03	1.2E-04
BIS(2-CHLOROISOPROPYL)ETHER	3.0E-03	7.9E+02		7.9E+02	(Use soil gas)	3.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	1.0E+02	1.0E+03		8.0E+03		1.0E+02
BORON	4.6E+04	no criteria		4.6E+04		
BROMODICHLOROMETHANE	3.4E-03	2.5E+03		7.4E+02	2.3E-02	3.4E-03
BROMOFORM	2.2E+00	1.0E+03		8.0E+03		2.2E+00
BROMOMETHANE	1.7E-01	1.0E+03		3.1E+01	1.7E-01	3.4E-01
CADMIUM	3.8E+02	2.5E+03		3.8E+02		
CARBON TETRACHLORIDE	2.7E-02	1.0E+03		1.8E+01	2.7E-02	1.1E+00
CHLORDANE	1.5E+01	2.5E+03		2.6E+02		1.5E+01
CHLOROANILINE, p-	5.3E-02	2.5E+03		1.6E+03		5.3E-02
CHLOROBENZENE	1.5E+00	6.8E+02		6.8E+02	2.1E+00	1.5E+00
CHLOROETHANE	2.7E-01	1.0E+03		1.6E+03	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	1.0E+03		2.1E+02	1.8E-02	1.8E+00
CHLOROMETHANE	3.2E+00	5.0E+02		3.8E+02	3.2E+00	2.4E+01
CHLOROPHENOL, 2-	1.2E-02	5.0E+02		5.3E+02	6.7E-01	1.2E-02
CHROMIUM (Total)	2.2E+02	2.5E+03		2.2E+02		
CHROMIUM III	2.5E+03	2.5E+03		1.0E+06		
CHROMIUM VI	3.1E+01	2.5E+03		3.1E+01		
CHRYSENE	2.3E+01	2.5E+03		2.4E+04	(Use soil gas)	2.3E+01
COBALT	1.0E+02	2.5E+03		1.0E+02		

TABLE C-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
				Human Health		Groundwater Protection (Soil Leaching)
		Gross Contamination Ceiling Value (Odors, etc.)		Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
COPPER	2.5E+03	2.5E+03		3.1E+04		
CYANIDE (Free)	5.0E+02	5.0E+02		8.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	9.9E+00	1.0E+03		2.4E+01		9.9E+00
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	1.0E+03		1.9E+01	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	1.1E-02	5.0E+02		9.6E+02	1.7E-02	1.1E-02
DIBROMOETHANE, 1,2-	4.6E-04	1.0E+03		2.9E+01	7.2E-04	4.6E-04
DICHLOROBENZENE, 1,2-	1.1E+00	6.0E+02		6.0E+02	7.0E+00	1.1E+00
DICHLOROBENZENE, 1,3-	7.4E+00	6.0E+02		6.0E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	6.5E-02	1.0E+03		3.0E+03	6.5E-02	5.9E-01
DICHLOROBENZIDINE, 3,3-	4.0E-02	1.0E+03		4.4E+02		4.0E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.5E+02	1.0E+03		1.2E+03		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E+03	1.0E+03		1.2E+03		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	4.3E+00	2.5E+03		3.0E+02		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	1.0E+03		1.7E+03	1.7E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.6E-02	1.0E+03		6.9E+01	1.6E-02	4.5E-02
DICHLOROETHYLENE, 1,1-	1.2E+00	1.0E+03		1.0E+03	7.0E+00	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	1.2E+00	5.0E+02		3.5E+02	1.2E+00	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	2.5E+00	1.0E+03		5.7E+02	2.5E+00	6.7E+00
DICHLOROPHENOL, 2,4-	3.0E-01	1.0E+03		1.2E+03		3.0E-01
DICHLOROPROPANE, 1,2-	2.1E-02	5.0E+02		4.7E+01	2.1E-02	1.2E-01
DICHLOROPROPENE, 1,3-	4.6E-02	1.0E+03		1.3E+02	1.0E-01	4.6E-02
DIELDRIN	2.3E-03	2.5E+03		1.2E+01		2.3E-03
DIETHYLPHTHALATE	3.5E-02	1.0E+03		3.2E+05		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	5.0E+02		8.0E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	1.0E+03		1.0E+06		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	1.0E+03		8.0E+02		2.1E-01
DINITROTOLUENE, 2,4-	2.5E-01	1.0E+03		8.0E+02		2.5E-01
DIOXANE, 1,4-	3.7E-03	1.0E+03		1.8E+04		3.7E-03
DIOXIN (2,3,7,8-TCDD)	2.0E-03	no criteria		2.0E-03		1.1E+06
ENDOSULFAN	4.6E-03	1.0E+03		2.4E+03		4.6E-03
ENDRIN	6.5E-04	1.0E+03		1.2E+02		6.5E-04
ETHANOL	4.5E+00	1.0E+03				4.5E+00
ETHYLBENZENE	3.3E+00	4.0E+02		4.0E+02	3.6E+02	3.3E+00
FLUORANTHENE	6.0E+01	1.0E+03		1.4E+04		6.0E+01
FLUORENE	8.9E+00	1.0E+03		2.6E+04	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	2.5E+03		4.4E+01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	2.5E+03		5.2E+00		1.4E-02

TABLE C-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
HEXACHLOROBENZENE	1.2E+02	1.0E+03		1.2E+02		7.9E+02
HEXACHLOROBUTADIENE	4.3E+00	1.0E+03		1.2E+02		4.3E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	1.0E+03		1.7E+02		4.9E-02
HEXACHLOROETHANE	1.6E+01	1.0E+03		4.0E+02		1.6E+01
INDENO(1,2,3-cd)PYRENE	2.4E+01	1.0E+03		2.4E+02		2.4E+01
LEAD	7.5E+02	2.5E+03		7.5E+02		
MERCURY	2.3E+02	1.0E+03		2.3E+02		
METHOXYCHLOR	1.9E+01	1.0E+03		2.0E+03		1.9E+01
METHYL ETHYL KETONE	6.4E+00	1.0E+03		3.4E+04	3.8E+03	6.4E+00
METHYL ISOBUTYL KETONE	3.9E+00	5.0E+02		1.7E+04	3.8E+03	3.9E+00
METHYL MERCURY	4.1E+01	5.0E+02		4.1E+01		
METHYL TERT BUTYL ETHER	2.3E-02	5.0E+02		2.8E+04	1.6E+00	2.3E-02
METHYLENE CHLORIDE	6.7E-02	1.0E+03		8.2E+03	9.0E-01	6.7E-02
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	1.0E+03		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	2.5E+03	2.5E+03		3.9E+03		
NAPHTHALENE	1.2E+00	1.0E+03		4.6E+02	3.6E+00	1.2E+00
NICKEL	2.5E+03	2.5E+03		1.5E+04		
PENTACHLOROPHENOL	5.3E+00	1.0E+03		9.8E+02		5.3E+00
PERCHLORATE	7.0E-03	2.5E+03		7.7E+01		7.0E-03
PHENANTHRENE	1.1E+01	1.0E+03		2.8E+04	(Use soil gas)	1.1E+01
PHENOL	7.6E-02	1.0E+03		1.2E+05		7.6E-02
POLYCHLORINATED BIPHENYLS (PCBs)	6.3E+00	1.0E+03		6.7E+00		6.3E+00
PYRENE	8.5E+01	1.0E+03		2.3E+04	8.5E+01	8.5E+01
SELENIUM	2.5E+03	2.5E+03		3.9E+03		
SILVER	2.5E+03	2.5E+03		3.9E+03		
STYRENE	1.5E+00	1.0E+03		1.5E+03	3.6E+02	1.5E+00
tert-BUTYL ALCOHOL	2.3E-02	5.0E+02		5.6E+04	(Use soil gas)	2.3E-02
TETRACHLOROETHANE, 1,1,1,2-	7.6E-03	5.0E+02		2.0E+03	(Use soil gas)	7.6E-03
TETRACHLOROETHANE, 1,1,2,2-	9.9E-04	1.0E+03		3.6E+02	7.2E-03	9.9E-04
TETRACHLOROETHYLENE	6.9E-02	2.3E+02		2.3E+02	6.9E-02	7.0E-01
THALLIUM	5.1E+01	2.5E+03		5.1E+01		
TOLUENE	2.9E+00	6.5E+02		6.5E+02	1.4E+02	2.9E+00
TOXAPHENE	4.2E-04	1.0E+03		1.7E+02		4.2E-04
TPH (gasolines)	1.0E+02	5.0E+03		1.5E+04	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	5.0E+03		1.5E+04	(Use soil gas)	1.0E+02
TPH (residual fuels)	1.0E+03	5.0E+03		5.3E+04		1.0E+03
TRICHLOROBENZENE, 1,2,4-	3.2E-01	1.0E+03		5.1E+02	3.2E-01	7.6E+00

TABLE C-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
TRICHLOROETHANE, 1,1,1-	7.8E+00	1.0E+03		1.2E+03	7.8E+01	7.8E+00
TRICHLOROETHANE, 1,1,2-	2.6E-02	5.0E+02		3.0E+02	2.6E-02	7.0E-02
TRICHLOROETHYLENE	3.6E-02	1.0E+03		4.9E+01	3.6E-02	4.6E-01
TRICHLOROPHENOL, 2,4,5-	1.8E-01	5.0E+02		1.9E+04	1.9E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	1.0E+03		4.0E+01		1.2E+00
VANADIUM	7.7E+02	2.5E+03		7.7E+02		
VINYL CHLORIDE	2.0E-02	1.0E+03		1.2E+02	2.0E-02	3.4E-01
XYLENES	2.3E+00	4.2E+02		4.2E+02	3.6E+01	2.3E+00
ZINC	2.5E+03	2.5E+03		2.3E+05		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	not applicable	-		-	-	-
Sodium Adsorption Ratio	not applcable	-		-	-	-

Notes:

1. Deep soils defined as soils situated >3 meters below ground surface (or shallower with institutional controls).

2. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Final Environmental Screening Level is lowest of ceiling values (nuisance concerns etc.), direct-exposure, indoor-air impact, and leaching screening levels.
Assumes soil pH 5.0 to 11.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE C-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
ACENAPHTHENE	1.6E+01	5.0E+03		3.5E+04	1.3E+02	1.6E+01
ACENAPHTHYLENE	1.3E+01	2.5E+03		1.1E+04	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	2.5E+03		1.0E+05	3.3E+03	5.0E-01
ALDRIN	5.0E+00	5.0E+03		1.2E+01		5.0E+00
ANTHRACENE	2.8E+00	2.5E+03		2.1E+05	6.1E+00	2.8E+00
ANTIMONY	3.1E+02	5.0E+03		3.1E+02		
ARSENIC	1.5E+02	5.0E+03	2.0E+01	1.5E+02		
BARIUM	2.5E+03	5.0E+03		2.5E+03		
BENZENE	2.2E-01	8.7E+02		2.7E+02	1.9E+00	2.2E-01
BENZO(a)ANTHRACENE	1.2E+01	2.5E+03		2.4E+02		1.2E+01
BENZO(a)PYRENE	2.4E+01	2.5E+03		2.4E+01		1.3E+02
BENZO(b)FLUORANTHENE	4.6E+01	2.5E+03		2.4E+02		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	2.5E+03		1.4E+04		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	2.5E+03		2.4E+03		3.7E+01
BERYLLIUM	9.8E+01	5.0E+03		9.8E+01		
BIPHENYL, 1,1-	6.5E-01	2.5E+03		2.8E+04	(Use soil gas)	6.5E-01
BIS(2-CHLOROETHYL)ETHER	1.2E-04	2.5E+03		1.6E+02	2.8E-02	1.2E-04
BIS(2-CHLOROISOPROPYL)ETHER	3.0E-03	7.9E+02		7.9E+02	(Use soil gas)	3.0E-03
BIS(2-ETHYLHEXYL)PHTHALATE	1.0E+02	2.5E+03		8.0E+03		1.0E+02
BORON	4.6E+04	no critiera		4.6E+04		
BROMODICHLOROMETHANE	3.4E-03	4.8E+03		7.4E+02	8.2E-02	3.4E-03
BROMOFORM	2.2E+00	2.5E+03		8.0E+03		2.2E+00
BROMOMETHANE	3.4E-01	2.5E+03		3.1E+01	5.1E-01	3.4E-01
CADMIUM	3.8E+02	5.0E+03		3.8E+02		
CARBON TETRACHLORIDE	9.6E-02	1.1E+03		1.8E+01	9.6E-02	1.1E+00
CHLORDANE	1.5E+01	5.0E+03		2.6E+02		1.5E+01
CHLOROANILINE, p-	5.3E-02	5.0E+03		1.6E+03		5.3E-02
CHLOROBENZENE	1.5E+00	6.8E+02		6.8E+02	6.2E+00	1.5E+00
CHLOROETHANE	2.7E-01	1.6E+03		1.6E+03	1.8E+00	2.7E-01
CHLOROFORM	6.3E-02	2.5E+03		2.1E+02	6.3E-02	1.8E+00
CHLOROMETHANE	9.5E+00	1.0E+03		3.8E+02	9.5E+00	2.4E+01
CHLOROPHENOL, 2-	1.2E-02	1.0E+03		5.3E+02	2.3E+00	1.2E-02
CHROMIUM (Total)	2.2E+02	5.0E+03		2.2E+02		
CHROMIUM III	5.0E+03	5.0E+03		1.0E+06		
CHROMIUM VI	3.1E+01	5.0E+03		3.1E+01		
CHRYSENE	2.3E+01	5.0E+03		2.4E+04	(Use soil gas)	2.3E+01
COBALT	1.0E+02	5.0E+03		1.0E+02		

TABLE C-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
COPPER	5.0E+03	5.0E+03		3.1E+04		
CYANIDE (Free)	1.0E+03	1.0E+03		8.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	9.9E+00	2.5E+03		2.4E+01		9.9E+00
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	1.1E+03		1.9E+01	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	1.1E-02	1.0E+03		9.6E+02	2.2E-02	1.1E-02
DIBROMOETHANE, 1,2-	4.6E-04	2.5E+03		2.9E+01	2.5E-03	4.6E-04
DICHLOROBENZENE, 1,2-	1.1E+00	6.0E+02		6.0E+02	2.1E+01	1.1E+00
DICHLOROBENZENE, 1,3-	7.4E+00	6.0E+02		6.0E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	2.3E-01	2.5E+03		3.0E+03	2.3E-01	5.9E-01
DICHLOROBENZIDINE, 3,3-	4.0E-02	2.5E+03		4.4E+02		4.0E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.5E+02	2.5E+03		1.2E+03		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.1E+03	2.5E+03		1.2E+03		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	4.3E+00	5.0E+03		3.0E+02		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	1.7E+03		1.7E+03	5.1E+01	1.9E+00
DICHLOROETHANE, 1,2-	4.5E-02	1.8E+03		6.9E+01	5.6E-02	4.5E-02
DICHLOROETHYLENE, 1,1-	1.2E+00	1.5E+03		1.0E+03	2.1E+01	1.2E+00
DICHLOROETHYLENE, Cis 1,2-	2.2E+00	1.0E+03		3.5E+02	3.6E+00	2.2E+00
DICHLOROETHYLENE, Trans 1,2-	6.7E+00	2.5E+03		5.7E+02	7.3E+00	6.7E+00
DICHLOROPHENOL, 2,4-	3.0E-01	2.5E+03		1.2E+03		3.0E-01
DICHLOROPROPANE, 1,2-	7.5E-02	1.0E+03		4.7E+01	7.5E-02	1.2E-01
DICHLOROPROPENE, 1,3-	4.6E-02	1.4E+03		1.3E+02	3.6E-01	4.6E-02
DIELDRIN	2.3E-03	5.0E+03		1.2E+01		2.3E-03
DIETHYLPHTHALATE	3.5E-02	2.5E+03		3.2E+05		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	1.0E+03		8.0E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	2.5E+03		1.0E+06		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	2.5E+03		8.0E+02		2.1E-01
DINITROTOLUENE, 2,4-	2.5E-01	2.5E+03		8.0E+02		2.5E-01
DIOXANE, 1,4-	3.7E-03	2.5E+03		1.8E+04		3.7E-03
DIOXIN (2,3,7,8-TCDD)	2.0E-03	no criteria		2.0E-03		1.1E+06
ENDOSULFAN	4.6E-03	2.5E+03		2.4E+03		4.6E-03
ENDRIN	6.5E-04	2.5E+03		1.2E+02		6.5E-04
ETHANOL	4.5E+00	2.5E+03				4.5E+00
ETHYLBENZENE	3.3E+00	4.0E+02		4.0E+02	3.9E+02	3.3E+00
FLUORANTHENE	6.0E+01	2.5E+03		1.4E+04		6.0E+01
FLUORENE	8.9E+00	2.5E+03		2.6E+04	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	5.0E+03		4.4E+01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	5.0E+03		5.2E+00		1.4E-02

TABLE C-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
HEXACHLOROBENZENE	1.2E+02	2.5E+03		1.2E+02		7.9E+02
HEXACHLOROBUTADIENE	4.3E+00	2.5E+03		1.2E+02		4.3E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	2.5E+03		1.7E+02		4.9E-02
HEXACHLOROETHANE	1.6E+01	2.5E+03		4.0E+02		1.6E+01
INDENO(1,2,3-cd)PYRENE	2.4E+01	2.5E+03		2.4E+02		2.4E+01
LEAD	7.5E+02	5.0E+03		7.5E+02		
MERCURY	2.3E+02	2.5E+03		2.3E+02		
METHOXYCHLOR	1.9E+01	2.5E+03		2.0E+03		1.9E+01
METHYL ETHYL KETONE	6.4E+00	2.5E+03		3.4E+04	1.3E+04	6.4E+00
METHYL ISOBUTYL KETONE	3.9E+00	1.0E+03		1.7E+04	1.3E+04	3.9E+00
METHYL MERCURY	4.1E+01	1.0E+03		4.1E+01		
METHYL TERT BUTYL ETHER	2.3E-02	1.0E+03		2.8E+04	5.6E+00	2.3E-02
METHYLENE CHLORIDE	6.7E-02	2.4E+03		8.2E+03	3.2E+00	6.7E-02
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	2.5E+03		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	3.9E+03	5.0E+03		3.9E+03		
NAPHTHALENE	1.2E+00	2.5E+03		4.6E+02	1.2E+01	1.2E+00
NICKEL	5.0E+03	5.0E+03		1.5E+04		
PENTACHLOROPHENOL	5.3E+00	2.5E+03		9.8E+02		5.3E+00
PERCHLORATE	7.0E-03	5.0E+03		7.7E+01		7.0E-03
PHENANTHRENE	1.1E+01	2.5E+03		2.8E+04	(Use soil gas)	1.1E+01
PHENOL	7.6E-02	2.5E+03		1.2E+05		7.6E-02
POLYCHLORINATED BIPHENYLS (PCBs)	6.3E+00	2.5E+03		6.7E+00		6.3E+00
PYRENE	8.5E+01	2.5E+03		2.3E+04	8.5E+01	8.5E+01
SELENIUM	3.9E+03	5.0E+03		3.9E+03		
SILVER	3.9E+03	5.0E+03		3.9E+03		
STYRENE	1.5E+00	1.5E+03		1.5E+03	1.1E+03	1.5E+00
tert-BUTYL ALCOHOL	2.3E-02	1.0E+03		5.6E+04	(Use soil gas)	2.3E-02
TETRACHLOROETHANE, 1,1,1,2-	7.6E-03	1.0E+03		2.0E+03	(Use soil gas)	7.6E-03
TETRACHLOROETHANE, 1,1,2,2-	9.9E-04	1.7E+03		3.6E+02	2.5E-02	9.9E-04
TETRACHLOROETHYLENE	2.4E-01	2.3E+02		2.3E+02	2.4E-01	7.0E-01
THALLIUM	5.1E+01	5.0E+03		5.1E+01		
TOLUENE	2.9E+00	6.5E+02		6.5E+02	4.0E+02	2.9E+00
TOXAPHENE	4.2E-04	2.5E+03		1.7E+02		4.2E-04
TPH (gasolines)	1.0E+02	5.0E+03		1.5E+04	(Use soil gas)	1.0E+02
TPH (middle distillates)	1.0E+02	5.0E+03		1.5E+04	(Use soil gas)	1.0E+02
TPH (residual fuels)	1.0E+03	5.0E+03		5.3E+04		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.1E+00	2.5E+03		5.1E+02	1.1E+00	7.6E+00

TABLE C-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
TRICHLOROETHANE, 1,1,1-	7.8E+00	1.2E+03		1.2E+03	2.3E+02	7.8E+00
TRICHLOROETHANE, 1,1,2-	7.0E-02	1.0E+03		3.0E+02	9.1E-02	7.0E-02
TRICHLOROETHYLENE	1.3E-01	1.3E+03		4.9E+01	1.3E-01	4.6E-01
TRICHLOROPHENOL, 2,4,5-	1.8E-01	1.0E+03		1.9E+04	6.3E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	1.2E+00	2.5E+03		4.0E+01		1.2E+00
VANADIUM	7.7E+02	5.0E+03		7.7E+02		
VINYL CHLORIDE	1.6E-01	2.5E+03		1.2E+02	1.6E-01	3.4E-01
XYLENES	2.3E+00	4.2E+02		4.2E+02	1.1E+02	2.3E+00
ZINC	5.0E+03	5.0E+03		2.3E+05		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	not applicable	-		-	-	-
Sodium Adsorption Ratio	not applicable	-		-	-	-

Notes:

1. Deep soils defined as soils situated >3 meters below ground surface (or shallower with institutional controls).

Final Environmental Screening Level is lowest of ceiling values (nuisance concerns etc.), direct-exposure, indoor-air impact, and leaching screening levels.
Assumes soil pH 5.0 to 11.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE D-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
ACENAPHTHENE	1.9E+01	2.5E+03		3.5E+04	1.3E+02	1.9E+01
ACENAPHTHYLENE	1.3E+01	1.0E+03		1.1E+04	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	1.0E+03		1.0E+05	1.1E+03	5.0E-01
ALDRIN	5.0E+00	2.5E+03		1.2E+01		5.0E+00
ANTHRACENE	2.8E+00	1.0E+03		2.1E+05	6.1E+00	2.8E+00
ANTIMONY	3.1E+02	2.5E+03		3.1E+02		
ARSENIC	1.5E+02	2.5E+03	2.0E+01	1.5E+02		
BARIUM	2.5E+03	2.5E+03		2.5E+03		
BENZENE	5.3E-01	8.7E+02		2.7E+02	5.3E-01	2.0E+00
BENZO(a)ANTHRACENE	1.2E+01	1.0E+03		2.4E+02		1.2E+01
BENZO(a)PYRENE	2.4E+01	1.0E+03		2.4E+01		1.3E+02
BENZO(b)FLUORANTHENE	4.6E+01	1.0E+03		2.4E+02		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	1.0E+03		1.4E+04		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	1.0E+03		2.4E+03		3.7E+01
BERYLLIUM	9.8E+01	2.5E+03		9.8E+01		
BIPHENYL, 1,1-	6.5E+00	1.0E+03		2.8E+04	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	6.7E-03	1.0E+03		1.6E+02	6.7E-03	7.8E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.6E-01	7.9E+02		7.9E+02	(Use soil gas)	6.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	5.3E+02	1.0E+03		8.0E+03		5.3E+02
BORON	4.6E+04	no criteria		4.6E+04		
BROMODICHLOROMETHANE	2.3E-02	2.5E+03		7.4E+02	2.3E-02	5.1E+00
BROMOFORM	6.9E+01	1.0E+03		8.0E+03		6.9E+01
BROMOMETHANE	1.7E-01	1.0E+03		3.1E+01	1.7E-01	6.4E+00
CADMIUM	3.8E+02	2.5E+03		3.8E+02		
CARBON TETRACHLORIDE	2.7E-02	1.0E+03		1.8E+01	2.7E-02	2.1E+00
CHLORDANE	1.5E+01	2.5E+03		2.6E+02		1.5E+01
CHLOROANILINE, p-	5.3E-02	2.5E+03		1.6E+03		5.3E-02
CHLOROBENZENE	1.5E+00	6.8E+02		6.8E+02	2.1E+00	1.5E+00
CHLOROETHANE	2.7E-01	1.0E+03		1.6E+03	5.0E-01	2.7E-01
CHLOROFORM	1.8E-02	1.0E+03		2.1E+02	1.8E-02	1.8E+00
CHLOROMETHANE	3.2E+00	5.0E+02		3.8E+02	3.2E+00	2.9E+02
CHLOROPHENOL, 2-	1.2E-01	5.0E+02		5.3E+02	6.7E-01	1.2E-01
CHROMIUM (Total)	2.2E+02	2.5E+03		2.2E+02		
CHROMIUM III	2.5E+03	2.5E+03		1.0E+06		
CHROMIUM VI	3.1E+01	2.5E+03		3.1E+01		
CHRYSENE	2.3E+01	2.5E+03		2.4E+04	(Use soil gas)	2.3E+01
COBALT	1.0E+02	2.5E+03		1.0E+02		

TABLE D-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
COPPER	2.5E+03	2.5E+03		3.1E+04		
CYANIDE (Free)	5.0E+02	5.0E+02		8.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	2.4E+01	1.0E+03		2.4E+01		1.4E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	1.0E+03		1.9E+01	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	1.7E-02	5.0E+02		9.6E+02	1.7E-02	1.3E+01
DIBROMOETHANE, 1,2-	7.2E-04	1.0E+03		2.9E+01	7.2E-04	1.5E-01
DICHLOROBENZENE, 1,2-	1.6E+00	6.0E+02		6.0E+02	7.0E+00	1.6E+00
DICHLOROBENZENE, 1,3-	7.4E+00	6.0E+02		6.0E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	6.5E-02	1.0E+03		3.0E+03	6.5E-02	1.8E+00
DICHLOROBENZIDINE, 3,3-	6.6E+01	1.0E+03		4.4E+02		6.6E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.5E+02	1.0E+03		1.2E+03		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E+03	1.0E+03		1.2E+03		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	4.3E+00	2.5E+03		3.0E+02		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	1.0E+03		1.7E+03	1.7E+01	1.9E+00
DICHLOROETHANE, 1,2-	1.6E-02	1.0E+03		6.9E+01	1.6E-02	1.2E+00
DICHLOROETHYLENE, 1,1-	4.3E+00	1.0E+03		1.0E+03	7.0E+00	4.3E+00
DICHLOROETHYLENE, Cis 1,2-	1.2E+00	5.0E+02		3.5E+02	1.2E+00	1.8E+01
DICHLOROETHYLENE, Trans 1,2-	2.5E+00	1.0E+03		5.7E+02	2.5E+00	3.9E+01
DICHLOROPHENOL, 2,4-	3.0E+00	1.0E+03		1.2E+03		3.0E+00
DICHLOROPROPANE, 1,2-	2.1E-02	5.0E+02		4.7E+01	2.1E-02	2.5E+00
DICHLOROPROPENE, 1,3-	1.0E-01	1.0E+03		1.3E+02	1.0E-01	1.4E+01
DIELDRIN	2.3E-03	2.5E+03		1.2E+01		2.3E-03
DIETHYLPHTHALATE	3.5E-02	1.0E+03		3.2E+05		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	5.0E+02		8.0E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	1.0E+03		1.0E+06		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	1.0E+03		8.0E+02		2.1E-01
DINITROTOLUENE, 2,4-	8.6E-01	1.0E+03		8.0E+02		8.6E-01
DIOXANE, 1,4-	3.0E+01	1.0E+03		1.8E+04		3.0E+01
DIOXIN (2,3,7,8-TCDD)	2.0E-03	no criteria		2.0E-03		1.1E+06
ENDOSULFAN	4.6E-03	1.0E+03		2.4E+03		4.6E-03
ENDRIN	6.5E-04	1.0E+03		1.2E+02		6.5E-04
ETHANOL	4.5E+00	1.0E+03				4.5E+00
ETHYLBENZENE	3.2E+01	4.0E+02		4.0E+02	3.6E+02	3.2E+01
FLUORANTHENE	6.0E+01	1.0E+03		1.4E+04		6.0E+01
FLUORENE	8.9E+00	1.0E+03		2.6E+04	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	2.5E+03		4.4E+01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	2.5E+03		5.2E+00		1.4E-02

TABLE D-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
HEXACHLOROBENZENE	1.2E+02	1.0E+03		1.2E+02		7.9E+02
HEXACHLOROBUTADIENE	2.3E+01	1.0E+03		1.2E+02		2.3E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	1.0E+03		1.7E+02		4.9E-02
HEXACHLOROETHANE	4.1E+01	1.0E+03		4.0E+02		4.1E+01
INDENO(1,2,3-cd)PYRENE	2.4E+01	1.0E+03		2.4E+02		2.4E+01
LEAD	7.5E+02	2.5E+03		7.5E+02		
MERCURY	2.3E+02	1.0E+03		2.3E+02		
METHOXYCHLOR	1.9E+01	1.0E+03		2.0E+03		1.9E+01
METHYL ETHYL KETONE	1.3E+01	1.0E+03		3.4E+04	3.8E+03	1.3E+01
METHYL ISOBUTYL KETONE	3.9E+00	5.0E+02		1.7E+04	3.8E+03	3.9E+00
METHYL MERCURY	4.1E+01	5.0E+02		4.1E+01		
METHYL TERT BUTYL ETHER	1.6E+00	5.0E+02		2.8E+04	1.6E+00	8.4E+00
METHYLENE CHLORIDE	9.0E-01	1.0E+03		8.2E+03	9.0E-01	3.4E+01
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	1.0E+03		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	2.5E+03	2.5E+03		3.9E+03		
NAPHTHALENE	3.6E+00	1.0E+03		4.6E+02	3.6E+00	4.8E+00
NICKEL	2.5E+03	2.5E+03		1.5E+04		
PENTACHLOROPHENOL	4.2E+01	1.0E+03		9.8E+02		4.2E+01
PERCHLORATE	1.2E+00	2.5E+03		7.7E+01		1.2E+00
PHENANTHRENE	1.1E+01	1.0E+03		2.8E+04	(Use soil gas)	1.1E+01
PHENOL	1.9E+01	1.0E+03		1.2E+05		1.9E+01
POLYCHLORINATED BIPHENYLS (PCBs)	6.3E+00	1.0E+03		6.7E+00		6.3E+00
PYRENE	8.5E+01	1.0E+03		2.3E+04	8.5E+01	8.5E+01
SELENIUM	2.5E+03	2.5E+03		3.9E+03		
SILVER	2.5E+03	2.5E+03		3.9E+03		
STYRENE	1.5E+01	1.0E+03		1.5E+03	3.6E+02	1.5E+01
tert-BUTYL ALCOHOL	1.1E+02	5.0E+02		5.6E+04	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	1.6E+01	5.0E+02		2.0E+03	(Use soil gas)	1.6E+01
TETRACHLOROETHANE, 1,1,2,2-	7.2E-03	1.0E+03		3.6E+02	7.2E-03	2.7E+00
TETRACHLOROETHYLENE	6.9E-02	2.3E+02		2.3E+02	6.9E-02	1.4E+01
THALLIUM	5.1E+01	2.5E+03		5.1E+01		
TOLUENE	9.3E+00	6.5E+02		6.5E+02	1.4E+02	9.3E+00
TOXAPHENE	4.2E-04	1.0E+03		1.7E+02		4.2E-04
TPH (gasolines)	4.0E+02	5.0E+03		1.5E+04	(Use soil gas)	4.0E+02
TPH (middle distillates)	5.0E+02	5.0E+03		1.5E+04	(Use soil gas)	5.0E+02
TPH (residual fuels)	1.0E+03	5.0E+03		5.3E+04		1.0E+03
TRICHLOROBENZENE, 1,2,4-	3.2E-01	1.0E+03		5.1E+02	3.2E-01	7.6E+00

TABLE D-1. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
[2]RESIDENTIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	[2]RESIDENTIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
TRICHLOROETHANE, 1,1,1-	7.8E+00	1.0E+03		1.2E+03	7.8E+01	7.8E+00
TRICHLOROETHANE, 1,1,2-	2.6E-02	5.0E+02		3.0E+02	2.6E-02	3.9E+00
TRICHLOROETHYLENE	3.6E-02	1.0E+03		4.9E+01	3.6E-02	6.8E+00
TRICHLOROPHENOL, 2,4,5-	1.8E-01	5.0E+02		1.9E+04	1.9E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	4.0E+01	1.0E+03		4.0E+01		1.6E+02
VANADIUM	7.7E+02	2.5E+03		7.7E+02		
VINYL CHLORIDE	2.0E-02	1.0E+03		1.2E+02	2.0E-02	1.9E+00
XYLENES	1.1E+01	4.2E+02		4.2E+02	3.6E+01	1.1E+01
ZINC	2.5E+03	2.5E+03		2.3E+05		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	not applicable	-		-	-	-
Sodium Adsorption Ratio	not applicable	-		-	-	-

Notes:

1. Deep soils defined as soils situated >3 meters below ground surface (or shallower with institutional controls).

2. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Final Environmental Screening Level is lowest of ceiling values (nuisance concerns etc.), direct-exposure, indoor-air impact, and leaching screening levels.
Assumes soil pH 5.0 to 11.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE D-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
ACENAPHTHENE	1.9E+01	5.0E+03		3.5E+04	1.3E+02	1.9E+01
ACENAPHTHYLENE	1.3E+01	2.5E+03		1.1E+04	(Use soil gas)	1.3E+01
ACETONE	5.0E-01	2.5E+03		1.0E+05	3.3E+03	5.0E-01
ALDRIN	5.0E+00	5.0E+03		1.2E+01		5.0E+00
ANTHRACENE	2.8E+00	2.5E+03		2.1E+05	6.1E+00	2.8E+00
ANTIMONY	3.1E+02	5.0E+03		3.1E+02		
ARSENIC	1.5E+02	5.0E+03	2.0E+01	1.5E+02		
BARIUM	2.5E+03	5.0E+03		2.5E+03		
BENZENE	1.9E+00	8.7E+02		2.7E+02	1.9E+00	2.0E+00
BENZO(a)ANTHRACENE	1.2E+01	2.5E+03		2.4E+02		1.2E+01
BENZO(a)PYRENE	2.4E+01	2.5E+03		2.4E+01		1.3E+02
BENZO(b)FLUORANTHENE	4.6E+01	2.5E+03		2.4E+02		4.6E+01
BENZO(g,h,i)PERYLENE	2.7E+01	2.5E+03		1.4E+04		2.7E+01
BENZO(k)FLUORANTHENE	3.7E+01	2.5E+03		2.4E+03		3.7E+01
BERYLLIUM	9.8E+01	5.0E+03		9.8E+01		
BIPHENYL, 1,1-	6.5E+00	2.5E+03		2.8E+04	(Use soil gas)	6.5E+00
BIS(2-CHLOROETHYL)ETHER	2.8E-02	2.5E+03		1.6E+02	2.8E-02	7.8E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.6E-01	7.9E+02		7.9E+02	(Use soil gas)	6.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	5.3E+02	2.5E+03		8.0E+03		5.3E+02
BORON	4.6E+04	no critiera		4.6E+04		
BROMODICHLOROMETHANE	8.2E-02	4.8E+03		7.4E+02	8.2E-02	5.1E+00
BROMOFORM	6.9E+01	2.5E+03		8.0E+03		6.9E+01
BROMOMETHANE	5.1E-01	2.5E+03		3.1E+01	5.1E-01	6.4E+00
CADMIUM	3.8E+02	5.0E+03		3.8E+02		
CARBON TETRACHLORIDE	9.6E-02	1.1E+03		1.8E+01	9.6E-02	2.1E+00
CHLORDANE	1.5E+01	5.0E+03		2.6E+02		1.5E+01
CHLOROANILINE, p-	5.3E-02	5.0E+03		1.6E+03		5.3E-02
CHLOROBENZENE	1.5E+00	6.8E+02		6.8E+02	6.2E+00	1.5E+00
CHLOROETHANE	2.7E-01	1.6E+03		1.6E+03	1.8E+00	2.7E-01
CHLOROFORM	6.3E-02	2.5E+03		2.1E+02	6.3E-02	1.8E+00
CHLOROMETHANE	9.5E+00	1.0E+03		3.8E+02	9.5E+00	2.9E+02
CHLOROPHENOL, 2-	1.2E-01	1.0E+03		5.3E+02	2.3E+00	1.2E-01
CHROMIUM (Total)	2.2E+02	5.0E+03	100	2.2E+02		
CHROMIUM III	5.0E+03	5.0E+03		1.0E+06		
CHROMIUM VI	3.1E+01	5.0E+03		3.1E+01		
CHRYSENE	2.3E+01	5.0E+03		2.4E+04	(Use soil gas)	2.3E+01
COBALT	1.0E+02	5.0E+03		1.0E+02		

TABLE D-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
COPPER	5.0E+03	5.0E+03		3.1E+04		
CYANIDE (Free)	1.0E+03	1.0E+03		8.2E+03	(Use soil gas)	1.2E+04
DIBENZO(a,h)ANTHTRACENE	2.4E+01	2.5E+03		2.4E+01		1.4E+02
DIBROMO,1,2- CHLOROPROPANE,3-	4.5E-03	1.1E+03		1.9E+01	(Use soil gas)	4.5E-03
DIBROMOCHLOROMETHANE	2.2E-02	1.0E+03		9.6E+02	2.2E-02	1.3E+01
DIBROMOETHANE, 1,2-	2.5E-03	2.5E+03		2.9E+01	2.5E-03	1.5E-01
DICHLOROBENZENE, 1,2-	1.6E+00	6.0E+02		6.0E+02	2.1E+01	1.6E+00
DICHLOROBENZENE, 1,3-	7.4E+00	6.0E+02		6.0E+02	(Use soil gas)	7.4E+00
DICHLOROBENZENE, 1,4-	2.3E-01	2.5E+03		3.0E+03	2.3E-01	1.8E+00
DICHLOROBENZIDINE, 3,3-	6.6E+01	2.5E+03		4.4E+02		6.6E+01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.5E+02	2.5E+03		1.2E+03		7.5E+02
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.1E+03	2.5E+03		1.2E+03		1.1E+03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	4.3E+00	5.0E+03		3.0E+02		4.3E+00
DICHLOROETHANE, 1,1-	1.9E+00	1.7E+03		1.7E+03	5.1E+01	1.9E+00
DICHLOROETHANE, 1,2-	5.6E-02	1.8E+03		6.9E+01	5.6E-02	1.2E+00
DICHLOROETHYLENE, 1,1-	4.3E+00	1.5E+03		1.0E+03	2.1E+01	4.3E+00
DICHLOROETHYLENE, Cis 1,2-	3.6E+00	1.0E+03		3.5E+02	3.6E+00	1.8E+01
DICHLOROETHYLENE, Trans 1,2-	7.3E+00	2.5E+03		5.7E+02	7.3E+00	3.9E+01
DICHLOROPHENOL, 2,4-	3.0E+00	2.5E+03		1.2E+03		3.0E+00
DICHLOROPROPANE, 1,2-	7.5E-02	1.0E+03		4.7E+01	7.5E-02	2.5E+00
DICHLOROPROPENE, 1,3-	3.6E-01	1.4E+03		1.3E+02	3.6E-01	1.4E+01
DIELDRIN	2.3E-03	5.0E+03		1.2E+01		2.3E-03
DIETHYLPHTHALATE	3.5E-02	2.5E+03		3.2E+05		3.5E-02
DIMETHYLPHENOL, 2,4-	7.3E-01	1.0E+03		8.0E+03		7.3E-01
DIMETHYLPHTHALATE	3.5E-02	2.5E+03		1.0E+06		3.5E-02
DINITROPHENOL, 2,4-	2.1E-01	2.5E+03		8.0E+02		2.1E-01
DINITROTOLUENE, 2,4-	8.6E-01	2.5E+03		8.0E+02		8.6E-01
DIOXANE, 1,4-	3.0E+01	2.5E+03		1.8E+04		3.0E+01
DIOXIN (2,3,7,8-TCDD)	2.0E-03	no criteria		2.0E-03		1.1E+06
ENDOSULFAN	4.6E-03	2.5E+03		2.4E+03		4.6E-03
ENDRIN	6.5E-04	2.5E+03		1.2E+02		6.5E-04
ETHANOL	4.5E+00	2.5E+03				4.5E+00
ETHYLBENZENE	3.2E+01	4.0E+02		4.0E+02	3.9E+02	3.2E+01
FLUORANTHENE	6.0E+01	2.5E+03		1.4E+04		6.0E+01
FLUORENE	8.9E+00	2.5E+03		2.6E+04	1.6E+02	8.9E+00
HEPTACHLOR	1.3E-02	5.0E+03		4.4E+01		1.3E-02
HEPTACHLOR EPOXIDE	1.4E-02	5.0E+03		5.2E+00		1.4E-02

TABLE D-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
HEXACHLOROBENZENE	1.2E+02	2.5E+03		1.2E+02		7.9E+02
HEXACHLOROBUTADIENE	2.3E+01	2.5E+03		1.2E+02		2.3E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.9E-02	2.5E+03		1.7E+02		4.9E-02
HEXACHLOROETHANE	4.1E+01	2.5E+03		4.0E+02		4.1E+01
INDENO(1,2,3-cd)PYRENE	2.4E+01	2.5E+03		2.4E+02		2.4E+01
LEAD	7.5E+02	5.0E+03		7.5E+02		
MERCURY	2.3E+02	2.5E+03		2.3E+02		
METHOXYCHLOR	1.9E+01	2.5E+03		2.0E+03		1.9E+01
METHYL ETHYL KETONE	1.3E+01	2.5E+03		3.4E+04	1.3E+04	1.3E+01
METHYL ISOBUTYL KETONE	3.9E+00	1.0E+03		1.7E+04	1.3E+04	3.9E+00
METHYL MERCURY	4.1E+01	1.0E+03		4.1E+01		
METHYL TERT BUTYL ETHER	5.6E+00	1.0E+03		2.8E+04	5.6E+00	8.4E+00
METHYLENE CHLORIDE	3.2E+00	2.4E+03		8.2E+03	3.2E+00	3.4E+01
METHYLNAPHTHALENE (total 1- & 2-)	2.5E-01	2.5E+03		1.1E+02	1.1E+02	2.5E-01
MOLYBDENUM	3.9E+03	5.0E+03		3.9E+03		
NAPHTHALENE	4.8E+00	2.5E+03		4.6E+02	1.2E+01	4.8E+00
NICKEL	5.0E+03	5.0E+03		1.5E+04		
PENTACHLOROPHENOL	4.2E+01	2.5E+03		9.8E+02		4.2E+01
PERCHLORATE	1.2E+00	5.0E+03		7.7E+01		1.2E+00
PHENANTHRENE	1.1E+01	2.5E+03		2.8E+04	(Use soil gas)	1.1E+01
PHENOL	1.9E+01	2.5E+03		1.2E+05		1.9E+01
POLYCHLORINATED BIPHENYLS (PCBs)	6.3E+00	2.5E+03		6.7E+00		6.3E+00
PYRENE	8.5E+01	2.5E+03		2.3E+04	8.5E+01	8.5E+01
SELENIUM	3.9E+03	5.0E+03		3.9E+03		
SILVER	3.9E+03	5.0E+03		3.9E+03		
STYRENE	1.5E+01	1.5E+03		1.5E+03	1.1E+03	1.5E+01
tert-BUTYL ALCOHOL	1.1E+02	1.0E+03		5.6E+04	(Use soil gas)	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	1.6E+01	1.0E+03		2.0E+03	(Use soil gas)	1.6E+01
TETRACHLOROETHANE, 1,1,2,2-	2.5E-02	1.7E+03		3.6E+02	2.5E-02	2.7E+00
TETRACHLOROETHYLENE	2.4E-01	2.3E+02		2.3E+02	2.4E-01	1.4E+01
THALLIUM	5.1E+01	5.0E+03		5.1E+01		
TOLUENE	9.3E+00	6.5E+02		6.5E+02	4.0E+02	9.3E+00
TOXAPHENE	4.2E-04	2.5E+03		1.7E+02		4.2E-04
TPH (gasolines)	4.0E+02	5.0E+03		1.5E+04	(Use soil gas)	4.0E+02
TPH (middle distillates)	5.0E+02	5.0E+03		1.5E+04	(Use soil gas)	5.0E+02
TPH (residual fuels)	1.0E+03	5.0E+03		5.3E+04		1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.1E+00	2.5E+03		5.1E+02	1.1E+00	7.6E+00

TABLE D-2. [1]DEEP SOIL SCREENING LEVELS (>3m bgs)
COMMERCIAL / INDUSTRIAL LAND USE
(potentially impacted groundwater IS NOT a current or potential drinking water resource)

	COMMERCIAL / INDUSTRIAL LAND USE (mg/kg)					
		Gross Contamination Ceiling Value (Odors, etc.)		Human Health		Groundwater Protection (Soil Leaching)
				Direct Exposure	Vapor Intrusion Into Buildings	NON-Drinking Water Resource
CHEMICAL PARAMETER	Final ESL	Table H-3	Background	Table K-3	Table E-1b	Table G
TRICHLOROETHANE, 1,1,1-	7.8E+00	1.2E+03		1.2E+03	2.3E+02	7.8E+00
TRICHLOROETHANE, 1,1,2-	9.1E-02	1.0E+03		3.0E+02	9.1E-02	3.9E+00
TRICHLOROETHYLENE	1.3E-01	1.3E+03		4.9E+01	1.3E-01	6.8E+00
TRICHLOROPHENOL, 2,4,5-	1.8E-01	1.0E+03		1.9E+04	6.3E+01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	4.0E+01	2.5E+03		4.0E+01		1.6E+02
VANADIUM	7.7E+02	5.0E+03		7.7E+02		
VINYL CHLORIDE	1.6E-01	2.5E+03		1.2E+02	1.6E-01	1.9E+00
XYLENES	1.1E+01	4.2E+02		4.2E+02	1.1E+02	1.1E+01
ZINC	5.0E+03	5.0E+03		2.3E+05		
Electrical Conductivity (mS/cm, USEPA Method 120.1 MOD)	not applicable	-		-	-	-
Sodium Adsorption Ratio	not applicable	-		-	-	-

Notes:

1. Deep soils defined as soils situated >3 meters below ground surface (or shallower with institutional controls).

Final Environmental Screening Level is lowest of ceiling values (nuisance concerns etc.), direct-exposure, indoor-air impact, and leaching screening levels.
Assumes soil pH 5.0 to 11.
Soil data should be reported on dry-weight basis (see Section 6.2).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Typical background As in soils assumed to be <20 mg/kg (refer to Volume 1, Section 2.9 and Appendix 1, Section 3).

TABLE E-1a. GROUNDWATER SCREENING LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS
(volatile chemicals only)

			[1,4]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
	Physical State		[2]High Permeability	[3]Low/Moderate Permeability	[2]High Permeability	[3]Low/Moderate Permeability
CHEMICAL PARAMETER			(ug/L)	(ug/L)	(ug/L)	(ug/L)
#ACENAPHTHENE	V	S	4.2E+03	4.2E+03	4.2E+03	4.2E+03
ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
#ACETONE	V	L	4.3E+07	5.6E+07	1.5E+08	2.0E+08
ALDRIN	NV	S				
#ANTHRACENE	V	S	4.3E+01	4.3E+01	4.3E+01	4.3E+01
ANTIMONY	NV	S				
ARSENIC	NV	S				
BARIUM	NV	S				
#BENZENE	V	L	1.6E+03	5.7E+03	6.7E+03	2.4E+04
BENZO(a)ANTHRACENE	NV	S				
BENZO(a)PYRENE	NV	S				
BENZO(b)FLUORANTHENE	NV	S				
BENZO(g,h,i)PERYLENE	NV	S				
BENZO(k)FLUORANTHENE	NV	S				
BERYLLIUM	NV	S				
BIPHENYL, 1,1-	V	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
BIS(2-CHLOROETHYL)ETHER	V	L	1.0E+02	1.4E+02	4.4E+02	5.8E+02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S				
BORON	NV	S				
BROMODICHLOROMETHANE	V	L	2.7E+02	5.1E+02	1.1E+03	2.2E+03
BROMOFORM	NV	S				
BROMOMETHANE	V	G	4.6E+02	1.6E+03	1.6E+03	5.7E+03
CADMIUM	NV	S				
CARBON TETRACHLORIDE	V	L	2.1E+01	8.9E+01	8.8E+01	3.8E+02
CHLORDANE	NV	S				
CHLOROANILINE, p-	NV	S				
CHLOROBENZENE	V	L	1.1E+04	3.4E+04	3.7E+04	1.2E+05
CHLOROETHANE	V	G	6.5E+02	2.6E+03	2.8E+03	1.1E+04
CHLOROFORM	V	L	6.2E+01	2.1E+02	2.6E+02	9.0E+02
CHLOROMETHANE	V	G	1.9E+03	8.3E+03	6.7E+03	2.9E+04
CHLOROPHENOL, 2-	V	L	4.2E+03	1.3E+04	1.5E+04	4.5E+04
CHROMIUM (Total)	NV	S				
CHROMIUM III	NV	S				
CHROMIUM VI	NV	S				
CHRYSENE	NV	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
COBALT	NV	S				

TABLE E-1a. GROUNDWATER SCREENING LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[1,4]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
			[2]High Permeability (ug/L)	[3]Low/Moderate Permeability (ug/L)	[2]High Permeability (ug/L)	[3]Low/Moderate Permeability (ug/L)
COPPER	NV	S				
CYANIDE (Free)	NV	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
DIBENZO(a,h)ANTHTRACENE	NV	S				
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
DIBROMOCHLOROMETHANE	V	S	1.6E+02	3.7E+02	6.9E+02	1.6E+03
DIBROMOETHANE, 1,2-	V	S	1.6E+01	2.5E+01	6.9E+01	1.1E+02
DICHLOROBENZENE, 1,2-	V	L	6.1E+04	1.6E+05	1.6E+05	1.6E+05
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	4.9E+02	1.4E+03	2.1E+03	5.9E+03
DICHLOROBENZIDINE, 3,3-	NV	S				
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S				
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S				
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S				
DICHLOROETHANE, 1,1-	V	L	5.5E+04	1.9E+05	2.0E+05	6.7E+05
DICHLOROETHANE, 1,2-	V	L	1.3E+02	3.2E+02	5.5E+02	1.4E+03
DICHLOROETHYLENE, 1,1-	V	L	5.0E+03	2.1E+04	1.8E+04	7.5E+04
DICHLOROETHYLENE, Cis 1,2-	V	L	4.9E+03	1.5E+04	1.7E+04	5.5E+04
DICHLOROETHYLENE, Trans 1,2-	V	L	5.3E+03	1.9E+04	1.9E+04	6.9E+04
DICHLOROPHENOL, 2,4-	NV	S				
DICHLOROPROPANE, 1,2-	V	L	1.2E+02	3.6E+02	5.0E+02	1.5E+03
DICHLOROPROPENE, 1,3-	V	L	1.6E+02	6.2E+02	6.6E+02	2.6E+03
DIELDRIN	NV	S				
DIETHYLPHTHALATE	NV	S				
#DIMETHYLPHENOL, 2,4-	V	S				
DIMETHYLPHTHALATE	NV	S				
DINITROPHENOL, 2,4-	NV	S				
DINITROTOLUENE, 2,4-	NV	S				
DIOXANE, 1,4-	NV	L				
DIOXIN (2,3,7,8-TCDD)	NV	S				
ENDOSULFAN	NV	S				
ENDRIN	NV	S				
ETHANOL	NV	S				
#ETHYLBENZENE	V	L	1.7E+05	1.7E+05	1.7E+05	1.7E+05
FLUORANTHENE	NV	S				
#FLUORENE	V	S	1.9E+03	1.9E+03	1.9E+03	1.9E+03
HEPTACHLOR	NV	S				
HEPTACHLOR EPOXIDE	NV	S				

TABLE E-1a. GROUNDWATER SCREENING LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[1,a]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
			[2]High Permeability (ug/L)	[3]Low/Moderate Permeability (ug/L)	[2]High Permeability (ug/L)	[3]Low/Moderate Permeability (ug/L)
HEXACHLOROBENZENE	NV	S				
HEXACHLOROBUTADIENE	NV	S				
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S				
HEXACHLOROETHANE	NV	S				
INDENO(1,2,3-cd)PYRENE	NV	S				
LEAD	NV	S				
MERCURY	V	S				
METHOXYCHLOR	NV	S				
#METHYL ETHYL KETONE	V	L	2.1E+08	2.7E+08	2.7E+08	2.7E+08
#METHYL ISOBUTYL KETONE	V	L	1.9E+07	1.9E+07	1.9E+07	1.9E+07
METHYL MERCURY	NV	S				
METHYL TERT BUTYL ETHER	V	L	1.9E+04	3.8E+04	8.0E+04	1.6E+05
METHYLENE CHLORIDE	V	L	4.2E+03	1.2E+04	1.8E+04	5.3E+04
#METHYLNAPHTHALENE (total 1- & 2-)	V	S	2.6E+04	2.6E+04	2.6E+04	2.6E+04
MOLYBDENUM	NV	S				
#NAPHTHALENE	V	S	2.3E+04	3.1E+04	3.1E+04	3.1E+04
NICKEL	NV	S				
PENTACHLOROPHENOL	NV	S				
PERCHLORATE	NV	S				
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
PHENOL	NV	S				
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S				
#PYRENE	V	S	1.4E+02	1.4E+02	1.4E+02	1.4E+02
SELENIUM	NV	S				
SILVER	NV	S				
#STYRENE	V	L	3.1E+05	3.1E+05	3.1E+05	3.1E+05
tert-BUTYL ALCOHOL			(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,1,2-	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,2,2-	V	L	1.5E+02	2.5E+02	6.4E+02	1.0E+03
TETRACHLOROETHYLENE	V	L	9.9E+01	4.0E+02	4.2E+02	1.7E+03
THALLIUM	NV	S				
#TOLUENE	V	L	3.8E+05	5.3E+05	5.3E+05	5.3E+05
TOXAPHENE	NV	S				
TPH (gasolines)	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TPH (middle distillates)	V	L	(Use soil gas)	(Use soil gas)	(Use soil gas)	(Use soil gas)
TPH (residual fuels)	NV	L/S				
TRICHLOROBENZENE, 1,2,4-	V	L	2.0E+03	3.6E+03	7.1E+03	1.3E+04

TABLE E-1a. GROUNDWATER SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[1,4]Residential Land Use		Commercial/Industrial Land Use	
			Vadose-Zone Soil Type		Vadose-Zone Soil Type	
			[2]High Permeability	[3]Low/Moderate Permeability	[2]High Permeability	[3]Low/Moderate Permeability
			(ug/L)	(ug/L)	(ug/L)	(ug/L)
TRICHLOROETHANE, 1,1,1-	V	L	1.0E+05	4.1E+05	3.6E+05	1.3E+06
TRICHLOROETHANE, 1,1,2-	V	L	2.8E+02	6.3E+02	1.2E+03	2.7E+03
TRICHLOROETHYLENE	V	L	7.4E+01	2.9E+02	3.1E+02	1.2E+03
TRICHLOROPHENOL, 2,4,5-	V	S	6.5E+05	6.5E+05	1.2E+06	1.2E+06
TRICHLOROPHENOL, 2,4,6-	NV	S				
VANADIUM	NV	S				
VINYL CHLORIDE	V	G	1.1E+01	5.1E+01	1.1E+02	5.1E+02
#XYLENES	V	L	1.2E+05	1.6E+05	1.6E+05	1.6E+05
ZINC	NV	S				

Notes:

1. "Residential" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).
2. High permeability soil model: One meter dry sandy soil (92% sand, 5% silt, 3% clay) over one meter moist clayey loam (33% sand, 34% silt, 33% clay).
3. Low/Moderate permeability soil model: One meter dry loamy sand (83% sand, 11% silt, 6% clay) over one meter moist silt (7% sand, 87% silt, 6% clay).
4. For inclusion in Tier 1 screening levels, all groundwater assumed to potentially migrate under a residential area. Screening levels for protection of indoor air under a residential exposure scenario carried forward for use at both residential and commercial/industrial sites (see Table F series).

Screening levels calculated using spreadhseet provided with *User's Guide for the Johnson and Ettinger Indoor Air model (1991) for Subsurface Vapor* Intrusion Into Buildings (USEPA 2003). Assumed vadose-zone thickness/depth to groundwater three meters. See Appendix 1 text for model details.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S -id, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004).
Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 except as noted.
"#": Nonchlorinated VOCs (except MTBE) adjusted upwards by factor of ten to account for assumed biodegradation in vadose-zone prior to emission at surface.
Target cancer risk = 1E-05 for TCE and volatile PAHs. Target Hazard Quotient = 0.5 for TPH.

TABLE E-1b. SOIL SCREENING LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS
(volatile chemicals only)
(Use with Soil Gas Screening Levels for sites with significant VOC releases)

CHEMICAL PARAMETER	Physical State		[1]Residenital Exposure (mg/kg)	Commercial/Industrial Exposure (mg/kg)
#ACENAPHTHENE	V	S	1.3E+02	1.3E+02
ACENAPHTHYLENE	V	S	(Use soil gas)	(Use soil gas)
#ACETONE	V	L	1.1E+03	3.3E+03
ALDRIN	NV	S		
#ANTHRACENE	V	S	6.1E+00	6.1E+00
ANTIMONY	NV	S		
ARSENIC	NV	S		
BARIUM	NV	S		
#BENZENE	V	L	5.3E-01	1.9E+00
BENZO(a)ANTHRACENE	NV	S		
BENZO(a)PYRENE	NV	S		
BENZO(b)FLUORANTHENE	NV	S		
BENZO(g,h,i)PERYLENE	NV	S		
BENZO(k)FLUORANTHENE	NV	S		
BERYLLIUM	NV	S		
BIPHENYL, 1,1-	V	S	(Use soil gas)	(Use soil gas)
BIS(2-CHLOROETHYL)ETHER	V	L	6.7E-03	2.8E-02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	(Use soil gas)	(Use soil gas)
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S		
BORON	NV	S		
BROMODICHLOROMETHANE	V	L	2.3E-02	8.2E-02
BROMOFORM	NV	S		
BROMOMETHANE	V	G	1.7E-01	5.1E-01
CADMIUM	NV	S		
CARBON TETRACHLORIDE	V	L	2.7E-02	9.6E-02
CHLORDANE	NV	S		
CHLOROANILINE, p-	NV	S		
CHLOROBENZENE	V	L	2.1E+00	6.2E+00
CHLOROETHANE	V	G	5.0E-01	1.8E+00
CHLOROFORM	V	L	1.8E-02	6.3E-02
CHLOROMETHANE	V	G	3.2E+00	9.5E+00
CHLOROPHENOL, 2-	V	L	6.7E-01	2.3E+00
CHROMIUM (Total)	NV	S		
CHROMIUM III	NV	S		
CHROMIUM VI	NV	S		
CHRYSENE	NV	S	(Use soil gas)	(Use soil gas)
COBALT	NV	S		
COPPER	NV	S		
CYANIDE (Free)	NV	S	(Use soil gas)	(Use soil gas)
DIBENZO(a,h)ANTHTRACENE	NV	S		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	(Use soil gas)	(Use soil gas)
DIBROMOCHLOROMETHANE	V	S	1.7E-02	2.2E-02
DIBROMOETHANE, 1,2-	V	S	7.2E-04	2.5E-03
DICHLOROBENZENE, 1,2-	V	L	7.0E+00	2.1E+01
DICHLOROBENZENE, 1,3-	V	L	(Use soil gas)	(Use soil gas)
DICHLOROBENZENE, 1,4-	V	S	6.5E-02	2.3E-01
DICHLOROBENZIDINE, 3,3-	NV	S		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S		
DICHLOROETHANE, 1,1-	V	L	1.7E+01	5.1E+01
DICHLOROETHANE, 1,2-	V	L	1.6E-02	5.6E-02
DICHLOROETHYLENE, 1,1-	V	L	7.0E+00	2.1E+01
DICHLOROETHYLENE, Cis 1,2-	V	L	1.2E+00	3.6E+00
DICHLOROETHYLENE, Trans 1,2-	V	L	2.5E+00	7.3E+00

TABLE E-1b. SOIL SCREENING LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS
(volatile chemicals only)
(Use with Soil Gas Screening Levels for sites with significant VOC releases)

CHEMICAL PARAMETER	Physical State		[1]Residenital Exposure (mg/kg)	Commercial/Industrial Exposure (mg/kg)
DICHLOROPHENOL, 2,4-	NV	S		
DICHLOROPROPANE, 1,2-	V	L	2.1E-02	7.5E-02
DICHLOROPROPENE, 1,3-	V	L	1.0E-01	3.6E-01
DIELDRIN	NV	S		
DIETHYLPHTHALATE	NV	S		
#DIMETHYLPHENOL, 2,4-	V	S		
DIMETHYLPHTHALATE	NV	S		
DINITROPHENOL, 2,4-	NV	S		
DINITROTOLUENE, 2,4-	NV	S		
DIOXANE, 1,4-	NV	L		
DIOXIN (2,3,7,8-TCDD)	NV	S		
ENDOSULFAN	NV	S		
ENDRIN	NV	S		
ETHANOL	NV	L		
#ETHYLBENZENE	V	L	3.6E+02	3.9E+02
FLUORANTHENE	NV	S		
#FLUORENE	V	S	1.6E+02	1.6E+02
HEPTACHLOR	NV	S		
HEPTACHLOR EPOXIDE	NV	S		
HEXACHLOROBENZENE	NV	S		
HEXACHLOROBUTADIENE	NV	S		
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S		
HEXACHLOROETHANE	NV	S		
INDENO(1,2,3-cd)PYRENE	NV	S		
LEAD	NV	S		
MERCURY	V	S		
METHOXYCHLOR	NV	S		
#METHYL ETHYL KETONE	V	L	3.8E+03	1.3E+04
#METHYL ISOBUTYL KETONE	V	L	3.8E+03	1.3E+04
METHYL MERCURY	NV	S		
METHYL TERT BUTYL ETHER	V	L	1.6E+00	5.6E+00
METHYLENE CHLORIDE	V	L	9.0E-01	3.2E+00
#METHYLNAPHTHALENE (total 1- & 2-)	V	S	1.1E+02	1.1E+02
MOLYBDENUM	NV	S		
#NAPHTHALENE	V	S	3.6E+00	1.2E+01
NICKEL	NV	S		
PENTACHLOROPHENOL	NV	S		
PERCHLORATE	NV	S		
PHENANTHRENE	V	S	(Use soil gas)	(Use soil gas)
PHENOL	NV	S		
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S		
#PYRENE	V	S	8.5E+01	8.5E+01
SELENIUM	NV	S		
SILVER	NV	S		
#STYRENE	V	L	3.6E+02	1.1E+03
tert-BUTYL ALCOHOL	V	L	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,1,2-	V	L	(Use soil gas)	(Use soil gas)
TETRACHLOROETHANE, 1,1,2,2-	V	L	7.2E-03	2.5E-02
TETRACHLOROETHYLENE	V	L	6.9E-02	2.4E-01
THALLIUM	NV	S		
#TOLUENE	V	L	1.4E+02	4.0E+02
TOXAPHENE	NV	S		
TPH (gasolines)	V	L	(Use soil gas)	(Use soil gas)
TPH (middle distillates)	V	L	(Use soil gas)	(Use soil gas)
TPH (residual fuels)	NV	L/S		

TABLE E-1b. SOIL SCREENING LEVELS
FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS
(volatile chemicals only)
(Use with Soil Gas Screening Levels for sites with significant VOC releases)

CHEMICAL PARAMETER	Physical State		[1]Residenital Exposure (mg/kg)	Commercial/Industrial Exposure (mg/kg)
TRICHLOROBENZENE, 1,2,4-	V	L	3.2E-01	1.1E+00
TRICHLOROETHANE, 1,1,1-	V	L	7.8E+01	2.3E+02
TRICHLOROETHANE, 1,1,2-	V	L	2.6E-02	9.1E-02
TRICHLOROETHYLENE	V	L	3.6E-02	1.3E-01
TRICHLOROPHENOL, 2,4,5-	V	S	1.9E+01	6.3E+01
TRICHLOROPHENOL, 2,4,6-	NV	S		
VANADIUM	NV	S		
VINYL CHLORIDE	V	G	2.0E-02	1.6E-01
#XYLENES	V	L	3.6E+01	1.1E+02
ZINC	NV	S		

Notes:

1. "Residential" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Screening levels calculated using spreadhseet provided with *User's Guide for the Johnson and Ettinger Indoor Air Model (1991) for Subsurface Vapor Intrusion Into Buildings* (USEPA 2003 and updates).
Soil model: Two meters dry sandy soil (92% sand, 5% silt, 3% clay) directly underlying building foundation.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S -solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004).
Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 except as noted.
"#": Nonchlorinated VOCs (except MTBE) adjusted upwards by factor of ten to account for assumed biodegradation in vadose-zone prior to emission at surface.
Target cancer risk = 1E-05 for TCE and volatile PAHs. Target Hazard Quotient = 0.5 for TPH.

TABLE E-2. [1]SHALLOW SOIL GAS SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
ACENAPHTHENE	V	S	4.4E+04		4.4E+04	1.2E+05		1.2E+05
ACENAPHTHYLENE	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
ACETONE	V	L	6.6E+05		6.6E+05	1.8E+06		1.8E+06
ALDRIN	NV	S						
ANTHRACENE	V	S	2.2E+05		2.2E+05	6.1E+05		6.1E+05
ANTIMONY	NV	S						
ARSENIC	NV	S						
BARIUM	NV	S						
BENZENE	V	L	2.5E+02	2.5E+02	6.3E+03	1.1E+03	1.1E+03	1.8E+04
BENZO(a)ANTHRACENE	NV	S						
BENZO(a)PYRENE	NV	S						
BENZO(b)FLUORANTHENE	NV	S						
BENZO(g,h,i)PERYLENE	NV	S						
BENZO(k)FLUORANTHENE	NV	S						
BERYLLIUM	NV	S						
BIPHENYL, 1,1-	V	S	3.7E+04		3.7E+04	1.0E+05		1.0E+05
BIS(2-CHLOROETHYL)ETHER	V	L	5.6E+00	5.6E+00		2.4E+01	2.4E+01	
BIS(2-CHLOROISOPROPYL)ETHER	V	L	1.9E+02	1.9E+02	2.9E+04	8.2E+02	8.2E+02	8.2E+04
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S						
BORON	NV	S						
BROMODICHLOROMETHANE	V	L	1.1E+02	1.1E+02	1.5E+04	4.6E+02	4.6E+02	4.1E+04
BROMOFORM	NV	S						
BROMOMETHANE	V	G	1.0E+03		1.0E+03	2.9E+03		2.9E+03
CADMIUM	NV	S						
CARBON TETRACHLORIDE	V	L	1.3E+02	1.3E+02	5.1E+02	5.4E+02	5.4E+02	1.4E+03
CHLORDANE	NV	S						
CHLOROANILINE, p-	NV	S						
CHLOROBENZENE	V	L	1.2E+04		1.2E+04	3.5E+04		3.5E+04
CHLOROETHANE	V	G	2.3E+03	2.3E+03	2.1E+06	9.9E+03	9.9E+03	5.9E+06
CHLOROFORM	V	L	8.3E+01	8.3E+01	1.0E+04	3.5E+02	3.5E+02	2.9E+04
CHLOROMETHANE	V	G	1.9E+04		1.9E+04	5.3E+04		5.3E+04
CHLOROPHENOL, 2-	V	L	3.7E+03		3.7E+03	1.0E+04		1.0E+04
CHROMIUM (Total)	NV	S						
CHROMIUM III	NV	S						
CHROMIUM VI	NV	S						
CHRYSENE	NV	S						
COBALT	NV	S						
COPPER	NV	S						
CYANIDE (Free)	NV	S						

TABLE E-2. [1]SHALLOW SOIL GAS SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
DIBENZO(a,h)ANTHTRACENE	NV	S						
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	4.2E+01	2.8E+03	4.2E+01	1.2E+02	1.2E+04	1.2E+02
DIBROMOCHLOROMETHANE	V	S	8.0E+01	8.0E+01	1.5E+04	3.4E+02	3.4E+02	4.1E+04
DIBROMOETHANE, 1,2-	V	S	3.4E+00	3.4E+00	1.9E+03	1.4E+01	1.4E+01	5.3E+03
DICHLOROBENZENE, 1,2-	V	L	4.2E+04		4.2E+04	1.2E+05		1.2E+05
DICHLOROBENZENE, 1,3-	V	L	2.2E+04		2.2E+04	6.1E+04		6.1E+04
DICHLOROBENZENE, 1,4-	V	S	3.1E+02	3.1E+02	2.2E+04	1.3E+03	1.3E+03	6.1E+04
DICHLOROBENZIDINE, 3,3-	NV	S						
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S						
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S						
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S						
DICHLOROETHANE, 1,1-	V	L	1.0E+05		1.0E+05	2.9E+05		2.9E+05
DICHLOROETHANE, 1,2-	V	L	7.4E+01	7.4E+01	1.0E+03	3.1E+02	3.1E+02	2.9E+03
DICHLOROETHYLENE, 1,1-	V	L	4.2E+04		4.2E+04	1.2E+05		1.2E+05
DICHLOROETHYLENE, Cis 1,2-	V	L	7.3E+03		7.3E+03	2.0E+04		2.0E+04
DICHLOROETHYLENE, Trans 1,2-	V	L	1.5E+04		1.5E+04	4.1E+04		4.1E+04
DICHLOROPHENOL, 2,4-	NV	S						
DICHLOROPROPANE, 1,2-	V	L	9.9E+01	9.9E+01	8.0E+02	4.2E+02	4.2E+02	2.2E+03
DICHLOROPROPENE, 1,3-	V	L	4.8E+02	4.8E+02	4.2E+03	2.0E+03	2.0E+03	1.2E+04
DIELDRIN	NV	S						
DIETHYLPHTHALATE	NV	S						
DIMETHYLPHENOL, 2,4-	V	S	1.5E+04		1.5E+04	4.1E+04		4.1E+04
DIMETHYLPHTHALATE	NV	S						
DINITROPHENOL, 2,4-	NV	S						
DINITROTOLUENE, 2,4-	NV	S						
DIOXANE, 1,4-	NV	L						
DIOXIN (2,3,7,8-TCDD)	NV	S						
ENDOSULFAN	NV	S						
ENDRIN	NV	S						
ETHANOL	NV	L	1.9E+07			3.8E+07		
ETHYLBENZENE	V	L	2.1E+05		2.1E+05	5.9E+05		5.9E+05
FLUORANTHENE	NV	S						
FLUORENE	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
HEPTACHLOR	NV	S						
HEPTACHLOR EPOXIDE	NV	S						
HEXACHLOROBENZENE	NV	S						
HEXACHLOROBUTADIENE	NV	S						
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S						
HEXACHLOROETHANE	NV	S						

TABLE E-2. [1]SHALLOW SOIL GAS SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
INDENO(1,2,3-cd)PYRENE	NV	S						
LEAD	NV	S						
MERCURY	V	S	6.2E+01		6.2E+01	1.7E+02		1.7E+02
METHOXYCHLOR	NV	S						
METHYL ETHYL KETONE	V	L	1.0E+06		1.0E+06	2.9E+06		2.9E+06
METHYL ISOBUTYL KETONE	V	L	6.3E+05		6.3E+05	1.8E+06		1.8E+06
METHYL MERCURY	NV	S						
METHYL TERT BUTYL ETHER	V	L	7.4E+03	7.4E+03	6.3E+05	3.1E+04	3.1E+04	1.8E+06
METHYLENE CHLORIDE	V	L	4.2E+03	4.2E+03	6.3E+05	1.8E+04	1.8E+04	1.8E+06
METHYLNAPHTHALENE (total 1- & 2-)	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
MOLYBDENUM	NV	S						
NAPHTHALENE	V	S	6.3E+02		6.3E+02	1.8E+03		1.8E+03
NICKEL	NV	S						
PENTACHLOROPHENOL	NV	S						
PERCHLORATE	NV	S						
PHENANTHRENE	V	S	2.9E+04		2.9E+04	8.2E+04		8.2E+04
PHENOL	NV	S						
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S						
PYRENE	V	S	2.2E+04		2.2E+04	6.1E+04		6.1E+04
SELENIUM	NV	S						
SILVER	NV	S						
STYRENE	V	L	2.1E+05		2.1E+05	5.9E+05		5.9E+05
tert-BUTYL ALCOHOL	V	L	2.2E+03	2.2E+03		9.5E+03	9.5E+03	
TETRACHLOROETHANE, 1,1,1,2-	V	L	2.6E+02	2.6E+02	2.2E+04	1.1E+03	1.1E+03	6.1E+04
TETRACHLOROETHANE, 1,1,2,2-	V	L	3.4E+01	3.4E+01	4.4E+04	1.4E+02	1.4E+02	1.2E+05
TETRACHLOROETHYLENE	V	L	3.2E+02	3.2E+02	7.3E+03	1.4E+03	1.4E+03	2.0E+04
THALLIUM	NV	S						
TOLUENE	V	L	8.0E+04		8.0E+04	2.2E+05		2.2E+05
TOXAPHENE	NV	S						
TPH (gasolines)	V	L	1.0E+04		1.0E+04	2.9E+04		2.9E+04
TPH (middle distillates)	V	L	1.0E+04		1.0E+04	2.9E+04		2.9E+04
TPH (residual fuels)	NV	L/S						
TRICHLOROBENZENE, 1,2,4-	V	L	7.3E+02		7.3E+02	2.0E+03		2.0E+03
TRICHLOROETHANE, 1,1,1-	V	L	4.6E+05		4.6E+05	1.3E+06		1.3E+06
TRICHLOROETHANE, 1,1,2-	V	L	1.2E+02	1.2E+02	2.9E+03	5.1E+02	5.1E+02	8.2E+03
TRICHLOROETHYLENE	V	L	1.7E+01	1.7E+01	7.3E+03	7.2E+01	7.2E+01	2.0E+04
TRICHLOROPHENOL, 2,4,5-	V	S	7.3E+04		7.3E+04	2.0E+05		2.0E+05
TRICHLOROPHENOL, 2,4,6-	NV	S						
VANADIUM	NV	S						

TABLE E-2. [1]SHALLOW SOIL GAS SCREENING LEVELS FOR EVALUATION OF POTENTIAL VAPOR INTRUSION CONCERNS (volatile chemicals only)

CHEMICAL PARAMETER	Physical State		[2]Residential Exposure			Commercial/Industrial Land Use		
			Lowest Residential (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)	Lowest C/I (ug/m^3)	Carcinogenic Effects (ug/m^3)	Noncarcinogenic Effects (ug/m^3)
VINYL CHLORIDE	V	G	2.2E+02	2.2E+02	2.1E+04	9.2E+02	9.2E+02	5.8E+04
XYLENES	V	L	2.1E+04		2.1E+04	5.9E+04		5.9E+04
ZINC	NV	S						

Notes:

1. Shallow soil gas defined as soil gas sample data collected within 1.5 meters (five feet) from a building foundation or the ground surface. Assumes very permeable (e.g., sandy) fill material is present below building foundation or could be present below future buildings following redevelopment. Evaluation of deeper soil gas data (e.g., >1.5m bgs) should be carried out on a site-specific basis.
2. "Residential" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Soil gas screening levels intended to be protective of indoor air quality, calculated for volatile chemicals only.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S - solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200 (see Table E-1).
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004).
Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 for all chemicals except as noted.
Target cancer risk = 1E-05 for TCE and volatile PAHs. Target Hazard Quotient = 0.5 for TPH.
Residential soil gas:indoor air attenuation factor = 0.001 (1/1000). Commercial/industrial soil gas:indoor air attenuation factor = 0.0005 (1/2000).
Soil gas screening level for ethanol based on potential indoor air nuisance concerns (refer to Section 5.3.3 and Table H series).
Soil gas screening levels do not address mass-balance issues. May be overly conservative for sites with low permeability shallow soils or limited soil impacts and no groundwater source of VOCs.
Soil gas screening levels for ethanol based on potential nuisance concerns. Human health risk toxicity data not available but likely to exceed the former.
Indoor-air sampling and/or passive vapor mitigation measures may be prudent for sites where concentrations of chemicals in soil gas approach but do not exceed screening levels. Consider other sources of VOCs in all indoor air studies

TABLE E-3. INDOOR AIR SCREENING LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Screening Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Residential Exposure: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table H-2) (ug/m^3)
ACENAPHTHENE	V	S		2.1E+02	4.4E+01		4.4E+01	6.1E+01		6.1E+01	5.13E+02
ACENAPHTHYLENE	V	S		1.4E+02	2.9E+01		2.9E+01	4.1E+01		4.1E+01	-
ACETONE	V	L		3.2E+03	6.6E+02		6.6E+02	9.2E+02		9.2E+02	3.09E+04
ALDRIN	NV	S									2.63E+02
ANTHRACENE	V	S		1.1E+03	2.2E+02		2.2E+02	3.1E+02		3.1E+02	-
ANTIMONY	NV	S									-
ARSENIC	NV	S									-
BARIUM	NV	S									-
BENZENE	V	L	7.7E-06	3.0E+01	2.5E-01	2.5E-01	6.3E+00	5.3E-01	5.3E-01	8.8E+00	4.89E+03
BENZO(a)ANTHRACENE	NV	S									-
BENZO(a)PYRENE	NV	S									-
BENZO(b)FLUORANTHENE	NV	S									-
BENZO(g,h,i)PERYLENE	NV	S									-
BENZO(k)FLUORANTHENE	NV	S									-
BERYLLIUM	NV	S									-
BIPHENYL, 1,1-	V	S		1.8E+02	3.7E+01		3.7E+01	5.1E+01		5.1E+01	6.00E+01
BIS(2-CHLOROETHYL)ETHER	V	L	3.4E-04		5.6E-03	5.6E-03		1.2E-02	1.2E-02		2.87E+02
BIS(2-CHLOROISOPROPYL)ETHER	V	L	1.0E-05	1.4E+02	1.9E-01	1.9E-01	2.9E+01	4.1E-01	4.1E-01	4.1E+01	2.24E+03
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S									-
BORON	NV	S									-
BROMODICHLOROMETHANE	V	L	1.8E-05	7.0E+01	1.1E-01	1.1E-01	1.5E+01	2.3E-01	2.3E-01	2.0E+01	1.10E+07
BROMOFORM	NV	S									1.35E+04
BROMOMETHANE	V	G		4.9E+00	1.0E+00		1.0E+00	1.4E+00		1.4E+00	8.00E+04
CADMIUM	NV	S									-
CARBON TETRACHLORIDE	V	L	1.5E-05	2.5E+00	1.3E-01	1.3E-01	5.1E-01	2.7E-01	2.7E-01	7.2E-01	6.30E+04
CHLORDANE	NV	S									8.40E+00
CHLOROANILINE, p-	NV	S									-
CHLOROBENZENE	V	L		6.0E+01	1.2E+01		1.2E+01	1.7E+01		1.7E+01	1.00E+03
CHLOROETHANE	V	G	8.3E-07	1.0E+04	2.3E+00	2.3E+00	2.1E+03	4.9E+00	4.9E+00	3.0E+03	3.80E+05
CHLOROFORM	V	L	2.3E-05	4.9E+01	8.3E-02	8.3E-02	1.0E+01	1.8E-01	1.8E-01	1.4E+01	4.22E+05
CHLOROMETHANE	V	G		9.1E+01	1.9E+01		1.9E+01	2.7E+01		2.7E+01	-
CHLOROPHENOL, 2-	V	L		1.8E+01	3.7E+00		3.7E+00	5.1E+00		5.1E+00	1.90E+01
CHROMIUM (Total)	NV	S									-
CHROMIUM III	NV	S									-
CHROMIUM VI	NV	S									-
CHRYSENE	NV	S									-
COBALT	NV	S									-
COPPER	NV	S									-
CYANIDE (Free)	NV	S									6.52E+02
DIBENZO(a,h)ANTHTRACENE	NV	S									-
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	6.9E-07	2.0E-01	4.2E-02	2.8E+00	4.2E-02	5.8E-02	6.0E+00	5.8E-02	-

TABLE E-3. INDOOR AIR SCREENING LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Screening Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Residential Exposure: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table H-2) (ug/m^3)
DIBROMOCHLOROMETHANE	V	S	2.4E-05	7.0E+01	8.0E-02	8.0E-02	1.5E+01	1.7E-01	1.7E-01	2.0E+01	-
DIBROMOETHANE, 1,2-	V	S	5.7E-04	9.1E+00	3.4E-03	3.4E-03	1.9E+00	7.2E-03	7.2E-03	2.7E+00	2.00E+05
DICHLOROBENZENE, 1,2-	V	L		2.0E+02	4.2E+01		4.2E+01	5.8E+01		5.8E+01	3.05E+05
DICHLOROBENZENE, 1,3-	V	L		1.1E+02	2.2E+01		2.2E+01	3.1E+01		3.1E+01	-
DICHLOROBENZENE, 1,4-	V	S	6.3E-06	1.1E+02	3.1E-01	3.1E-01	2.2E+01	6.5E-01	6.5E-01	3.1E+01	1.10E+03
DICHLOROBENZIDINE, 3,3-	NV	S									-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S									-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S									-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S									-
DICHLOROETHANE, 1,1-	V	L		4.9E+02	1.0E+02		1.0E+02	1.4E+02		1.4E+02	1.25E+05
DICHLOROETHANE, 1,2-	V	L	2.6E-05	4.9E+00	7.4E-02	7.4E-02	1.0E+00	1.6E-01	1.6E-01	1.4E+00	2.42E+03
DICHLOROETHYLENE, 1,1-	V	L		2.0E+02	4.2E+01		4.2E+01	5.8E+01		5.8E+01	2.00E+06
DICHLOROETHYLENE, Cis 1,2-	V	L		3.5E+01	7.3E+00		7.3E+00	1.0E+01		1.0E+01	-
DICHLOROETHYLENE, Trans 1,2-	V	L		7.0E+01	1.5E+01		1.5E+01	2.0E+01		2.0E+01	6.73E+04
DICHLOROPHENOL, 2,4-	NV	S									1.40E+03
DICHLOROPROPANE, 1,2-	V	L	1.9E-05	3.9E+00	9.9E-02	9.9E-02	8.0E-01	2.1E-01	2.1E-01	1.1E+00	1.19E+03
DICHLOROPROPENE, 1,3-	V	L	4.0E-06	2.0E+01	4.8E-01	4.8E-01	4.2E+00	1.0E+00	1.0E+00	5.8E+00	4.16E+03
DIELDRIN	NV	S									-
DIETHYLPHTHALATE	NV	S									-
DIMETHYLPHENOL, 2,4-	V	S		7.0E+01	1.5E+01		1.5E+01	2.0E+01		2.0E+01	1.00E+00
DIMETHYLPHTHALATE	NV	S									-
DINITROPHENOL, 2,4-	NV	S									-
DINITROTOLUENE, 2,4-	NV	S									-
DIOXANE, 1,4-	NV	L									6.12E+05
DIOXIN (2,3,7,8-TCDD)	NV	S									-
ENDOSULFAN	NV	S									-
ENDRIN	NV	S									-
ETHANOL	NV	L			1.9E+04			1.9E+04			1.92E+04
ETHYLBENZENE	V	L		1.0E+03	2.1E+02		2.1E+02	3.0E+02		3.0E+02	2.00E+03
FLUORANTHENE	NV	S									-
FLUORENE	V	S		1.4E+02	2.9E+01		2.9E+01	4.1E+01		4.1E+01	-
HEPTACHLOR	NV	S									3.00E+02
HEPTACHLOR EPOXIDE	NV	S									3.00E+02
HEXACHLOROBENZENE	NV	S									-
HEXACHLOROBUTADIENE	NV	S									1.20E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S									-
HEXACHLOROETHANE	NV	S									-
INDENO(1,2,3-cd)PYRENE	NV	S									-
LEAD	NV	S									-
MERCURY	V	S		3.0E-01	6.2E-02		6.2E-02	8.7E-02		8.7E-02	-
METHOXYCHLOR	NV	S									-

TABLE E-3. INDOOR AIR SCREENING LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Screening Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Residential Exposure: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table H-2) (ug/m^3)
METHYL ETHYL KETONE	V	L		4.9E+03	1.0E+03		1.0E+03	1.4E+03		1.4E+03	3.20E+04
METHYL ISOBUTYL KETONE	V	L		3.0E+03	6.3E+02		6.3E+02	8.8E+02		8.8E+02	4.20E+02
METHYL MERCURY	NV	S									-
METHYL TERT BUTYL ETHER	V	L	2.6E-07	3.0E+03	7.4E+00	7.4E+00	6.3E+02	1.6E+01	1.6E+01	8.8E+02	5.30E+02
METHYLENE CHLORIDE	V	L	4.6E-07	3.0E+03	4.2E+00	4.2E+00	6.3E+02	8.9E+00	8.9E+00	8.8E+02	5.60E+05
METHYLNAPHTHALENE (total 1- & 2-)	V	S		1.4E+02	2.9E+01		2.9E+01	4.1E+01		4.1E+01	6.80E+01
MOLYBDENUM	NV	S									-
NAPHTHALENE	V	S		3.0E+00	6.3E-01		6.3E-01	8.8E-01		8.8E-01	4.40E+02
NICKEL	NV	S									-
PENTACHLOROPHENOL	NV	S									-
PERCHLORATE	NV	S									-
PHENANTHRENE	V	S		1.4E+02	2.9E+01		2.9E+01	4.1E+01		4.1E+01	5.50E+01
PHENOL	NV	S									1.56E+02
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S									-
PYRENE	V	S		1.1E+02	2.2E+01		2.2E+01	3.1E+01		3.1E+01	-
SELENIUM	NV	S									-
SILVER	NV	S									-
STYRENE	V	L		1.0E+03	2.1E+02		2.1E+02	3.0E+02		3.0E+02	1.36E+03
tert-BUTYL ALCOHOL	V	L	8.6E-07		2.2E+00	2.2E+00		4.8E+00	4.8E+00		-
TETRACHLOROETHANE, 1,1,1,2-	V	L	7.4E-06	1.1E+02	2.6E-01	2.6E-01	2.2E+01	5.5E-01	5.5E-01	3.1E+01	-
TETRACHLOROETHANE, 1,1,2,2-	V	L	5.7E-05	2.1E+02	3.4E-02	3.4E-02	4.4E+01	7.2E-02	7.2E-02	6.1E+01	1.05E+04
TETRACHLOROETHYLENE	V	L	6.0E-06	3.5E+01	3.2E-01	3.2E-01	7.3E+00	6.8E-01	6.8E-01	1.0E+01	3.17E+04
THALLIUM	NV	S									-
TOLUENE	V	L		3.9E+02	8.0E+01		8.0E+01	1.1E+02		1.1E+02	3.00E+04
TOXAPHENE	NV	S									-
TPH (gasolines)	V	L		4.9E+01	1.0E+01		1.0E+01	1.4E+01		1.4E+01	1.00E+02
TPH (middle distillates)	V	L		4.9E+01	1.0E+01		1.0E+01	1.4E+01		1.4E+01	1.00E+03
TPH (residual fuels)	NV	L/S									-
TRICHLOROBENZENE, 1,2,4-	V	L		3.5E+00	7.3E-01		7.3E-01	1.0E+00		1.0E+00	2.20E+04
TRICHLOROETHANE, 1,1,1-	V	L		2.2E+03	4.6E+02		4.6E+02	6.4E+02		6.4E+02	6.51E+04
TRICHLOROETHANE, 1,1,2-	V	L	1.6E-05	1.4E+01	1.2E-01	1.2E-01	2.9E+00	2.6E-01	2.6E-01	4.1E+00	-
TRICHLOROETHYLENE	V	L	1.1E-04	3.5E+01	1.7E-02	1.7E-02	7.3E+00	3.6E-02	3.6E-02	1.0E+01	1.36E+06
TRICHLOROPHENOL, 2,4,5-	V	S		3.5E+02	7.3E+01		7.3E+01	1.0E+02		1.0E+02	-
TRICHLOROPHENOL, 2,4,6-	NV	S									3.00E-01
VANADIUM	NV	S									-

TABLE E-3. INDOOR AIR SCREENING LEVELS
(volatile chemicals only)

CHEMICAL PARAMETER	Physical State		Health-Based Screening Levels: Unit Risk Factor URF $(ug/m^3)^{-1}$	Reference Concentration RfC (ug/m^3)	[1]Residential Exposure: Lowest Residential (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	Commercial/Industrial Exposure: Lowest C/I (ug/m^3)	Indoor Air (carcinogens) (ug/m^3)	Indoor Air (noncarcinogens) (ug/m^3)	50% Odor Recognition Threshold (Table H-2) (ug/m^3)
VINYL CHLORIDE	V	G	8.9E-06	1.0E+02	2.2E-01	2.2E-01	2.1E+01	4.6E-01	4.6E-01	2.9E+01	7.71E+05
XYLENES	V	L		1.0E+02	2.1E+01		2.1E+01	3.0E+01		3.0E+01	4.41E+02
ZINC	NV	S									-

Notes:

1. "Residential" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Target cancer risk = 1E-06, Target Hazard Quotient = 0.2 for all chemicals except as noted.
Target cancer risk = 1E-05 for TCE and volatile PAHs. Target Hazard Quotient = 0.5 for TPH.
Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S - solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200 (see Table E-1).
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004).
Calculated based on spreadhseet provided with *User's Guide for the Johnson and Ettinger Indoor Air model (1991) for Subsurface Vapor Intrusion Into Buildings (*USEPA 2003) using default input parameter values noted in Appendix 4 (see text for equations).
Indoor air screening levels listed only for volatile chemicals included in database of referenced model spreadsheet (plus MTBE).
URFs as presented in referenced spreadhseet (USEPA 2003). RfCs presented in spreadsheet or added as indicated in Appendix 4 (refer to footnotes to VLOOKUP worksheet).
URF for TBA based on conversion of CSF presented in Table J.
Indoor air screening level for ethanol based on potential odor concerns (refer to Section 5.3.3 and Table H series). Human health risk toxicity data not available but likely to exceed odor thresholds.
50% Odor Recognition Thresholds from Massachusetts Department of Environmental Protection (MADEP, 1994) and ATSDR; included for reference (potential nuisance concerns, see Table H series).

TABLE F-1a. GROUNDWATER SCREENING LEVELS
(groundwater IS a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-1	Drinking Water (Toxicity) Table F-3	Vapor Intrusion Into Buildings Table E-1a	Aquatic Habitat Goal (Chronic) Table F-4a
ACENAPHTHENE	2.0E+01	Ceiling Value	2.0E+01	3.7E+02	4.2E+03	2.3E+01
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Goal	2.0E+03	2.4E+02	(Use soil gas)	3.0E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	2.0E+04	5.5E+03	4.3E+07	1.5E+03
ALDRIN	4.0E-03	Drinking Water Toxicity	8.5E+00	4.0E-03		1.3E-01
ANTHRACENE	7.3E-01	Aquatic Habitat Goal	2.2E+01	1.8E+03	4.3E+01	7.3E-01
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00		3.0E+01
ARSENIC	1.0E+01	Drinking Water Toxicity	5.0E+04	1.0E+01		3.6E+01
BARIUM	2.0E+03	Aquatic Habitat Goal	5.0E+04	2.0E+03		2.0E+03
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	1.6E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	5.0E+00	9.2E-02		2.7E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Goal	1.9E+00	2.0E-01		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Aquatic Habitat Goal	7.0E+00	9.2E-02		9.2E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Goal	1.3E-01	1.5E+03		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Ceiling Value	4.0E-01	9.2E-01		3.7E+00
BERYLLIUM	2.7E+00	Aquatic Habitat Goal	5.0E+04	4.0E+00		2.7E+00
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	3.0E+02	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	9.5E-03	Drinking Water Toxicity	3.6E+02	9.5E-03	1.0E+02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	Drinking Water Toxicity	3.2E+02	2.7E-01	(Use soil gas)	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	Drinking Water Toxicity	6.5E+02	6.0E+00		3.2E+01
BORON	1.6E+00	Aquatic Habitat Goal	5.0E+04	7.3E+03		1.6E+00
BROMODICHLOROMETHANE	1.8E-01	Drinking Water Toxicity	5.0E+04	1.8E-01	2.7E+02	3.2E+03
BROMOFORM	1.0E+02	Drinking Water Toxicity	5.1E+02	1.0E+02		3.2E+03
BROMOMETHANE	8.5E+00	Drinking Water Toxicity	5.0E+04	8.5E+00	4.6E+02	1.6E+02
CADMIUM	2.5E-01	Aquatic Habitat Goal	5.0E+04	5.0E+00		2.5E-01
CARBON TETRACHLORIDE	5.0E+00	Drinking Water Toxicity	5.2E+02	5.0E+00	2.1E+01	9.8E+00
CHLORDANE	4.0E-03	Aquatic Habitat Goal	2.5E+00	2.0E+00		4.0E-03
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Goal	5.0E+04	1.5E+02		5.0E+00
CHLOROBENZENE	2.5E+01	Aquatic Habitat Goal	5.0E+01	1.0E+02	1.1E+04	2.5E+01
CHLOROETHANE	3.9E+00	Aquatic Habitat Goal	1.6E+01	3.9E+00	6.5E+02	3.9E+00
CHLOROFORM	6.2E+01	Indoor Air Impacts	2.4E+03	1.0E+02	6.2E+01	6.2E+02
CHLOROMETHANE	1.6E+02	Drinking Water Toxicity	5.0E+04	1.6E+02	1.9E+03	3.2E+03
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	3.0E+01	4.2E+03	4.4E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Goal	5.0E+04	1.0E+02		7.4E+01
CHROMIUM III	7.4E+01	Aquatic Habitat Goal	5.0E+04	5.5E+04		7.4E+01
CHROMIUM VI	1.1E+01	Aquatic Habitat Goal	5.0E+04	1.1E+02		1.1E+01
CHRYSENE	3.5E-01	Aquatic Habitat Goal	8.0E-01	9.2E+00	(Use soil gas)	3.5E-01
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04	7.3E+02		3.0E+00

TABLE F-1a. GROUNDWATER SCREENING LEVELS
(groundwater IS a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-1	Drinking Water (Toxicity) Table F-3	Vapor Intrusion Into Buildings Table E-1a	Aquatic Habitat Goal (Chronic) Table F-4a
COPPER	3.1E+00	Aquatic Habitat Goal	1.0E+03	1.3E+03		3.1E+00
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+02	2.0E+02	(Use soil gas)	1.0E+00
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	2.5E-01	9.2E-03		7.5E+00
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E-01	Aquatic Habitat Goal	1.0E+01	2.0E-01	(Use soil gas)	2.0E-01
DIBROMOCHLOROMETHANE	1.3E-01	Drinking Water Toxicity	5.0E+04	1.3E-01	1.6E+02	3.2E+03
DIBROMOETHANE, 1,2-	5.0E-02	Drinking Water Toxicity	5.0E+04	5.0E-02	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Value	1.0E+01	6.0E+02	6.1E+04	1.4E+01
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Goal	5.0E+04	1.8E+02	(Use soil gas)	6.5E+01
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	4.9E+02	1.5E+01
DICHLOROBENZIDINE, 3,3-	1.5E-01	Drinking Water Toxicity	1.6E+03	1.5E-01		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	Aquatic Habitat Goal	8.0E+01	2.8E-01		1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	Aquatic Habitat Goal	2.0E+01	2.8E-01		1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	1.5E+00	2.0E-01		1.0E-03
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Goal	5.0E+04	8.0E+02	5.5E+04	4.7E+01
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	1.3E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	7.0E+00	Drinking Water Toxicity	1.5E+03	7.0E+00	5.0E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	4.9E+03	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.3E+03	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Value	3.0E-01	1.1E+02		1.8E+02
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	1.2E+02	1.5E+03
DICHLOROPROPENE, 1,3-	4.0E-01	Drinking Water Toxicity	5.0E+04	4.0E-01	1.6E+02	1.2E+02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	4.1E+01	4.2E-03		1.9E-03
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04	2.9E+04		1.5E+00
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Goal	4.0E+02	7.3E+02		1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04	3.7E+05		1.5E+00
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01		7.5E+01
DINITROTOLUENE, 2,4-	3.4E+01	Drinking Water Toxicity	5.0E+04	3.4E+01		1.2E+02
DIOXANE, 1,4-	6.1E+00	Drinking Water Toxicity	5.0E+04	6.1E+00		3.4E+05
DIOXIN (2,3,7,8-TCDD)	3.0E-08	Drinking Water Toxicity	7.0E+03	3.0E-08		5.0E-06
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	7.5E+01	2.2E+02		8.7E-03
ENDRIN	2.3E-03	Aquatic Habitat Goal	4.1E+01	2.0E+00		2.3E-03
ETHANOL	5.0E+04	Ceiling Value	5.0E+04			
ETHYLBENZENE	3.0E+01	Ceiling Value	3.0E+01	7.0E+02	1.7E+05	2.9E+02
FLUORANTHENE	8.0E+00	Aquatic Habitat Goal	1.3E+02	1.5E+03		8.0E+00
FLUORENE	3.9E+00	Aquatic Habitat Goal	9.5E+02	2.4E+02	1.9E+03	3.9E+00
HEPTACHLOR	3.6E-03	Aquatic Habitat Goal	2.0E+01	4.0E-01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Aquatic Habitat Goal	1.8E+02	2.0E-01		3.6E-03

TABLE F-1a. GROUNDWATER SCREENING LEVELS
(groundwater IS a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-1	Drinking Water (Toxicity) Table F-3	Vapor Intrusion Into Buildings Table E-1a	Aquatic Habitat Goal (Chronic) Table F-4a
HEXACHLOROBENZENE	1.0E+00	Drinking Water Toxicity	5.5E+01	1.0E+00		3.7E+00
HEXACHLOROBUTADIENE	8.6E-01	Drinking Water Toxicity	6.0E+00	8.6E-01		4.7E+00
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Aquatic Habitat Goal	3.5E+03	2.0E-01		8.0E-02
HEXACHLOROETHANE	4.8E+00	Drinking Water Toxicity	1.0E+01	4.8E+00		1.2E+01
INDENO(1,2,3-cd)PYRENE	9.2E-02	Aquatic Habitat Goal	2.7E-01	9.2E-02		9.2E-02
LEAD	2.5E+00	Aquatic Habitat Goal	5.0E+04	1.5E+01		2.5E+00
MERCURY	7.7E-01	Aquatic Habitat Goal	5.0E+04	2.0E+00		7.7E-01
METHOXYCHLOR	1.9E-02	Aquatic Habitat Goal	2.0E+01	4.0E+01		1.9E-02
METHYL ETHYL KETONE	7.0E+03	Drinking Water Toxicity	8.4E+03	7.0E+03	2.1E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+03	2.0E+03	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Aquatic Habitat Goal	5.0E+04	3.7E+00		3.0E-03
METHYL TERT BUTYL ETHER	5.0E+00	Ceiling Value	5.0E+00	1.1E+01	1.9E+04	8.0E+03
METHYLENE CHLORIDE	4.3E+00	Drinking Water Toxicity	9.1E+03	4.3E+00	4.2E+03	2.2E+03
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	Aquatic Habitat Goal	1.0E+01	2.4E+02	2.6E+04	2.1E+00
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02		2.4E+02
NAPHTHALENE	6.2E+00	Drinking Water Toxicity	2.1E+01	6.2E+00	2.3E+04	2.4E+01
NICKEL	8.2E+00	Aquatic Habitat Goal	5.0E+04	1.0E+02		8.2E+00
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00		7.9E+00
PERCHLORATE	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00		6.0E+02
PHENANTHRENE	4.6E+00	Aquatic Habitat Goal	4.1E+02	2.4E+02	(Use soil gas)	4.6E+00
PHENOL	5.0E+00	Ceiling Value	5.0E+00	1.1E+04		1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	1.6E+01	5.0E-01		1.4E-02
PYRENE	2.0E+00	Aquatic Habitat Goal	6.8E+01	1.8E+02	1.4E+02	2.0E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04	5.0E+01		5.0E+00
SILVER	1.9E-01	Aquatic Habitat Goal	1.0E+02	1.8E+02		1.9E-01
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	3.1E+05	1.0E+02
tert-BUTYL ALCOHOL	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	(Use soil gas)	9.3E+02
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	Drinking Water Toxicity	5.0E+02	5.6E-02	1.5E+02	4.2E+02
TETRACHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	9.9E+01	1.2E+02
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00		2.0E+01
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	3.8E+05	1.3E+02
TOXAPHENE	2.0E-04	Aquatic Habitat Goal	1.4E+02	3.0E+00		2.0E-04
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	(Use soil gas)	5.0E+02
TPH (middle distillates)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	(Use soil gas)	6.4E+02
TPH (residual fuels)	1.0E+02	Ceiling Value	1.0E+02	1.0E+03		6.4E+02
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Goal	3.0E+03	7.0E+01	2.0E+03	2.5E+01

TABLE F-1a. GROUNDWATER SCREENING LEVELS
(groundwater IS a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-1	Drinking Water (Toxicity) Table F-3	Vapor Intrusion Into Buildings Table E-1a	Aquatic Habitat Goal (Chronic) Table F-4a
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Goal	9.7E+02	2.0E+02	1.0E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	2.8E+02	4.7E+03
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	7.4E+01	3.6E+02
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Goal	2.0E+02	6.1E+02	6.5E+05	1.1E+01
TRICHLOROPHENOL, 2,4,6-	3.7E+00	Drinking Water Toxicity	1.0E+02	3.7E+00		4.9E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04	3.7E+01		1.9E+01
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	1.1E+01	7.8E+02
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	1.2E+05	1.0E+02
ZINC	8.1E+01	Aquatic Habitat Goal	5.0E+03	1.1E+04		8.1E+01

Notes:

1. Lowest of Ceiling Value, Drinking Water (toxicity) goal, Indoor-Air Impact goal and Aquatic Habitat Goal>Used to develop soil leaching levels for protection of groundwater quality.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

sol - solubility threshold

Ceiling Level: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation.

Odor-thresholds assume no dilution.

Human Toxicity: Based on primary maximum concentration levels (MCLs), or equivalent. Considered protective of human health.

Indoor Air Impact: Addresses potential emission of volatile chemicals from groundwater and subsequent impact on indoor air. Value for very permeable (e.g., sandy vadose-zone soils).

Aquatic Habitat Goal: Addresses potential discharge of groundwater to surface waterbody and subsequent impact on aquatic life; Potential dilution upon discharge to surface water not considered.

Review of aquatic ecotoxicty data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).

Method detection limits and background concentrations replace final screening level as appropriate.

TABLE F-1b. GROUNDWATER SCREENING LEVELS
(groundwater IS NOT a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-2	Vapor Intrusion Into Buildings Table E-1a	Estuary Aquatic Habitat Goal (Chronic) Table F-4a
ACENAPHTHENE	2.3E+01	Aquatic Habitat Goal	2.0E+02	4.2E+03	2.3E+01
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Goal	2.0E+03	(Use soil gas)	3.0E+01
ACETONE	1.5E+03	Aquatic Habitat Goal	5.0E+04	4.3E+07	1.5E+03
ALDRIN	1.3E-01	Aquatic Habitat Goal	8.5E+00		1.3E-01
ANTHRACENE	7.3E-01	Aquatic Habitat Goal	2.2E+01	4.3E+01	7.3E-01
ANTIMONY	3.0E+01	Aquatic Habitat Goal	5.0E+04		3.0E+01
ARSENIC	3.6E+01	Aquatic Habitat Goal	5.0E+04		3.6E+01
BARIUM	2.0E+03	Aquatic Habitat Goal	5.0E+04		2.0E+03
BENZENE	4.6E+01	Aquatic Habitat Goal	2.0E+04	1.6E+03	4.6E+01
BENZO(a)ANTHRACENE	2.7E-02	Aquatic Habitat Goal	5.0E+00		2.7E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Goal	1.9E+00		1.4E-02
BENZO(b)FLUORANTHENE	9.2E-02	Aquatic Habitat Goal	7.0E+00		9.2E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Goal	1.3E-01		1.0E-01
BENZO(k)FLUORANTHENE	4.0E-01	Ceiling Value	4.0E-01		3.7E+00
BERYLLIUM	2.7E+00	Aquatic Habitat Goal	5.0E+04		2.7E+00
BIPHENYL, 1,1-	5.0E+00	Ceiling Value	5.0E+00	(Use soil gas)	1.4E+01
BIS(2-CHLOROETHYL)ETHER	6.1E+01	Aquatic Habitat Goal	3.6E+03	1.0E+02	6.1E+01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Goal	3.2E+03	(Use soil gas)	6.1E+01
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	Aquatic Habitat Goal	6.5E+02		3.2E+01
BORON	1.6E+00	Aquatic Habitat Goal	5.0E+04		1.6E+00
BROMODICHLOROMETHANE	2.7E+02	Indoor Air Impacts	5.0E+04	2.7E+02	3.2E+03
BROMOFORM	3.2E+03	Aquatic Habitat Goal	5.1E+03		3.2E+03
BROMOMETHANE	1.6E+02	Aquatic Habitat Goal	5.0E+04	4.6E+02	1.6E+02
CADMIUM	2.5E-01	Aquatic Habitat Goal	5.0E+04		2.5E-01
CARBON TETRACHLORIDE	9.8E+00	Aquatic Habitat Goal	5.2E+03	2.1E+01	9.8E+00
CHLORDANE	4.0E-03	Aquatic Habitat Goal	2.5E+01		4.0E-03
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
CHLOROBENZENE	2.5E+01	Aquatic Habitat Goal	5.0E+02	1.1E+04	2.5E+01
CHLOROETHANE	3.9E+00	Aquatic Habitat Goal	1.6E+02	6.5E+02	3.9E+00
CHLOROFORM	6.2E+01	Indoor Air Impacts	2.4E+04	6.2E+01	6.2E+02
CHLOROMETHANE	1.9E+03	Indoor Air Impacts	5.0E+04	1.9E+03	3.2E+03
CHLOROPHENOL, 2-	1.8E+00	Ceiling Value	1.8E+00	4.2E+03	4.4E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Goal	5.0E+04		7.4E+01
CHROMIUM III	7.4E+01	Aquatic Habitat Goal	5.0E+04		7.4E+01
CHROMIUM VI	1.1E+01	Aquatic Habitat Goal	5.0E+04		1.1E+01
CHRYSENE	3.5E-01	Aquatic Habitat Goal	8.0E-01	(Use soil gas)	3.5E-01
COBALT	3.0E+00	Aquatic Habitat Goal	5.0E+04		3.0E+00
COPPER	3.1E+00	Aquatic Habitat Goal	5.0E+04		3.1E+00

TABLE F-1b. GROUNDWATER SCREENING LEVELS
(groundwater IS NOT a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-2	Vapor Intrusion Into Buildings Table E-1a	Estuary Aquatic Habitat Goal (Chronic) Table F-4a
CYANIDE (Free)	1.0E+00	Aquatic Habitat Goal	1.7E+03	(Use soil gas)	1.0E+00
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Ceiling Value	2.5E-01		7.5E+00
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E-01	Aquatic Habitat Goal	1.0E+02	(Use soil gas)	2.0E-01
DIBROMOCHLOROMETHANE	1.6E+02	Indoor Air Impacts	5.0E+04	1.6E+02	3.2E+03
DIBROMOETHANE, 1,2-	1.6E+01	Indoor Air Impacts	5.0E+04	1.6E+01	1.4E+03
DICHLOROBENZENE, 1,2-	1.4E+01	Aquatic Habitat Goal	1.0E+02	6.1E+04	1.4E+01
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	6.5E+01
DICHLOROBENZENE, 1,4-	1.5E+01	Aquatic Habitat Goal	1.1E+02	4.9E+02	1.5E+01
DICHLOROBENZIDINE, 3,3-	2.5E+02	Aquatic Habitat Goal	1.6E+03		2.5E+02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	Aquatic Habitat Goal	8.0E+01		1.0E-03
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	Aquatic Habitat Goal	2.0E+01		1.0E-03
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	Aquatic Habitat Goal	1.5E+00		1.0E-03
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Goal	5.0E+04	5.5E+04	4.7E+01
DICHLOROETHANE, 1,2-	1.3E+02	Indoor Air Impacts	5.0E+04	1.3E+02	1.0E+04
DICHLOROETHYLENE, 1,1-	2.5E+01	Aquatic Habitat Goal	1.5E+04	5.0E+03	2.5E+01
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Goal	5.0E+04	4.9E+03	5.9E+02
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	Aquatic Habitat Goal	2.6E+03	5.3E+03	5.9E+02
DICHLOROPHENOL, 2,4-	3.0E+00	Ceiling Value	3.0E+00		1.8E+02
DICHLOROPROPANE, 1,2-	1.0E+02	Ceiling Value	1.0E+02	1.2E+02	1.5E+03
DICHLOROPROPENE, 1,3-	1.2E+02	Aquatic Habitat Goal	5.0E+04	1.6E+02	1.2E+02
DIELDRIN	1.9E-03	Aquatic Habitat Goal	9.3E+01		1.9E-03
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04		1.5E+00
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Goal	4.0E+03		1.1E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Goal	5.0E+04		1.5E+00
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Goal	5.0E+04		7.5E+01
DINITROTOLUENE, 2,4-	1.2E+02	Aquatic Habitat Goal	5.0E+04		1.2E+02
DIOXANE, 1,4-	5.0E+04	Ceiling Value	5.0E+04		3.4E+05
DIOXIN (2,3,7,8-TCDD)	5.0E-06	Aquatic Habitat Goal	7.0E+03		5.0E-06
ENDOSULFAN	8.7E-03	Aquatic Habitat Goal	7.5E+01		8.7E-03
ENDRIN	2.3E-03	Aquatic Habitat Goal	1.3E+02		2.3E-03
ETHANOL	5.0E+04	Ceiling Value	5.0E+04		
ETHYLBENZENE	2.9E+02	Aquatic Habitat Goal	3.0E+02	1.7E+05	2.9E+02
FLUORANTHENE	8.0E+00	Aquatic Habitat Goal	1.3E+02		8.0E+00
FLUORENE	3.9E+00	Aquatic Habitat Goal	9.5E+02	1.9E+03	3.9E+00
HEPTACHLOR	3.6E-03	Aquatic Habitat Goal	2.8E+01		3.6E-03
HEPTACHLOR EPOXIDE	3.6E-03	Aquatic Habitat Goal	1.8E+02		3.6E-03
HEXACHLOROBENZENE	3.7E+00	Aquatic Habitat Goal	5.5E+01		3.7E+00
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Goal	6.0E+01		4.7E+00

TABLE F-1b. GROUNDWATER SCREENING LEVELS
(groundwater IS NOT a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-2	Vapor Intrusion Into Buildings Table E-1a	Estuary Aquatic Habitat Goal (Chronic) Table F-4a
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	Aquatic Habitat Goal	3.5E+03		8.0E-02
HEXACHLOROETHANE	1.2E+01	Aquatic Habitat Goal	1.0E+02		1.2E+01
INDENO(1,2,3-cd)PYRENE	9.2E-02	Aquatic Habitat Goal	2.7E-01		9.2E-02
LEAD	2.5E+00	Aquatic Habitat Goal	5.0E+04		2.5E+00
MERCURY	7.7E-01	Aquatic Habitat Goal	5.0E+04		7.7E-01
METHOXYCHLOR	1.9E-02	Aquatic Habitat Goal	2.0E+01		1.9E-02
METHYL ETHYL KETONE	1.4E+04	Aquatic Habitat Goal	5.0E+04	2.1E+08	1.4E+04
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Goal	1.3E+04	1.9E+07	1.7E+02
METHYL MERCURY	3.0E-03	Aquatic Habitat Goal	5.0E+04		3.0E-03
METHYL TERT BUTYL ETHER	1.8E+03	Ceiling Value	1.8E+03	1.9E+04	8.0E+03
METHYLENE CHLORIDE	2.2E+03	Aquatic Habitat Goal	5.0E+04	4.2E+03	2.2E+03
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	Aquatic Habitat Goal	1.0E+02	2.6E+04	2.1E+00
MOLYBDENUM	2.4E+02	Aquatic Habitat Goal	5.0E+04		2.4E+02
NAPHTHALENE	2.4E+01	Aquatic Habitat Goal	2.1E+02	2.3E+04	2.4E+01
NICKEL	8.2E+00	Aquatic Habitat Goal	5.0E+04		8.2E+00
PENTACHLOROPHENOL	7.9E+00	Aquatic Habitat Goal	5.9E+03		7.9E+00
PERCHLORATE	6.0E+02	Aquatic Habitat Goal	5.0E+04		6.0E+02
PHENANTHRENE	4.6E+00	Aquatic Habitat Goal	4.1E+02	(Use soil gas)	4.6E+00
PHENOL	1.3E+03	Aquatic Habitat Goal	5.0E+04		1.3E+03
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	Aquatic Habitat Goal	1.6E+01		1.4E-02
PYRENE	2.0E+00	Aquatic Habitat Goal	6.8E+01	1.4E+02	2.0E+00
SELENIUM	5.0E+00	Aquatic Habitat Goal	5.0E+04		5.0E+00
SILVER	1.9E-01	Aquatic Habitat Goal	5.0E+04		1.9E-01
STYRENE	1.0E+02	Aquatic Habitat Goal	1.1E+02	3.1E+05	1.0E+02
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	1.8E+04
TETRACHLOROETHANE, 1,1,1,2-	9.3E+02	Aquatic Habitat Goal	5.0E+04	(Use soil gas)	9.3E+02
TETRACHLOROETHANE, 1,1,2,2-	1.5E+02	Indoor Air Impacts	5.0E+03	1.5E+02	4.2E+02
TETRACHLOROETHYLENE	9.9E+01	Indoor Air Impacts	3.0E+03	9.9E+01	1.2E+02
THALLIUM	2.0E+01	Aquatic Habitat Goal	5.0E+04		2.0E+01
TOLUENE	1.3E+02	Aquatic Habitat Goal	4.0E+02	3.8E+05	1.3E+02
TOXAPHENE	2.0E-04	Aquatic Habitat Goal	1.4E+02		2.0E-04
TPH (gasolines)	5.0E+02	Aquatic Habitat Goal	5.0E+03	(Use soil gas)	5.0E+02
TPH (middle distillates)	6.4E+02	Aquatic Habitat Goal	2.5E+03	(Use soil gas)	6.4E+02
TPH (residual fuels)	6.4E+02	Aquatic Habitat Goal	2.5E+03		6.4E+02
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Goal	3.0E+04	2.0E+03	2.5E+01
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Goal	5.0E+04	1.0E+05	6.2E+01
TRICHLOROETHANE, 1,1,2-	2.8E+02	Indoor Air Impacts	5.0E+04	2.8E+02	4.7E+03
TRICHLOROETHYLENE	7.4E+01	Indoor Air Impacts	5.0E+04	7.4E+01	3.6E+02

TABLE F-1b. GROUNDWATER SCREENING LEVELS
(groundwater IS NOT a current or potential drinking water resource)
(ug/l)

CHEMICAL PARAMETER	[1]Final Groundwater Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-2	Vapor Intrusion Into Buildings Table E-1a	Estuary Aquatic Habitat Goal (Chronic) Table F-4a
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Goal	2.0E+03	6.5E+05	1.1E+01
TRICHLOROPHENOL, 2,4,6-	4.9E+02	Aquatic Habitat Goal	1.0E+03		4.9E+02
VANADIUM	1.9E+01	Aquatic Habitat Goal	5.0E+04		1.9E+01
VINYL CHLORIDE	1.1E+01	Indoor Air Impacts	3.4E+04	1.1E+01	7.8E+02
XYLENES	1.0E+02	Aquatic Habitat Goal	5.3E+03	1.2E+05	1.0E+02
ZINC	8.1E+01	Aquatic Habitat Goal	5.0E+04		8.1E+01

Notes:

1. Lowest of groundwater Ceiling Value, Indoor-Air Impact goal and Aquatic Habitat Goal. Used to develop soil leaching levels for protection of groundwater quality.

NV: No Value. Use of soil gas screening levels recommended for chemicals with inadequate physio-chemical constant data for groundwater models.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

sol - solubility threshold

Category includes groundwater that does not meet drinking water quality requirements under natural conditions (e.g., excessive total dissolved solids) AND/OR situated in strata that lack adequate aquifer characteristics AND is not likely to otherwise directly impact a source of drinking water.

Ceiling Level: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit general groundwater resource degradation.

Odor-thresholds assume ten-fold dilution of groundwater upon mixing with surface water.

Indoor Air Impact: Addresses potential emission of volatile chemicals from groundwater and subsequent impact on indoor air.

Value for very permeable (e.g., coarse-grained soils).

Aquatic Life Protection: Addresses potential discharge of groundwater to surface waterbody and subsequent impact on aquatic life; screening levels assume no dilution upon discharge to surface water unless otherwise noted.

Review of aquatic ecotoxicty data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).

Method detection limits and background concentrations replace final screening level as appropriate.

TABLE F-2a. SURFACE WATER SCREENING LEVELS
Fresh Water Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-3	Drinking Water (Toxicity) Table F-3	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
ACENAPHTHENE	2.0E+01	Ceiling Value	2.0E+01	3.7E+02	2.3E+01	9.9E+02
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	2.4E+02	3.0E+01	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	5.5E+03	1.5E+03	
ALDRIN	5.0E-05	Bioaccumulation/Human Consumption	8.5E+00	4.0E-03	3.0E-01	5.0E-05
ANTHRACENE	7.3E-01	Aquatic Habitat Chronic Toxicity	2.2E+01	1.8E+03	7.3E-01	4.0E+04
ANTIMONY	6.0E+00	Drinking Water Toxicity	5.0E+04	6.0E+00	3.0E+01	6.4E+02
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	1.0E+01	1.5E+02	1.4E-01
BARIUM	2.0E+03	Drinking Water Toxicity	5.0E+04	2.0E+03	2.0E+03	
BENZENE	5.0E+00	Drinking Water Toxicity	1.7E+02	5.0E+00	4.6E+01	5.1E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	5.0E+00	9.2E-02	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	1.9E+00	2.0E-01	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.0E+00	9.2E-02	9.2E-02	1.8E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Chronic Toxicity	1.3E-01	1.5E+03	1.0E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	9.2E-01	3.7E+00	1.8E-02
BERYLLIUM	2.7E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	4.0E+00	2.7E+00	
BIPHENYL, 1,1-	5.0E-01	Ceiling Value	5.0E-01	3.0E+02	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	9.5E-03	Drinking Water Toxicity	3.6E+02	9.5E-03	6.1E+01	5.3E-01
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	Drinking Water Toxicity	3.2E+02	2.7E-01	6.1E+01	6.5E+04
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	6.5E+02	6.0E+00	3.2E+01	2.2E+00
BORON	1.6E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+03	1.6E+00	
BROMODICHLOROMETHANE	1.8E-01	Drinking Water Toxicity	5.0E+04	1.8E-01	3.2E+03	
BROMOFORM	1.0E+02	Drinking Water Toxicity	5.1E+02	1.0E+02	3.2E+03	1.4E+02
BROMOMETHANE	8.5E+00	Drinking Water Toxicity	5.0E+04	8.5E+00	1.6E+02	1.5E+03
CADMIUM	2.5E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	2.5E-01	
CARBON TETRACHLORIDE	1.6E+00	Bioaccumulation/Human Consumption	5.2E+02	5.0E+00	9.8E+00	1.6E+00
CHLORDANE	8.1E-04	Bioaccumulation/Human Consumption	2.5E+00	2.0E+00	4.3E-03	8.1E-04
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+02	5.0E+00	
CHLOROBENZENE	2.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+01	1.0E+02	2.5E+01	2.1E+04
CHLOROETHANE	3.9E+00	Drinking Water Toxicity	1.6E+01	3.9E+00	3.9E+00	
CHLOROFORM	1.0E+02	Drinking Water Toxicity	2.4E+03	1.0E+02	6.2E+02	4.7E+02
CHLOROMETHANE	1.6E+02	Drinking Water Toxicity	5.0E+04	1.6E+02	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Value	1.8E-01	3.0E+01	4.4E+02	1.5E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+02	7.4E+01	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.5E+04	7.4E+01	
CHROMIUM VI	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+02	1.1E+01	

TABLE F-2a. SURFACE WATER SCREENING LEVELS
Fresh Water Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-3	Drinking Water (Toxicity) Table F-3	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	9.2E+00	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	7.3E+02	3.0E+00	
COPPER	9.0E+00	Aquatic Habitat Chronic Toxicity	1.0E+03	1.3E+03	9.0E+00	
CYANIDE (Free)	5.2E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	2.0E+02	5.2E+00	2.2E+05
DIBENZO(a,h)ANTHTRACENE	9.2E-03	Drinking Water Toxicity	2.5E-01	9.2E-03	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E-01	Drinking Water Toxicity	1.0E+01	2.0E-01	2.0E-01	
DIBROMOCHLOROMETHANE	1.3E-01	Drinking Water Toxicity	5.0E+04	1.3E-01	3.2E+03	1.3E+01
DIBROMOETHANE, 1,2-	5.0E-02	Drinking Water Toxicity	5.0E+04	5.0E-02	1.4E+03	
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Value	1.0E+01	6.0E+02	1.4E+01	1.7E+04
DICHLOROBENZENE, 1,3-	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+02	7.1E+01	9.6E+02
DICHLOROBENZENE, 1,4-	5.0E+00	Ceiling Value	5.0E+00	7.5E+01	1.5E+01	2.6E+03
DICHLOROBENZIDINE, 3,3-	2.8E-02	Bioaccumulation/Human Consumption	1.6E+03	1.5E-01	2.5E+02	2.8E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	8.0E+01	2.8E-01	1.0E-03	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	2.8E-01	1.0E-03	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.2E-04	Bioaccumulation/Human Consumption	1.5E+00	2.0E-01	1.0E-03	2.2E-04
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.0E+02	4.7E+01	
DICHLOROETHANE, 1,2-	5.0E+00	Drinking Water Toxicity	7.0E+03	5.0E+00	1.0E+04	3.7E+01
DICHLOROETHYLENE, 1,1-	3.2E+00	Bioaccumulation/Human Consumption	1.5E+03	7.0E+00	2.5E+01	3.2E+00
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	Drinking Water Toxicity	5.0E+04	7.0E+01	5.9E+02	
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	Drinking Water Toxicity	2.6E+02	1.0E+02	5.9E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Value	3.0E-01	1.1E+02	1.8E+02	2.9E+02
DICHLOROPROPANE, 1,2-	5.0E+00	Drinking Water Toxicity	1.0E+01	5.0E+00	2.9E+03	1.5E+01
DICHLOROPROPENE, 1,3-	4.0E-01	Drinking Water Toxicity	5.0E+04	4.0E-01	1.2E+02	1.7E+03
DIELDRIN	5.4E-05	Bioaccumulation/Human Consumption	4.1E+01	4.2E-03	5.6E-02	5.4E-05
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.9E+04	1.5E+00	4.4E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	Ceiling Value	4.0E+02	7.3E+02	5.3E+02	8.5E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+05	1.5E+00	1.1E+06
DINITROPHENOL, 2,4-	7.3E+01	Drinking Water Toxicity	5.0E+04	7.3E+01	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4-	3.4E+00	Bioaccumulation/Human Consumption	5.0E+04	3.4E+01	1.2E+02	3.4E+00
DIOXANE, 1,4-	6.1E+00	Drinking Water Toxicity	5.0E+04	6.1E+00	3.4E+05	
DIOXIN (2,3,7,8-TCDD)	5.1E-09	Bioaccumulation/Human Consumption	7.0E+03	3.0E-08	5.0E-06	5.1E-09
ENDOSULFAN	5.6E-02	Aquatic Habitat Chronic Toxicity	7.5E+01	2.2E+02	5.6E-02	8.9E+01
ENDRIN	3.6E-02	Aquatic Habitat Chronic Toxicity	4.1E+01	2.0E+00	3.6E-02	8.1E-01
ETHANOL	5.0E+04	Ceiling Value	5.0E+04			
ETHYLBENZENE	3.0E+01	Ceiling Value	3.0E+01	7.0E+02	2.9E+02	2.9E+04

TABLE F-2a. SURFACE WATER SCREENING LEVELS
Fresh Water Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-3	Drinking Water (Toxicity) Table F-3	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
FLUORANTHENE	8.1E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	1.5E+03	8.1E+00	1.4E+02
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	2.4E+02	3.9E+00	5.3E+03
HEPTACHLOR	7.9E-05	Bioaccumulation/Human Consumption	2.0E+01	4.0E-01	3.8E-03	7.9E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.8E+02	2.0E-01	3.8E-03	3.9E-05
HEXACHLOROBENZENE	2.9E-04	Bioaccumulation/Human Consumption	5.5E+01	1.0E+00	3.7E+00	2.9E-04
HEXACHLOROBUTADIENE	8.6E-01	Drinking Water Toxicity	6.0E+00	8.6E-01	4.7E+00	1.8E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	Bioaccumulation/Human Consumption	3.5E+03	2.0E-01	8.0E-02	6.3E-02
HEXACHLOROETHANE	3.3E+00	Bioaccumulation/Human Consumption	1.0E+01	4.8E+00	1.2E+01	3.3E+00
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	2.7E-01	9.2E-02	9.2E-02	1.8E-02
LEAD	2.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+01	2.5E+00	
MERCURY	3.0E-01	Bioaccumulation/Human Consumption	5.0E+04	2.0E+00	7.7E-01	3.0E-01
METHOXYCHLOR	1.9E-02	Aquatic Habitat Chronic Toxicity	2.0E+01	4.0E+01	1.9E-02	
METHYL ETHYL KETONE	7.0E+03	Drinking Water Toxicity	8.4E+03	7.0E+03	1.4E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	2.0E+03	1.7E+02	
METHYL MERCURY	3.0E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+00	3.0E-03	
METHYL TERT BUTYL ETHER	5.0E+00	Ceiling Value	5.0E+00	1.1E+01	6.6E+04	
METHYLENE CHLORIDE	4.3E+00	Drinking Water Toxicity	9.1E+03	4.3E+00	2.2E+03	5.9E+02
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.4E+02	2.1E+00	
MOLYBDENUM	1.8E+02	Drinking Water Toxicity	5.0E+04	1.8E+02	2.4E+02	
NAPHTHALENE	6.2E+00	Drinking Water Toxicity	2.1E+01	6.2E+00	2.4E+01	
NICKEL	5.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.0E+02	5.2E+01	4.6E+03
PENTACHLOROPHENOL	1.0E+00	Drinking Water Toxicity	3.0E+01	1.0E+00	1.5E+01	3.0E+00
PERCHLORATE	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	6.0E+02	
PHENANTHRENE	6.3E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	2.4E+02	6.3E+00	
PHENOL	5.0E+00	Ceiling Value	5.0E+00	1.1E+04	1.3E+03	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	6.4E-05	Bioaccumulation/Human Consumption	1.6E+01	5.0E-01	1.4E-02	6.4E-05
PYRENE	2.0E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	1.8E+02	2.0E+00	4.0E+03
SELENIUM	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	5.0E+00	
SILVER	3.2E-01	Aquatic Habitat Chronic Toxicity	1.0E+02	1.8E+02	3.2E-01	
STYRENE	1.0E+01	Ceiling Value	1.0E+01	1.0E+02	1.0E+02	
tert-BUTYL ALCOHOL	3.7E+00	Drinking Water Toxicity	5.0E+04	3.7E+00	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	Drinking Water Toxicity	5.0E+04	4.3E-01	9.3E+02	
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	Drinking Water Toxicity	5.0E+02	5.6E-02	4.2E+02	4.0E+00
TETRACHLOROETHYLENE	3.3E+00	Bioaccumulation/Human Consumption	1.7E+02	5.0E+00	1.2E+02	3.3E+00
THALLIUM	2.0E+00	Drinking Water Toxicity	5.0E+04	2.0E+00	2.0E+01	6.3E+00

TABLE F-2a. SURFACE WATER SCREENING LEVELS
Fresh Water Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Ceiling Value (Taste & Odors, etc.) Table I-3	Drinking Water (Toxicity) Table F-3	Fresh Water Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
TOLUENE	4.0E+01	Ceiling Value	4.0E+01	1.0E+03	1.3E+02	2.0E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	3.0E+00	2.0E-04	2.8E-04
TPH (gasolines)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	5.0E+02	
TPH (middle distillates)	1.0E+02	Ceiling Value	1.0E+02	1.0E+02	6.4E+02	
TPH (residual fuels)	1.0E+02	Ceiling Value	1.0E+02	1.0E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Chronic Toxicity	3.0E+03	7.0E+01	2.5E+01	
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Chronic Toxicity	9.7E+02	2.0E+02	6.2E+01	
TRICHLOROETHANE, 1,1,2-	5.0E+00	Drinking Water Toxicity	5.0E+04	5.0E+00	4.7E+03	1.6E+01
TRICHLOROETHYLENE	5.0E+00	Drinking Water Toxicity	3.1E+02	5.0E+00	3.6E+02	3.0E+01
TRICHLOROPHENOL, 2,4,5-	6.3E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	6.1E+02	6.3E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	3.7E+00	Drinking Water Toxicity	1.0E+02	3.7E+00	4.9E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.7E+01	1.9E+01	
VINYL CHLORIDE	2.0E+00	Drinking Water Toxicity	3.4E+03	2.0E+00	7.8E+02	5.3E+02
XYLENES	2.0E+01	Ceiling Value	2.0E+01	1.0E+04	1.0E+02	
ZINC	1.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	1.1E+04	1.2E+02	

Notes:

1. Lowest of ceiling value, drinking water goal, aquatic habitat goal, and bioaccumulation goal.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Ceiling Level: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit nuisances and general resource degradation.
Review of aquatic ecotoxicty data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).
Method detection limits and background concentrations replace final screening level as appropriate.

TABLE F-2b. SURFACE WATER SCREENING LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
ACENAPHTHENE	2.0E+01	Ceiling Level	2.0E+01	4.0E+01	9.9E+02
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	3.0E+01	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.5E+03	
ALDRIN	5.0E-05	Bioaccumulation/Human Consumption	8.5E+00	1.3E-01	5.0E-05
ANTHRACENE	7.3E-01	Aquatic Habitat Chronic Toxicity	2.2E+01	7.3E-01	4.0E+04
ANTIMONY	5.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+02	6.4E+02
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	3.6E+01	1.4E-01
BARIUM	2.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+03	
BENZENE	5.1E+01	Bioaccumulation/Human Consumption	2.0E+03	3.5E+02	5.1E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	5.0E+00	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	1.9E+00	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.0E+00	9.2E-02	1.8E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Chronic Toxicity	1.3E-01	1.0E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	3.7E+00	1.8E-02
BERYLLIUM	2.7E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.7E+00	
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	5.3E-01	Bioaccumulation/Human Consumption	3.6E+02	6.1E+01	5.3E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Chronic Toxicity	3.2E+02	6.1E+01	6.5E+04
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	6.5E+02	3.2E+01	2.2E+00
BORON	1.6E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+00	
BROMODICHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	3.2E+03	1.4E+02
BROMOMETHANE	1.5E+03	Bioaccumulation/Human Consumption	5.0E+04	3.2E+03	1.5E+03
CADMIUM	8.8E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.8E+00	
CARBON TETRACHLORIDE	1.6E+00	Bioaccumulation/Human Consumption	5.2E+02	3.2E+03	1.6E+00
CHLORDANE	8.1E-04	Bioaccumulation/Human Consumption	2.5E+00	4.0E-03	8.1E-04
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
CHLOROBENZENE	5.0E+01	Ceiling Level	5.0E+01	6.5E+01	2.1E+04
CHLOROETHANE	3.9E+00	Aquatic Habitat Chronic Toxicity	1.6E+01	3.9E+00	
CHLOROFORM	4.7E+02	Bioaccumulation/Human Consumption	2.4E+03	3.2E+03	4.7E+02
CHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	4.4E+02	1.5E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.4E+01	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.4E+01	
CHROMIUM VI	5.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+01	

TABLE F-2b. SURFACE WATER SCREENING LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	
COPPER	3.1E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.1E+00	
CYANIDE (Free)	1.0E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	1.0E+00	2.2E+05
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	2.5E-01	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E-01	Aquatic Habitat Chronic Toxicity	1.0E+01	2.0E-01	
DIBROMOCHLOROMETHANE	1.3E+01	Bioaccumulation/Human Consumption	5.0E+04	3.2E+03	1.3E+01
DIBROMOETHANE, 1,2-	1.4E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+03	
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	6.5E+01	1.7E+04
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	9.6E+02
DICHLOROBENZENE, 1,4-	1.1E+01	Ceiling Level	1.1E+01	6.5E+01	2.6E+03
DICHLOROBENZIDINE, 3,3-	2.8E-02	Bioaccumulation/Human Consumption	1.6E+03	2.5E+02	2.8E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	8.0E+01	1.0E-03	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	1.0E-03	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.2E-04	Bioaccumulation/Human Consumption	1.5E+00	1.0E-03	2.2E-04
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+01	
DICHLOROETHANE, 1,2-	3.7E+01	Bioaccumulation/Human Consumption	2.0E+04	1.0E+04	3.7E+01
DICHLOROETHYLENE, 1,1-	3.2E+00	Bioaccumulation/Human Consumption	1.5E+03	2.5E+01	3.2E+00
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	5.9E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.9E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	1.8E+02	2.9E+02
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.5E+03	1.5E+01
DICHLOROPROPENE, 1,3-	1.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.2E+02	1.7E+03
DIELDRIN	5.4E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	5.4E-05
DIETHYLPHTHALATE	1.7E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+00	4.4E+04
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.1E+02	8.5E+02
DIMETHYLPHTHALATE	1.7E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.7E+00	1.1E+06
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4-	3.4E+00	Bioaccumulation/Human Consumption	5.0E+04	1.9E+02	3.4E+00
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	5.0E+05	
DIOXIN (2,3,7,8-TCDD)	5.1E-09	Bioaccumulation/Human Consumption	7.0E+03	5.0E-06	5.1E-09
ENDOSULFAN	8.7E-03	Aquatic Habitat Chronic Toxicity	7.5E+01	8.7E-03	8.9E+01
ENDRIN	2.3E-03	Aquatic Habitat Chronic Toxicity	4.1E+01	2.3E-03	8.1E-01
ETHANOL	5.0E+04	Ceiling Level	5.0E+04		
ETHYLBENZENE	3.0E+01	Ceiling Level	3.0E+01	2.9E+02	2.9E+04

TABLE F-2b. SURFACE WATER SCREENING LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
FLUORANTHENE	8.0E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+00	1.4E+02
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	3.9E+00	5.3E+03
HEPTACHLOR	7.9E-05	Bioaccumulation/Human Consumption	2.0E+01	3.6E-03	7.9E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.8E+02	3.6E-03	3.9E-05
HEXACHLOROBENZENE	2.9E-04	Bioaccumulation/Human Consumption	5.5E+01	6.5E+01	2.9E-04
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Chronic Toxicity	6.0E+00	4.7E+00	1.8E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	Bioaccumulation/Human Consumption	3.5E+03	8.0E-02	6.3E-02
HEXACHLOROETHANE	3.3E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	3.3E+00
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	2.7E-01	9.2E-02	1.8E-02
LEAD	8.1E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+00	
MERCURY	3.0E-01	Bioaccumulation/Human Consumption	5.0E+04	9.4E-01	3.0E-01
METHOXYCHLOR	1.9E-02	Aquatic Habitat Chronic Toxicity	2.0E+01	1.9E-02	
METHYL ETHYL KETONE	8.4E+03	Ceiling Level	8.4E+03	1.4E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	1.7E+02	
METHYL MERCURY	3.0E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E-03	
METHYL TERT BUTYL ETHER	1.8E+02	Ceiling Level	1.8E+02	8.0E+03	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	3.2E+03	5.9E+02
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
MOLYBDENUM	2.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.4E+02	
NAPHTHALENE	2.1E+01	Ceiling Level	2.1E+01	2.4E+01	
NICKEL	8.2E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.2E+00	4.6E+03
PENTACHLOROPHENOL	3.0E+00	Bioaccumulation/Human Consumption	5.9E+02	7.9E+00	3.0E+00
PERCHLORATE	6.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	
PHENANTHRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	4.6E+00	
PHENOL	1.3E+03	Aquatic Habitat Chronic Toxicity	7.9E+03	1.3E+03	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	6.4E-05	Bioaccumulation/Human Consumption	1.6E+01	3.0E-02	6.4E-05
PYRENE	2.0E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	2.0E+00	4.0E+03
SELENIUM	7.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.1E+01	
SILVER	1.9E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E-01	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	1.0E+02	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	9.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	9.3E+02	
TETRACHLOROETHANE, 1,1,2,2-	4.0E+00	Bioaccumulation/Human Consumption	5.0E+02	4.2E+02	4.0E+00
TETRACHLOROETHYLENE	3.3E+00	Bioaccumulation/Human Consumption	3.0E+02	2.3E+02	3.3E+00
THALLIUM	6.3E+00	Bioaccumulation/Human Consumption	5.0E+04	2.0E+01	6.3E+00

TABLE F-2b. SURFACE WATER SCREENING LEVELS
Marine Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Marine Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
TOLUENE	4.0E+01	Ceiling Level	4.0E+01	2.5E+03	2.0E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.8E-04
TPH (gasolines)	3.7E+03	Aquatic Habitat Chronic Toxicity	5.0E+03	3.7E+03	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	6.5E+01	Aquatic Habitat Chronic Toxicity	3.0E+03	6.5E+01	
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+01	
TRICHLOROETHANE, 1,1,2-	1.6E+01	Bioaccumulation/Human Consumption	5.0E+04	4.7E+03	1.6E+01
TRICHLOROETHYLENE	3.0E+01	Bioaccumulation/Human Consumption	1.0E+04	3.6E+02	3.0E+01
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	1.1E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Ceiling Level	1.0E+02	4.9E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
VINYL CHLORIDE	5.3E+02	Bioaccumulation/Human Consumption	3.4E+03	7.8E+02	5.3E+02
XYLENES	1.0E+02	Aquatic Habitat Chronic Toxicity	5.3E+02	1.0E+02	
ZINC	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	

Notes:

1. Lowest of Ceiling Value, aquatic habitat goal, and bioaccumulation goal.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Ceiling Level: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit nuisances and general resource degradation.
Review of aquatic ecotoxicty data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).
Method detection limits and background concentrations replace final screening level as appropriate.

TABLE F-2c. SURFACE WATER SCREENING LEVELS
*Estuary Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
ACENAPHTHENE	2.0E+01	Ceiling Level	2.0E+01	2.3E+01	9.9E+02
ACENAPHTHYLENE	3.0E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	3.0E+01	
ACETONE	1.5E+03	Aquatic Habitat Chronic Toxicity	2.0E+04	1.5E+03	
ALDRIN	5.0E-05	Bioaccumulation/Human Consumption	8.5E+00	1.3E-01	5.0E-05
ANTHRACENE	7.3E-01	Aquatic Habitat Chronic Toxicity	2.2E+01	7.3E-01	4.0E+04
ANTIMONY	3.0E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+01	6.4E+02
ARSENIC	1.4E-01	Bioaccumulation/Human Consumption	5.0E+04	3.6E+01	1.4E-01
BARIUM	2.0E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	2.0E+03	
BENZENE	4.6E+01	Aquatic Habitat Chronic Toxicity	2.0E+03	4.6E+01	5.1E+01
BENZO(a)ANTHRACENE	1.8E-02	Bioaccumulation/Human Consumption	5.0E+00	2.7E-02	1.8E-02
BENZO(a)PYRENE	1.4E-02	Aquatic Habitat Chronic Toxicity	1.9E+00	1.4E-02	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	7.0E+00	9.2E-02	1.8E-02
BENZO(g,h,i)PERYLENE	1.0E-01	Aquatic Habitat Chronic Toxicity	1.3E-01	1.0E-01	
BENZO(k)FLUORANTHENE	1.8E-02	Bioaccumulation/Human Consumption	4.0E-01	3.7E+00	1.8E-02
BERYLLIUM	2.7E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.7E+00	
BIPHENYL, 1,1-	5.0E-01	Ceiling Level	5.0E-01	1.4E+01	
BIS(2-CHLOROETHYL)ETHER	5.3E-01	Bioaccumulation/Human Consumption	3.6E+02	6.1E+01	5.3E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	Aquatic Habitat Chronic Toxicity	3.2E+02	6.1E+01	6.5E+04
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00	Bioaccumulation/Human Consumption	6.5E+02	3.2E+01	2.2E+00
BORON	1.6E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+00	
BROMODICHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
BROMOFORM	1.4E+02	Bioaccumulation/Human Consumption	5.1E+02	3.2E+03	1.4E+02
BROMOMETHANE	1.6E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.6E+02	1.5E+03
CADMIUM	2.5E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	2.5E-01	
CARBON TETRACHLORIDE	1.6E+00	Bioaccumulation/Human Consumption	5.2E+02	9.8E+00	1.6E+00
CHLORDANE	8.1E-04	Bioaccumulation/Human Consumption	2.5E+00	4.0E-03	8.1E-04
CHLOROANILINE, p-	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
CHLOROBENZENE	2.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+01	2.5E+01	2.1E+04
CHLOROETHANE	3.9E+00	Aquatic Habitat Chronic Toxicity	1.6E+01	3.9E+00	
CHLOROFORM	4.7E+02	Bioaccumulation/Human Consumption	2.4E+03	6.2E+02	4.7E+02
CHLOROMETHANE	3.2E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.2E+03	
CHLOROPHENOL, 2-	1.8E-01	Ceiling Level	1.8E-01	4.4E+02	1.5E+02
CHROMIUM (Total)	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.4E+01	
CHROMIUM III	7.4E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.4E+01	
CHROMIUM VI	1.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.1E+01	
CHRYSENE	1.8E-02	Bioaccumulation/Human Consumption	8.0E-01	3.5E-01	1.8E-02
COBALT	3.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E+00	

TABLE F-2c. SURFACE WATER SCREENING LEVELS
*Estuary Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
COPPER	3.1E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	3.1E+00	
CYANIDE (Free)	1.0E+00	Aquatic Habitat Chronic Toxicity	1.7E+02	1.0E+00	2.2E+05
DIBENZO(a,h)ANTHTRACENE	1.8E-02	Bioaccumulation/Human Consumption	2.5E-01	7.5E+00	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E-01	Aquatic Habitat Chronic Toxicity	1.0E+01	2.0E-01	
DIBROMOCHLOROMETHANE	1.3E+01	Bioaccumulation/Human Consumption	5.0E+04	3.2E+03	1.3E+01
DIBROMOETHANE, 1,2-	1.4E+03	Aquatic Habitat Chronic Toxicity	5.0E+04	1.4E+03	
DICHLOROBENZENE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.4E+01	1.7E+04
DICHLOROBENZENE, 1,3-	6.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.5E+01	9.6E+02
DICHLOROBENZENE, 1,4-	1.1E+01	Ceiling Level	1.1E+01	1.5E+01	2.6E+03
DICHLOROBENZIDINE, 3,3-	2.8E-02	Bioaccumulation/Human Consumption	1.6E+03	2.5E+02	2.8E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04	Bioaccumulation/Human Consumption	8.0E+01	1.0E-03	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04	Bioaccumulation/Human Consumption	2.0E+01	1.0E-03	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.2E-04	Bioaccumulation/Human Consumption	1.5E+00	1.0E-03	2.2E-04
DICHLOROETHANE, 1,1-	4.7E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	4.7E+01	
DICHLOROETHANE, 1,2-	3.7E+01	Bioaccumulation/Human Consumption	2.0E+04	1.0E+04	3.7E+01
DICHLOROETHYLENE, 1,1-	3.2E+00	Bioaccumulation/Human Consumption	1.5E+03	2.5E+01	3.2E+00
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	5.9E+02	
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Ceiling Level	2.6E+02	5.9E+02	140000
DICHLOROPHENOL, 2,4-	3.0E-01	Ceiling Level	3.0E-01	1.8E+02	2.9E+02
DICHLOROPROPANE, 1,2-	1.0E+01	Ceiling Level	1.0E+01	1.5E+03	1.5E+01
DICHLOROPROPENE, 1,3-	1.2E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	1.2E+02	1.7E+03
DIELDRIN	5.4E-05	Bioaccumulation/Human Consumption	4.1E+01	1.9E-03	5.4E-05
DIETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+00	4.4E+04
DIMETHYLPHENOL, 2,4-	1.1E+02	Aquatic Habitat Chronic Toxicity	4.0E+02	1.1E+02	8.5E+02
DIMETHYLPHTHALATE	1.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	1.5E+00	1.1E+06
DINITROPHENOL, 2,4-	7.5E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	7.5E+01	5.3E+03
DINITROTOLUENE, 2,4-	3.4E+00	Bioaccumulation/Human Consumption	5.0E+04	1.2E+02	3.4E+00
DIOXANE, 1,4-	5.0E+04	Ceiling Level	5.0E+04	3.4E+05	
DIOXIN (2,3,7,8-TCDD)	5.1E-09	Bioaccumulation/Human Consumption	7.0E+03	5.0E-06	5.1E-09
ENDOSULFAN	8.7E-03	Aquatic Habitat Chronic Toxicity	7.5E+01	8.7E-03	8.9E+01
ENDRIN	2.3E-03	Aquatic Habitat Chronic Toxicity	4.1E+01	2.3E-03	8.1E-01
ETHANOL	5.0E+04	Ceiling Level	5.0E+04		
ETHYLBENZENE	3.0E+01	Ceiling Level	3.0E+01	2.9E+02	2.9E+04
FLUORANTHENE	8.0E+00	Aquatic Habitat Chronic Toxicity	1.3E+02	8.0E+00	1.4E+02
FLUORENE	3.9E+00	Aquatic Habitat Chronic Toxicity	9.5E+02	3.9E+00	5.3E+03
HEPTACHLOR	7.9E-05	Bioaccumulation/Human Consumption	2.0E+01	3.6E-03	7.9E-05
HEPTACHLOR EPOXIDE	3.9E-05	Bioaccumulation/Human Consumption	1.8E+02	3.6E-03	3.9E-05

TABLE F-2c. SURFACE WATER SCREENING LEVELS
*Estuary Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
HEXACHLOROBENZENE	2.9E-04	Bioaccumulation/Human Consumption	5.5E+01	3.7E+00	2.9E-04
HEXACHLOROBUTADIENE	4.7E+00	Aquatic Habitat Chronic Toxicity	6.0E+00	4.7E+00	1.8E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02	Bioaccumulation/Human Consumption	3.5E+03	8.0E-02	6.3E-02
HEXACHLOROETHANE	3.3E+00	Bioaccumulation/Human Consumption	1.0E+01	1.2E+01	3.3E+00
INDENO(1,2,3-cd)PYRENE	1.8E-02	Bioaccumulation/Human Consumption	2.7E-01	9.2E-02	1.8E-02
LEAD	2.5E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	2.5E+00	
MERCURY	3.0E-01	Bioaccumulation/Human Consumption	5.0E+04	7.7E-01	3.0E-01
METHOXYCHLOR	1.9E-02	Aquatic Habitat Chronic Toxicity	2.0E+01	1.9E-02	
METHYL ETHYL KETONE	8.4E+03	Ceiling Level	8.4E+03	1.4E+04	
METHYL ISOBUTYL KETONE	1.7E+02	Aquatic Habitat Chronic Toxicity	1.3E+03	1.7E+02	
METHYL MERCURY	3.0E-03	Aquatic Habitat Chronic Toxicity	5.0E+04	3.0E-03	
METHYL TERT BUTYL ETHER	1.8E+02	Ceiling Level	1.8E+02	8.0E+03	
METHYLENE CHLORIDE	5.9E+02	Bioaccumulation/Human Consumption	9.1E+03	2.2E+03	5.9E+02
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	Aquatic Habitat Chronic Toxicity	1.0E+01	2.1E+00	
MOLYBDENUM	2.4E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	2.4E+02	
NAPHTHALENE	2.1E+01	Ceiling Level	2.1E+01	2.4E+01	
NICKEL	8.2E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	8.2E+00	4.6E+03
PENTACHLOROPHENOL	3.0E+00	Bioaccumulation/Human Consumption	5.9E+02	7.9E+00	3.0E+00
PERCHLORATE	6.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	6.0E+02	
PHENANTHRENE	4.6E+00	Aquatic Habitat Chronic Toxicity	4.1E+02	4.6E+00	
PHENOL	1.3E+03	Aquatic Habitat Chronic Toxicity	7.9E+03	1.3E+03	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	6.4E-05	Bioaccumulation/Human Consumption	1.6E+01	1.4E-02	6.4E-05
PYRENE	2.0E+00	Aquatic Habitat Chronic Toxicity	6.8E+01	2.0E+00	4.0E+03
SELENIUM	5.0E+00	Aquatic Habitat Chronic Toxicity	5.0E+04	5.0E+00	
SILVER	1.9E-01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E-01	
STYRENE	1.1E+01	Ceiling Level	1.1E+01	1.0E+02	
tert-BUTYL ALCOHOL	1.8E+04	Aquatic Habitat Chronic Toxicity	5.0E+04	1.8E+04	
TETRACHLOROETHANE, 1,1,1,2-	9.3E+02	Aquatic Habitat Chronic Toxicity	5.0E+04	9.3E+02	
TETRACHLOROETHANE, 1,1,2,2-	4.0E+00	Bioaccumulation/Human Consumption	5.0E+02	4.2E+02	4.0E+00
TETRACHLOROETHYLENE	3.3E+00	Bioaccumulation/Human Consumption	3.0E+02	1.2E+02	3.3E+00
THALLIUM	6.3E+00	Bioaccumulation/Human Consumption	5.0E+04	2.0E+01	6.3E+00
TOLUENE	4.0E+01	Ceiling Level	4.0E+01	1.3E+02	2.0E+05
TOXAPHENE	2.0E-04	Aquatic Habitat Chronic Toxicity	1.4E+02	2.0E-04	2.8E-04
TPH (gasolines)	5.0E+02	Aquatic Habitat Chronic Toxicity	5.0E+03	5.0E+02	
TPH (middle distillates)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TPH (residual fuels)	6.4E+02	Aquatic Habitat Chronic Toxicity	2.5E+03	6.4E+02	
TRICHLOROBENZENE, 1,2,4-	2.5E+01	Aquatic Habitat Chronic Toxicity	3.0E+03	2.5E+01	

TABLE F-2c. SURFACE WATER SCREENING LEVELS
*Estuary Habitats
(ug/l)

CHEMICAL PARAMETER	[1]Final Surface Water Screening Level	Basis	Gross Contamination Ceiling Value (Odors, etc.) Table I-4	Estuary Aquatic Habitat Goal (Chronic Toxicity) Table F-4a	Bioaccumulation and Human Consumption Table F-4d
TRICHLOROETHANE, 1,1,1-	6.2E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	6.2E+01	
TRICHLOROETHANE, 1,1,2-	1.6E+01	Bioaccumulation/Human Consumption	5.0E+04	4.7E+03	1.6E+01
TRICHLOROETHYLENE	3.0E+01	Bioaccumulation/Human Consumption	1.0E+04	3.6E+02	3.0E+01
TRICHLOROPHENOL, 2,4,5-	1.1E+01	Aquatic Habitat Chronic Toxicity	2.0E+02	1.1E+01	3.6E+03
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Ceiling Level	1.0E+02	4.9E+02	
VANADIUM	1.9E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	1.9E+01	
VINYL CHLORIDE	5.3E+02	Bioaccumulation/Human Consumption	3.4E+03	7.8E+02	5.3E+02
XYLENES	1.0E+02	Aquatic Habitat Chronic Toxicity	5.3E+02	1.0E+02	
ZINC	8.1E+01	Aquatic Habitat Chronic Toxicity	5.0E+04	8.1E+01	

Notes:

***Estuary Habitats: Mixed freshwater/marine water habitats.**

1. Lowest of Ceiling Value, aquatic habitat goal, and bioaccumulation goal.

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

Ceiling Level: Odor threshold, 1/2 solubility or 50000 ug/L maximum, whichever is lower. Intended to limit nuisances and general resource degradation.

Review of aquatic ecotoxicty data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (refer to USEPA 2003b, ECOTOX database).

Method detection limits and background concentrations replace final screening level as appropriate.

TABLE F-3. SUMMARY OF DRINKING WATER SCREENING LEVELS FOR HUMAN TOXICITY
(ug/L)

CHEMICAL PARAMETER	Final Screening Level	Basis	CNMI Primary MCL	Other Criteria	Reference	USEPA Region IX Tapwater Goal (Table F-6)	Basis
ACENAPHTHENE	3.7E+02	noncarcinogenic effects				3.7E+02	noncarcinogenic effects
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
ACETONE	5.5E+03	noncarcinogenic effects				5.5E+03	noncarcinogenic effects
ALDRIN	4.0E-03	carcinogenic effects				4.0E-03	carcinogenic effects
ANTHRACENE	1.8E+03	noncarcinogenic effects				1.8E+03	noncarcinogenic effects
ANTIMONY	6.0E+00	CNMI Primary MCL	6.0E+00			1.5E+01	noncarcinogenic effects
ARSENIC	1.0E+01	CNMI Primary MCL	1.0E+01			4.5E-02	carcinogenic effects
BARIUM	2.0E+03	CNMI Primary MCL	2.0E+03			2.6E+03	noncarcinogenic effects
BENZENE	5.0E+00	CNMI Primary MCL	5.0E+00			3.5E-01	carcinogenic effects
BENZO(a)ANTHRACENE	9.2E-02	carcinogenic effects				9.2E-02	carcinogenic effects
BENZO(a)PYRENE	2.0E-01	CNMI Primary MCL	2.0E-01			9.2E-03	carcinogenic effects
BENZO(b)FLUORANTHENE	9.2E-02	carcinogenic effects				9.2E-02	carcinogenic effects
BENZO(g,h,i)PERYLENE	1.5E+03	noncarcinogenic effects				1.5E+03	noncarcinogenic effects
BENZO(k)FLUORANTHENE	9.2E-01	carcinogenic effects				9.2E-01	carcinogenic effects
BERYLLIUM	4.0E+00	CNMI Primary MCL	4.0E+00			7.3E+01	noncarcinogenic effects
BIPHENYL, 1,1-	3.0E+02	noncarcinogenic effects				3.0E+02	noncarcinogenic effects
BIS(2-CHLOROETHYL)ETHER	9.5E-03	carcinogenic effects				9.5E-03	carcinogenic effects
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	carcinogenic effects				2.7E-01	carcinogenic effects
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E+00	CNMI Primary MCL	6.0E+00			4.8E+00	carcinogenic effects
BORON	7.3E+03	noncarcinogenic effects				7.3E+03	noncarcinogenic effects
BROMODICHLOROMETHANE	1.8E-01	carcinogenic effects				1.8E-01	carcinogenic effects
BROMOFORM	1.0E+02	HDOH Primary MCL		1.0E+02	HDOH Primary MCL	8.5E+00	carcinogenic effects
BROMOMETHANE	8.5E+00	noncarcinogenic effects				8.5E+00	noncarcinogenic effects
CADMIUM	5.0E+00	CNMI Primary MCL	5.0E+00			1.8E+01	noncarcinogenic effects
CARBON TETRACHLORIDE	5.0E+00	CNMI Primary MCL	5.0E+00			1.7E-01	carcinogenic effects
CHLORDANE	2.0E+00	CNMI Primary MCL	2.0E+00			1.9E-01	carcinogenic effects
CHLOROANILINE, p-	1.5E+02	noncarcinogenic effects				1.5E+02	noncarcinogenic effects
CHLOROBENZENE	1.0E+02	CNMI Primary MCL	1.0E+02			1.1E+02	noncarcinogenic effects
CHLOROETHANE	3.9E+00	carcinogenic effects				3.9E+00	carcinogenic effects
CHLOROFORM	1.0E+02	HDOH Primary MCL		1.0E+02	HDOH Primary MCL	1.7E-01	carcinogenic effects
CHLOROMETHANE	1.6E+02	noncarcinogenic effects				1.6E+02	noncarcinogenic effects
CHLOROPHENOL, 2-	3.0E+01	noncarcinogenic effects				3.0E+01	noncarcinogenic effects
CHROMIUM (Total)	1.0E+02	CNMI Primary MCL	1.0E+02				
CHROMIUM III	5.5E+04	noncarcinogenic effects				5.5E+04	noncarcinogenic effects
CHROMIUM VI	1.1E+02	noncarcinogenic effects				1.1E+02	noncarcinogenic effects
CHRYSENE	9.2E+00	carcinogenic effects				9.2E+00	carcinogenic effects

TABLE F-3. SUMMARY OF DRINKING WATER SCREENING LEVELS FOR HUMAN TOXICITY
(ug/L)

CHEMICAL PARAMETER	Final Screening Level	Basis	CNMI Primary MCL	Other Criteria	Reference	USEPA Region IX Tapwater Goal (Table F-6)	Basis
COBALT	7.3E+02	noncarcinogenic effects				7.3E+02	noncarcinogenic effects
COPPER	1.3E+03	HDOH Primary MCL		1.3E+03	HDOH Primary MCL	1.5E+03	noncarcinogenic effects
CYANIDE (Free)	2.0E+02	CNMI Primary MCL	2.0E+02			7.3E+02	noncarcinogenic effects
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects				9.2E-03	carcinogenic effects
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E-01	CNMI Primary MCL	2.0E-01			4.8E-02	carcinogenic effects
DIBROMOCHLOROMETHANE	1.3E-01	carcinogenic effects				1.3E-01	carcinogenic effects
DIBROMOETHANE, 1,2-	5.0E-02	CNMI Primary MCL	5.0E-02			5.6E-03	carcinogenic effects
DICHLOROBENZENE, 1,2-	6.0E+02	CNMI Primary MCL	6.0E+02			3.7E+02	noncarcinogenic effects
DICHLOROBENZENE, 1,3-	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
DICHLOROBENZENE, 1,4-	7.5E+01	CNMI Primary MCL	7.5E+01			5.0E-01	carcinogenic effects
DICHLOROBENZIDINE, 3,3-	1.5E-01	carcinogenic effects				1.5E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	carcinogenic effects				2.8E-01	carcinogenic effects
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.8E-01	carcinogenic effects				2.8E-01	carcinogenic effects
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects				2.0E-01	carcinogenic effects
DICHLOROETHANE, 1,1-	8.0E+02	noncarcinogenic effects				8.0E+02	noncarcinogenic effects
DICHLOROETHANE, 1,2-	5.0E+00	CNMI Primary MCL	5.0E+00			1.2E-01	carcinogenic effects
DICHLOROETHYLENE, 1,1-	7.0E+00	CNMI Primary MCL	7.0E+00			3.4E+02	noncarcinogenic effects
DICHLOROETHYLENE, Cis 1,2-	7.0E+01	CNMI Primary MCL	7.0E+01			6.1E+01	noncarcinogenic effects
DICHLOROETHYLENE, Trans 1,2-	1.0E+02	CNMI Primary MCL	1.0E+02			1.2E+02	noncarcinogenic effects
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects				1.1E+02	noncarcinogenic effects
DICHLOROPROPANE, 1,2-	5.0E+00	CNMI Primary MCL	5.0E+00			1.6E-01	carcinogenic effects
DICHLOROPROPENE, 1,3-	4.0E-01	carcinogenic effects				4.0E-01	carcinogenic effects
DIELDRIN	4.2E-03	carcinogenic effects				4.2E-03	carcinogenic effects
DIETHYLPHTHALATE	2.9E+04	noncarcinogenic effects				2.9E+04	noncarcinogenic effects
DIMETHYLPHENOL, 2,4-	7.3E+02	noncarcinogenic effects				7.3E+02	noncarcinogenic effects
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects				3.7E+05	noncarcinogenic effects
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects				7.3E+01	noncarcinogenic effects
DINITROTOLUENE, 2,4-	3.4E+01	carcinogenic effects				3.4E+01	carcinogenic effects
DIOXANE, 1,4-	6.1E+00	carcinogenic effects				6.1E+00	carcinogenic effects
DIOXIN (2,3,7,8-TCDD)	3.0E-08	CNMI Primary MCL	3.0E-08			4.5E-07	carcinogenic effects
ENDOSULFAN	2.2E+02	noncarcinogenic effects				2.2E+02	noncarcinogenic effects
ENDRIN	2.0E+00	CNMI Primary MCL	2.0E+00			1.1E+01	noncarcinogenic effects
ETHANOL		no data					
ETHYLBENZENE	7.0E+02	CNMI Primary MCL	7.0E+02			1.3E+03	noncarcinogenic effects
FLUORANTHENE	1.5E+03	noncarcinogenic effects				1.5E+03	noncarcinogenic effects
FLUORENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects

TABLE F-3. SUMMARY OF DRINKING WATER SCREENING LEVELS FOR HUMAN TOXICITY
(ug/L)

CHEMICAL PARAMETER	Final Screening Level	Basis	CNMI Primary MCL	Other Criteria	Reference	USEPA Region IX Tapwater Goal (Table F-6)	Basis
HEPTACHLOR	4.0E-01	CNMI Primary MCL	4.0E-01			1.5E-02	carcinogenic effects
HEPTACHLOR EPOXIDE	2.0E-01	CNMI Primary MCL	2.0E-01			7.4E-03	carcinogenic effects
HEXACHLOROBENZENE	1.0E+00	CNMI Primary MCL	1.0E+00			4.2E-02	carcinogenic effects
HEXACHLOROBUTADIENE	8.6E-01	carcinogenic effects				8.6E-01	carcinogenic effects
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	2.0E-01	CNMI Primary MCL	2.0E-01			5.2E-02	carcinogenic effects
HEXACHLOROETHANE	4.8E+00	carcinogenic effects				4.8E+00	carcinogenic effects
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects				9.2E-02	carcinogenic effects
LEAD	1.5E+01	CNMI Action Level		1.5E+01	CNMI Action Level		
MERCURY	2.0E+00	CNMI Primary MCL	2.0E+00			1.1E+01	noncarcinogenic effects
METHOXYCHLOR	4.0E+01	CNMI Primary MCL	4.0E+01			1.8E+02	noncarcinogenic effects
METHYL ETHYL KETONE	7.0E+03	noncarcinogenic effects				7.0E+03	noncarcinogenic effects
METHYL ISOBUTYL KETONE	2.0E+03	noncarcinogenic effects				2.0E+03	noncarcinogenic effects
METHYL MERCURY	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
METHYL TERT BUTYL ETHER	1.1E+01	carcinogenic effects				1.1E+01	carcinogenic effects
METHYLENE CHLORIDE	4.3E+00	carcinogenic effects				4.3E+00	carcinogenic effects
METHYLNAPHTHALENE (total 1- & 2-)	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
MOLYBDENUM	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
NAPHTHALENE	6.2E+00	noncarcinogenic effects				6.2E+00	noncarcinogenic effects
NICKEL	1.0E+02	HDOH Primary MCL		1.0E+02	HDOH Primary MCL	7.3E+02	noncarcinogenic effects
PENTACHLOROPHENOL	1.0E+00	CNMI Primary MCL	1.0E+00			5.6E-01	carcinogenic effects
PERCHLORATE	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
PHENANTHRENE	2.4E+02	noncarcinogenic effects				2.4E+02	noncarcinogenic effects
PHENOL	1.1E+04	noncarcinogenic effects				1.1E+04	noncarcinogenic effects
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E-01	CNMI Primary MCL	5.0E-01			3.4E-02	carcinogenic effects
PYRENE	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
SELENIUM	5.0E+01	CNMI Primary MCL	5.0E+01			1.8E+02	noncarcinogenic effects
SILVER	1.8E+02	noncarcinogenic effects				1.8E+02	noncarcinogenic effects
STYRENE	1.0E+02	CNMI Primary MCL	1.0E+02			1.6E+03	noncarcinogenic effects
tert-BUTYL ALCOHOL	3.7E+00	carcinogenic effects				3.7E+00	carcinogenic effects
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	carcinogenic effects				4.3E-01	carcinogenic effects
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	carcinogenic effects				5.6E-02	carcinogenic effects
TETRACHLOROETHYLENE	5.0E+00	CNMI Primary MCL	5.0E+00			1.0E-01	carcinogenic effects
THALLIUM	2.0E+00	CNMI Primary MCL	2.0E+00			2.4E+00	noncarcinogenic effects
TOLUENE	1.0E+03	CNMI Primary MCL	1.0E+03			7.2E+02	noncarcinogenic effects
TOXAPHENE	3.0E+00	CNMI Primary MCL	3.0E+00			5.6E-02	carcinogenic effects
TPH (gasolines)	1.0E+02	noncarcinogenic effects		1.0E+02	noncarcinogenic effects	9.3E+01	noncarcinogenic effects

TABLE F-3. SUMMARY OF DRINKING WATER SCREENING LEVELS FOR HUMAN TOXICITY
(ug/L)

CHEMICAL PARAMETER	Final Screening Level	Basis	CNMI Primary MCL	Other Criteria	Reference	USEPA Region IX Tapwater Goal (Table F-6)	Basis
TPH (middle distillates)	1.0E+02	noncarcinogenic effects		1.0E+02	noncarcinogenic effects	9.3E+01	noncarcinogenic effects
TPH (residual fuels)	1.0E+03	noncarcinogenic effects		1.0E+03	noncarcinogenic effects	1.1E+03	noncarcinogenic effects
TRICHLOROBENZENE, 1,2,4-	7.0E+01	CNMI Primary MCL	7.0E+01			7.2E+00	noncarcinogenic effects
TRICHLOROETHANE, 1,1,1-	2.0E+02	CNMI Primary MCL	2.0E+02			3.2E+03	noncarcinogenic effects
TRICHLOROETHANE, 1,1,2-	5.0E+00	CNMI Primary MCL	5.0E+00			2.0E-01	carcinogenic effects
TRICHLOROETHYLENE	5.0E+00	CNMI Primary MCL	5.0E+00			2.8E-02	carcinogenic effects
TRICHLOROPHENOL, 2,4,5-	6.1E+02	noncarcinogenic effects				6.1E+02	noncarcinogenic effects
TRICHLOROPHENOL, 2,4,6-	3.7E+00	noncarcinogenic effects				3.7E+00	noncarcinogenic effects
VANADIUM	3.7E+01	noncarcinogenic effects				3.7E+01	noncarcinogenic effects
VINYL CHLORIDE	2.0E+00	CNMI Primary MCL	2.0E+00			4.1E-02	carcinogenic effects
XYLENES	1.0E+04	CNMI Primary MCL	1.0E+04			2.1E+02	noncarcinogenic effects
ZINC	1.1E+04	noncarcinogenic effects				1.1E+04	noncarcinogenic effects

Source (unless otherwise noted):

CNMI Drinking Water Regulations (CNMI 2005); Hawai'I Department of Health Primary MCLs (HDOH 2002); USEPA Tapwater Goals (USEPA 2004).

Notes:

Used for development of groundwater and soil screening levels.

Final health-based screening level for drinking water: CNMI Primary MCLs or, in order of preference and availability, HDOH Primary MCL and USEPA Region IX Tapwater Goal (Table F-6)

TPH -Total Petroleum Hydrocarbons. TPH goals for gasoline and diesel rounded to 100 ug/L and 1,000 ug/L for residual fuels. See text for discussion of different TPH categories.

HDOH Primary MCL: Hawai'I Department of Health Primary Maximum Concentration Level.

TABLE F-4a. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	**[1]Lowest Estuary Aquatic Habitat Goal**	**Basis**	**Lowest Freshwater Aquatic Habitat Goal**	**Basis**	**Lowest Marine Aquatic Habitat Goal**	**Basis**
ACENAPHTHENE	2.3E+01	USEPA Ecotox FW Chronic	2.3E+01	USEPA Ecotox FW Chronic	4.0E+01	USEPA Ecotox SW Chronic
ACENAPHTHYLENE	3.0E+01	10% USEPA SW Acute LOEL	3.0E+01	10% USEPA SW Acute LOEL	3.0E+01	10% USEPA SW Acute LOEL
ACETONE	1.5E+03	USDOE FW Chronic PRG	1.5E+03	USDOE FW Chronic PRG	1.5E+03	USDOE FW Chronic PRG
ALDRIN	1.3E-01	10% CNMI/USEPA SW CMC	3.0E-01	10% CNMI/USEPA FW CMC	1.3E-01	10% CNMI/USEPA SW CMC
ANTHRACENE	7.3E-01	USDOE FW Chronic PRG	7.3E-01	USDOE FW Chronic PRG	7.3E-01	USDOE FW Chronic PRG
ANTIMONY	3.0E+01	CNMI/USEPA FW CCC	3.0E+01	CNMI/USEPA FW CCC	5.0E+02	CNMI/USEPA SW CCC
ARSENIC	3.6E+01	CNMI/USEPA SW CCC	1.5E+02	CNMI/USEPA FW CCC	3.6E+01	CNMI/USEPA SW CCC
BARIUM	2.0E+03	=Drinking Water (Table F-3)	2.0E+03	=Drinking Water (Table F-3)	2.0E+03	=Drinking Water (Table F-3)
BENZENE	4.6E+01	USEPA Ecotox FW Chronic	4.6E+01	USEPA Ecotox FW Chronic	3.5E+02	50% USEPA SW Chronic LOEL
BENZO(a)ANTHRACENE	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG	2.7E-02	USDOE FW Chronic PRG
BENZO(a)PYRENE	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic	1.4E-02	USEPA Ecotox FW Chronic
BENZO(b)FLUORANTHENE	9.2E-02	=Drinking Water (Table F-3)	9.2E-02	=Drinking Water (Table F-3)	9.2E-02	=Drinking Water (Table F-3)
BENZO(g,h,i)PERYLENE	1.0E-01	50% MOEE FW Chronic LOEL	1.0E-01	50% MOEE FW Chronic LOEL	1.0E-01	50% MOEE FW Chronic LOEL
BENZO(k)FLUORANTHENE	3.7E+00	50% MOEE FW Chronic LOEL	3.7E+00	50% MOEE FW Chronic LOEL	3.7E+00	50% MOEE FW Chronic LOEL
BERYLLIUM	2.7E+00	50% USEPA FW Chronic LOEL	2.7E+00	50% USEPA FW Chronic LOEL	2.7E+00	50% USEPA FW Chronic LOEL
BIPHENYL, 1,1-	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic
BIS(2-CHLOROETHYL)ETHER	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL
BIS(2-CHLOROISOPROPYL)ETHER	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL	6.1E+01	50% USEPA FW Chronic LOEL
BIS(2-ETHYLHEXYL)PHTHALATE	3.2E+01	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic	3.2E+01	USEPA Ecotox FW Chronic
BORON	1.6E+00	USDOE FW Chronic PRG	1.6E+00	USDOE FW Chronic PRG	1.6E+00	USDOE FW Chronic PRG
BROMODICHLOROMETHANE	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
BROMOFORM	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
BROMOMETHANE	1.6E+02	50% MOEE FW Chronic LOEL	1.6E+02	50% MOEE FW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
CADMIUM	2.5E-01	CNMI/USEPA FW CCC	2.5E-01	CNMI/USEPA FW CCC	8.8E+00	CNMI/USEPA SW CCC
CARBON TETRACHLORIDE	9.8E+00	USDOE FW Chronic PRG	9.8E+00	USDOE FW Chronic PRG	3.2E+03	50% USEPA SW Chronic LOEL
CHLORDANE	4.0E-03	CNMI/USEPA SW CCC	4.3E-03	CNMI/USEPA FW CCC	4.0E-03	CNMI/USEPA SW CCC
CHLOROANILINE, p-	5.0E+00	50% MOEE FW Chronic LOEL	5.0E+00	50% MOEE FW Chronic LOEL	5.0E+00	50% MOEE FW Chronic LOEL
CHLOROBENZENE	2.5E+01	50% USEPA FW Chronic LOEL	2.5E+01	50% USEPA FW Chronic LOEL	6.5E+01	50% USEPA SW Chronic LOEL
CHLOROETHANE	3.9E+00	=Drinking Water (Table F-3)	3.9E+00	=Drinking Water (Table F-3)	3.9E+00	=Drinking Water (Table F-3)
CHLOROFORM	6.2E+02	50% USEPA FW Chronic LOEL	6.2E+02	50% USEPA FW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
CHLOROMETHANE	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
CHLOROPHENOL, 2-	4.4E+02	10% USEPA FW Acute LOEL	4.4E+02	10% USEPA FW Acute LOEL	4.4E+02	10% USEPA FW Acute LOEL
CHROMIUM (Total)	7.4E+01	= Chromium III FW CCC	7.4E+01	= Chromium III FW CCC	7.4E+01	= Chromium III FW CCC
CHROMIUM III	7.4E+01	CNMI/USEPA FW CCC	7.4E+01	CNMI/USEPA FW CCC	7.4E+01	CNMI/USEPA FW CCC
CHROMIUM VI	1.1E+01	CNMI/USEPA FW CCC	1.1E+01	CNMI/USEPA FW CCC	5.0E+01	CNMI/USEPA SW CCC
CHRYSENE	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL	3.5E-01	50% MOEE FW Chronic LOEL
COBALT	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic	3.0E+00	USEPA Ecotox FW Chronic
COPPER	3.1E+00	CNMI/USEPA SW CCC	9.0E+00	CNMI/USEPA FW CCC	3.1E+00	CNMI/USEPA SW CCC
CYANIDE (Free)	1.0E+00	CNMI/USEPA SW CCC	5.2E+00	CNMI/USEPA FW CCC	1.0E+00	CNMI/USEPA SW CCC
DIBENZO(a,h)ANTHTRACENE	7.5E+00	50% MOEE FW Chronic LOEL	7.5E+00	50% MOEE FW Chronic LOEL	7.5E+00	50% MOEE FW Chronic LOEL

TABLE F-4a. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	**[1]Lowest Estuary Aquatic Habitat Goal**	**Basis**	**Lowest Freshwater Aquatic Habitat Goal**	**Basis**	**Lowest Marine Aquatic Habitat Goal**	**Basis**
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E-01	=Drinking Water (Table F-3)	2.0E-01	=Drinking Water (Table F-3)	2.0E-01	=Drinking Water (Table F-3)
DIBROMOCHLOROMETHANE	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL	3.2E+03	50% USEPA SW Chronic LOEL
DIBROMOETHANE, 1,2-	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC	1.4E+03	50% MOEE FW Chronic AWQC
DICHLOROBENZENE, 1,2-	1.4E+01	USEPA Ecotox FW Chronic	1.4E+01	USEPA Ecotox FW Chronic	6.5E+01	50% USEPA SW Chronic LOEL
DICHLOROBENZENE, 1,3-	6.5E+01	50% USEPA SW Chronic LOEL	7.1E+01	USEPA Ecotox FW Chronic	6.5E+01	50% USEPA SW Chronic LOEL
DICHLOROBENZENE, 1,4-	1.5E+01	USEPA Ecotox FW Chronic	1.5E+01	USEPA Ecotox FW Chronic	6.5E+01	50% USEPA SW Chronic LOEL
DICHLOROBENZIDINE, 3,3-	2.5E+02	50% MOEE FW Chronic LOEL	2.5E+02	50% MOEE FW Chronic LOEL	2.5E+02	50% MOEE FW Chronic LOEL
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E-03	=DDT	1.0E-03	=DDT	1.0E-03	=DDT
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E-03	=DDT	1.0E-03	=DDT	1.0E-03	=DDT
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03	CNMI/USEPA FW CCC	1.0E-03	CNMI/USEPA FW CCC	1.0E-03	CNMI/USEPA SW CCC
DICHLOROETHANE, 1,1-	4.7E+01	USEPA Ecotox FW Chronic	4.7E+01	USEPA Ecotox FW Chronic	4.7E+01	USEPA Ecotox FW Chronic
DICHLOROETHANE, 1,2-	1.0E+04	50% USEPA FW Chronic LOEL	1.0E+04	50% USEPA FW Chronic LOEL	1.0E+04	50% USEPA FW Chronic LOEL
DICHLOROETHYLENE, 1,1-	2.5E+01	USDOE FW Chronic PRG	2.5E+01	USDOE FW Chronic PRG	2.5E+01	USDOE FW Chronic PRG
DICHLOROETHYLENE, Cis 1,2-	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG
DICHLOROETHYLENE, Trans 1,2-	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG	5.9E+02	USDOE FW Chronic PRG
DICHLOROPHENOL, 2,4-	1.8E+02	50% USEPA FW Chronic LOEL	1.8E+02	50% USEPA FW Chronic LOEL	1.8E+02	50% USEPA FW Chronic LOEL
DICHLOROPROPANE, 1,2-	1.5E+03	50% USEPA SW Chronic LOEL	2.9E+03	50% USEPA FW Chronic LOEL	1.5E+03	50% USEPA SW Chronic LOEL
DICHLOROPROPENE, 1,3-	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL
DIELDRIN	1.9E-03	CNMI/USEPA SW CCC	5.6E-02	CNMI/USEPA FW CCC	1.9E-03	CNMI/USEPA SW CCC
DIETHYLPHTHALATE	1.5E+00	50% USEPA FW Chronic LOEL	1.5E+00	50% USEPA FW Chronic LOEL	1.7E+00	50% USEPA SW Chronic LOEL
DIMETHYLPHENOL, 2,4-	1.1E+02	CNMI/USEPA SW CCC	5.3E+02	CNMI/USEPA FW CCC	1.1E+02	CNMI/USEPA SW CCC
DIMETHYLPHTHALATE	1.5E+00	50% USEPA FW Chronic LOEL	1.5E+00	50% USEPA FW Chronic LOEL	1.7E+00	50% USEPA SW Chronic LOEL
DINITROPHENOL, 2,4-	7.5E+01	50% USEPA FW Chronic LOEL	7.5E+01	50% USEPA FW Chronic LOEL	7.5E+01	50% USEPA FW Chronic LOEL
DINITROTOLUENE, 2,4-	1.2E+02	50% USEPA FW Chronic LOEL	1.2E+02	50% USEPA FW Chronic LOEL	1.9E+02	50% USEPA SW Chronic LOEL
DIOXANE, 1,4-	3.4E+05	5% Acute FW LC 50	3.4E+05	5% Acute FW LC 50	5.0E+05	5% acute FW LC 50
DIOXIN (2,3,7,8-TCDD)	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL	5.0E-06	50% USEPA FW Chronic LOEL
ENDOSULFAN	8.7E-03	CNMI/USEPA SW CCC	5.6E-02	CNMI/USEPA FW CCC	8.7E-03	CNMI/USEPA SW CCC
ENDRIN	2.3E-03	CNMI/USEPA SW CCC	3.6E-02	CNMI/USEPA FW CCC	2.3E-03	CNMI/USEPA SW CCC
ETHANOL						
ETHYLBENZENE	2.9E+02	USEPA Ecotox FW Chronic	2.9E+02	USEPA Ecotox FW Chronic	2.9E+02	USEPA Ecotox FW Chronic
FLUORANTHENE	8.0E+00	50% USEPA SW Chronic LOEL	8.1E+00	USEPA Ecotox FW Chronic	8.0E+00	50% USEPA SW Chronic LOEL
FLUORENE	3.9E+00	USEPA Ecotox FW Chronic	3.9E+00	USEPA Ecotox FW Chronic	3.9E+00	USEPA Ecotox FW Chronic
HEPTACHLOR	3.6E-03	CNMI/USEPA SW CCC	3.8E-03	CNMI/USEPA FW CCC	3.6E-03	CNMI/USEPA SW CCC
HEPTACHLOR EPOXIDE	3.6E-03	CNMI/USEPA SW CCC	3.8E-03	CNMI/USEPA FW CCC	3.6E-03	CNMI/USEPA SW CCC
HEXACHLOROBENZENE	3.7E+00	CNMI/USEPA FW CCC	3.7E+00	CNMI/USEPA FW CCC	6.5E+01	50% USEPA SW Chronic LOEL
HEXACHLOROBUTADIENE	4.7E+00	50% USEPA FW Chronic LOEL	4.7E+00	50% USEPA FW Chronic LOEL	4.7E+00	50% USEPA FW Chronic LOEL
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	8.0E-02	USEPA Ecotox FW Chronic	8.0E-02	USEPA Ecotox FW Chronic	8.0E-02	USEPA Ecotox FW Chronic
HEXACHLOROETHANE	1.2E+01	USEPA Ecotox FW Chronic	1.2E+01	USEPA Ecotox FW Chronic	1.2E+01	USEPA Ecotox FW Chronic
INDENO(1,2,3-cd)PYRENE	9.2E-02	=Drinking Water (Table F-3)	9.2E-02	=Drinking Water (Table F-3)	9.2E-02	=Drinking Water (Table F-3)
LEAD	2.5E+00	CNMI/USEPA FW CCC	2.5E+00	CNMI/USEPA FW CCC	8.1E+00	CNMI/USEPA SW CCC

TABLE F-4a. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	**[1]Lowest Estuary Aquatic Habitat Goal**	**Basis**	**Lowest Freshwater Aquatic Habitat Goal**	**Basis**	**Lowest Marine Aquatic Habitat Goal**	**Basis**
MERCURY	7.7E-01	CNMI/USEPA FW CCC	7.7E-01	CNMI/USEPA FW CCC	9.4E-01	CNMI/USEPA SW CCC
METHOXYCHLOR	1.9E-02	USEPA Ecotox FW Chronic	1.9E-02	USEPA Ecotox FW Chronic	1.9E-02	USEPA Ecotox FW Chronic
METHYL ETHYL KETONE	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG	1.4E+04	USDOE FW Chronic PRG
METHYL ISOBUTYL KETONE	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG	1.7E+02	USDOE FW Chronic PRG
METHYL MERCURY	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic	3.0E-03	USEPA Ecotox FW Chronic
METHYL TERT BUTYL ETHER	8.0E+03	CalEPA SW Chronic	6.6E+04	SFRWQCB FW Chronic	8.0E+03	CalEPA SW Chronic
METHYLENE CHLORIDE	2.2E+03	USDOE FW Chronic PRG	2.2E+03	USDOE FW Chronic PRG	3.2E+03	50% USEPA SW Chronic LOEL
METHYLNAPHTHALENE (total 1- & 2-)	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG	2.1E+00	USDOE FW Chronic PRG
MOLYBDENUM	2.4E+02	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic	2.4E+02	USEPA Ecotox FW Chronic
NAPHTHALENE	2.4E+01	USEPA Ecotox FW Chronic	2.4E+01	USEPA Ecotox FW Chronic	2.4E+01	USEPA Ecotox FW Chronic
NICKEL	8.2E+00	CNMI/USEPA SW CCC	5.2E+01	CNMI/USEPA FW CCC	8.2E+00	CNMI/USEPA SW CCC
PENTACHLOROPHENOL	7.9E+00	CNMI/USEPA SW CCC	1.5E+01	CNMI/USEPA FW CCC	7.9E+00	CNMI/USEPA SW CCC
PERCHLORATE	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic	6.0E+02	USEPA Ecotox FW Chronic
PHENANTHRENE	4.6E+00	CNMI/USEPA SW CCC	6.3E+00	CNMI/USEPA FW CCC	4.6E+00	CNMI/USEPA SW CCC
PHENOL	1.3E+03	50% USEPA FW Chronic LOEL	1.3E+03	50% USEPA FW Chronic LOEL	1.3E+03	50% USEPA FW Chronic LOEL
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02	CNMI/USEPA FW CCC	1.4E-02	CNMI/USEPA FW CCC	3.0E-02	CNMI/USEPA SW CCC
PYRENE	2.0E+00	50% MOEE FW Chronic LOEL	2.0E+00	50% MOEE FW Chronic LOEL	2.0E+00	50% MOEE FW Chronic LOEL
SELENIUM	5.0E+00	CNMI/USEPA FW CCC	5.0E+00	CNMI/USEPA FW CCC	7.1E+01	CNMI/USEPA SW CCC
SILVER	1.9E-01	10% CNMI/USEPA SW CMC	3.2E-01	10% CNMI/USEPA FW CMC	1.9E-01	10% CNMI/USEPA SW CMC
STYRENE	1.0E+02	=Drinking Water (Table F-3)	1.0E+02	=Drinking Water (Table F-3)	1.0E+02	=Drinking Water (Table F-3)
tert-BUTYL ALCOHOL	1.8E+04	10% Acute FW LC 0	1.8E+04	10% Acute FW LC 0	1.8E+04	10% Acute FW LC 0
TETRACHLOROETHANE, 1,1,1,2-	9.3E+02	10% USEPA FW Acute LOEL	9.3E+02	10% USEPA FW Acute LOEL	9.3E+02	10% USEPA FW Acute LOEL
TETRACHLOROETHANE, 1,1,2,2-	4.2E+02	USEPA Ecotox FW Chronic	4.2E+02	USEPA Ecotox FW Chronic	4.2E+02	USEPA Ecotox FW Chronic
TETRACHLOROETHYLENE	1.2E+02	USEPA Ecotox FW Chronic	1.2E+02	USEPA Ecotox FW Chronic	2.3E+02	50% USEPA SW Chronic LOEL
THALLIUM	2.0E+01	50% USEPA FW Chronic LOEL	2.0E+01	50% USEPA FW Chronic LOEL	2.0E+01	50% USEPA FW Chronic LOEL
TOLUENE	1.3E+02	USEPA Ecotox FW Chronic	1.3E+02	USEPA Ecotox FW Chronic	2.5E+03	50% USEPA SW Chronic LOEL
TOXAPHENE	2.0E-04	CNMI/USEPA FW CCC	2.0E-04	CNMI/USEPA FW CCC	2.0E-04	CNMI/USEPA SW CCC
TPH (gasolines)	5.0E+02	SFBRWQCB	5.0E+02	SFBRWQCB	3.7E+03	SFBRWQCB
TPH (middle distillates)	6.4E+02	SFBRWQCB	6.4E+02	SFBRWQCB	6.4E+02	SFBRWQCB
TPH (residual fuels)	6.4E+02	SFBRWQCB	6.4E+02	SFBRWQCB	6.4E+02	SFBRWQCB
TRICHLOROBENZENE, 1,2,4-	2.5E+01	50% USEPA FW Chronic LOEL	2.5E+01	50% USEPA FW Chronic LOEL	6.5E+01	50% USEPA SW Chronic LOEL
TRICHLOROETHANE, 1,1,1-	6.2E+01	USEPA Ecotox FW Chronic	6.2E+01	USEPA Ecotox FW Chronic	6.2E+01	USEPA Ecotox FW Chronic
TRICHLOROETHANE, 1,1,2-	4.7E+03	50% USEPA FW Chronic LOEL	4.7E+03	50% USEPA FW Chronic LOEL	4.7E+03	50% USEPA FW Chronic LOEL
TRICHLOROETHYLENE	3.6E+02	USEPA Ecotox FW Chronic	3.6E+02	USEPA Ecotox FW Chronic	3.6E+02	USEPA Ecotox FW Chronic
TRICHLOROPHENOL, 2,4,5-	1.1E+01	CNMI/USEPA SW CCC	6.3E+01	CNMI/USEPA FW CCC	1.1E+01	CNMI/USEPA SW CCC
TRICHLOROPHENOL, 2,4,6-	4.9E+02	50% USEPA FW Chronic LOEL	4.9E+02	50% USEPA FW Chronic LOEL	4.9E+02	50% USEPA FW Chronic LOEL
VANADIUM	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic	1.9E+01	USEPA Ecotox FW Chronic

TABLE F-4a. SUMMARY OF SELECTED CHRONIC AQUATIC HABITAT GOALS
(ug/l)

	[1]Aquatic Habitat Goals					
CHEMICAL PARAMETER	**[1]Lowest Estuary Aquatic Habitat Goal**	**Basis**	**Lowest Freshwater Aquatic Habitat Goal**	**Basis**	**Lowest Marine Aquatic Habitat Goal**	**Basis**
VINYL CHLORIDE	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG	7.8E+02	USDOE FW Chronic PRG
XYLENES	1.0E+02	5% acute SW LC 50	1.0E+02	5% acute SW LC 50	1.0E+02	5% acute SW LC 50
ZINC	8.1E+01	CNMI/USEPA SW CCC	1.2E+02	CNMI/USEPA FW CCC	8.1E+01	CNMI/USEPA SW CCC

Notes:

1. Refer to Table F-4b for summary of aquatic habitat goal sources. Lowest Estuary Goal = Lowest of Freshwater vs Marine chronic goals. Used for development of groundwater and soil screening levels.

Aquatic Habitat Goals: Addresses potential impact on freshwater or marine aquatic habitats. Final screening levels are lowest of marine and freshwater criteria.

See text for prioritization and selection of surface water quality screening levels. CNMI/USEPA HH criteria for potential bioaccumulation of chemicals in aquatic life considered in surface water screening levels only (refer to main text).

Drinking water goal substituted as aquatic habitat goal if latter was not available (see text).

Review of aquatic ecotoxicty data for ethanol underway. Based on preliminary review of available data, chronic toxicity screening levels likely to be significantly greater than ceiling level of 50,000 ug/L (see Table I series). Refer to USEPA 2003b, ECOTOX database).

Methyl tert-Butyl Ether: Interim salt water CCC proposed by Region 2 Water Quality Control Board (RWQCBSF, 1998b)

TPH screening levels: Based on TPH screening levels published in SFRWQCB Board Orders. See footnotes for Table F-4b.

AWQC: Aquatic Water Quality Criteria
CCC: Criterion for Continuous Concentration
CMC: Criterion for Maximum Concentration
CNMI: Commonwealth of the Northern Marianas Islands (CNMI 2005)
FCV: Final Chronic Value
FW: Freshwater
LOEL: Lowest Observed Effects Level
MOEE: Ontario Ministry of Environment and Energy (MOEE 1996)
PRG: USDOE Preliminary Remediation Goal for ecological concerns.
SW: Saltwater
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
USDOE: U. S. Department of Energy
USEPA: U.S. Environmental Protection Agency

TABLE F-4b. SUMMARY OF CNMI/USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater							Marine					Other	
CHEMICAL PARAMETER	CNMI/ USEPA CCC	USEPA Chronic LOEL	CNMI/ USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other	Basis	CNMI/ USEPA CCC	USEPA Chronic LOEL	CNMI/ USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Value	Basis
ACENAPHTHENE		5.2E+02		1.7E+03	2.3E+01				7.1E+02		9.7E+02	4.0E+01		
ACENAPHTHYLENE											3.0E+02			
ACETONE						1.5E+03	USDOE FW Chronic PRG							
ALDRIN			3.0E+00							1.3E+00				
ANTHRACENE						7.3E-01	USDOE FW Chronic PRG							
ANTIMONY	3.0E+01		8.8E+01					5.0E+02		1.5E+03				
ARSENIC	1.5E+02		3.4E+02		1.9E+02			3.6E+01		6.9E+01		3.6E+01		
BARIUM														
BENZENE				5.3E+03	4.6E+01				7.0E+02		5.1E+03			
BENZO(a)ANTHRACENE						2.7E-02	USDOE FW Chronic PRG							
BENZO(a)PYRENE					1.4E-02									
BENZO(b)FLUORANTHENE														
BENZO(g,h,i)PERYLENE						1.0E-01	50% MOEE FW Chronic LOEL							
BENZO(k)FLUORANTHENE						3.7E+00	50% MOEE FW Chronic LOEL							
BERYLLIUM		5.3E+00		1.3E+02	5.1E+00									
BIPHENYL, 1,1-					1.4E+01									
BIS(2-CHLOROETHYL)ETHER		1.2E+02		2.4E+05										
BIS(2-CHLOROISOPROPYL)ETHER		1.2E+02		2.4E+05										
BIS(2-ETHYLHEXYL)PHTHALATE					3.2E+01									
BORON						1.6E+00	USDOE FW Chronic PRG							
BROMODICHLOROMETHANE				1.1E+04					6.4E+03		1.2E+04			
BROMOFORM				1.1E+04					6.4E+03		1.2E+04			
BROMOMETHANE				1.1E+04		1.6E+02	50% MOEE FW Chronic LOEL		6.4E+03		1.2E+04			
CADMIUM	2.5E-01		2.0E+00		1.0E+00			8.8E+00		4.0E+01		9.3E+00		
CARBON TETRACHLORIDE				3.5E+04		9.8E+00	USDOE FW Chronic PRG		6.4E+03		5.0E+04			
CHLORDANE	4.3E-03		2.4E+00					4.0E-03		9.0E-02				
CHLOROANILINE, p-						5.0E+00	50% MOEE FW Chronic LOEL							
CHLOROBENZENE		5.0E+01		2.5E+02	1.3E+02				1.3E+02		1.6E+02			
CHLOROETHANE														
CHLOROFORM		1.2E+03		2.9E+04		2.8E+01	USDOE FW Chronic PRG		6.4E+03		1.2E+04			
CHLOROMETHANE				1.1E+04					6.4E+03		1.2E+04			
CHLOROPHENOL, 2-				4.4E+03										
CHROMIUM (Total)						7.4E+01	= Chromium III FW CCC							
CHROMIUM III	7.4E+01		5.7E+02		1.8E+02						1.03E+04			
CHROMIUM VI	1.1E+01		1.6E+01		1.0E+01			5.0E+01		1.1E+03				
CHRYSENE						3.5E-01	50% MOEE FW Chronic LOEL							
COBALT					3.0E+00									
COPPER	9.0E+00		1.3E+01		1.1E+01			3.1E+00		4.8E+00		2.4E+00		
CYANIDE (Free)	5.2E+00		2.2E+01		5.2E+00			1.0E+00		1.0E+00		1.0E+00		
DIBENZO(a,h)ANTHTRACENE						7.5E+00	50% MOEE FW Chronic LOEL							
DIBROMO,1,2- CHLOROPROPANE,3-														
DIBROMOCHLOROMETHANE				1.1E+04					6.4E+03		1.2E+04			
DIBROMOETHANE, 1,2-						1.4E+03	50% MOEE FW Chronic AWQC							
DICHLOROBENZENE, 1,2-		7.6E+02		1.1E+03	1.4E+01				1.3E+02		1.97E+03			
DICHLOROBENZENE, 1,3-		7.6E+02		1.1E+03	7.1E+01				1.3E+02		1.97E+03			
DICHLOROBENZENE, 1,4-		7.6E+02		1.1E+03	1.5E+01				1.3E+02		1.97E+03			
DICHLOROBENZIDINE, 3,3-						2.5E+02	50% MOEE FW Chronic LOEL							
DICHLORODIPHENYLDICHLOROETHANE (DDD)				6.0E-01		1.0E-03	=DDT				3.6E+00		1.0E-03	=DDT
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)				1.1E+03		1.0E-03	=DDT				1.4E+01		1.0E-03	=DDT
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E-03		1.1E+00		1.3E-02			1.0E-03		1.3E-01				
DICHLOROETHANE, 1,1-					4.7E+01									
DICHLOROETHANE, 1,2-		2.0E+04		1.2E+05		9.1E+02	USDOE FW Chronic PRG				1.13E+05			

TABLE F-4b. SUMMARY OF CNMI/USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater							Marine					Other	
CHEMICAL PARAMETER	CNMI/ USEPA CCC	USEPA Chronic LOEL	CNMI/ USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other	Basis	CNMI/ USEPA CCC	USEPA Chronic LOEL	CNMI/ USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Value	Basis
DICHLOROETHYLENE, 1,1-				1.2E+04		2.5E+01	USDOE FW Chronic PRG				2.24E+05			
DICHLOROETHYLENE, Cis 1,2-				1.2E+04		5.9E+02	USDOE FW Chronic PRG				2.24E+05			
DICHLOROETHYLENE, Trans 1,2-				1.2E+04		5.9E+02	USDOE FW Chronic PRG				2.24E+05			
DICHLOROPHENOL, 2,4-		3.7E+02		2.0E+03										
DICHLOROPROPANE, 1,2-		5.7E+03		2.3E+04					3.0E+03		1.03E+04			
DICHLOROPROPENE, 1,3-		2.4E+02		6.1E+03							7.9E+02			
DIELDRIN	5.6E-02		2.4E-01		6.2E-02			1.9E-03		7.1E-01		1.1E-01		
DIETHYLPHTHALATE		3.0E+00		9.4E+02	2.2E+02				3.4E+00		2.94E+03			
DIMETHYLPHENOL, 2,4-	5.3E+02		1.3E+03					1.1E+02		2.7E+02				
DIMETHYLPHTHALATE		3.0E+00		9.4E+02					3.4E+00		2.94E+03			
DINITROPHENOL, 2,4-		1.5E+02		2.3E+02							4.85E+03			
DINITROTOLUENE, 2,4-		2.3E+02		3.3E+02					3.7E+02		5.9E+02			
DIOXANE, 1,4-						3.4E+05	5% Acute FW LC 50						5.0E+05	5% acute FW LC 50
DIOXIN (2,3,7,8-TCDD)		1.0E-05		1.0E-02										
ENDOSULFAN	5.6E-02		2.2E-01		5.6E-02			8.7E-03		3.4E-02				
ENDRIN	3.6E-02		8.6E-02		6.1E-02			2.3E-03		3.7E-02		1.0E-02		
ETHANOL														
ETHYLBENZENE				3.2E+04	2.9E+02						4.3E+02			
FLUORANTHENE				3.98E+03	8.1E+00				1.6E+01		4.0E+01	1.1E+01		
FLUORENE					3.9E+00						3.0E+02			
HEPTACHLOR	3.8E-03		5.2E-01		6.9E-03			3.6E-03		5.3E-02				
HEPTACHLOR EPOXIDE	3.8E-03		5.2E-01					3.6E-03		5.3E-02				
HEXACHLOROBENZENE	3.7E+00		6.0E+00						1.3E+02		1.6E+02			
HEXACHLOROBUTADIENE		9.3E+00		9.0E+01							3.2E+01			
HEXACHLOROCYCLOHEXANE (gamma) LINDANE			9.5E-01		8.0E-02					1.6E-01				
HEXACHLOROETHANE		5.4E+02		9.8E+02	1.2E+01						9.4E+02			
INDENO(1,2,3-cd)PYRENE														
LEAD	2.5E+00		6.5E+01		2.5E+00			8.1E+00		2.1E+02		8.1E+00		
MERCURY	7.7E-01		1.4E+00		1.3E+00			9.4E-01		1.8E+00		1.1E+00		
METHOXYCHLOR			3.0E-02		1.9E-02					3.0E-02				
METHYL ETHYL KETONE						1.4E+04	USDOE FW Chronic PRG							
METHYL ISOBUTYL KETONE						1.7E+02	USDOE FW Chronic PRG							
METHYL MERCURY					3.0E-03									
METHYL TERT BUTYL ETHER						6.6E+04	SFRWQCB FW Chronic						8.0E+03	CalEPA SW Chronic
METHYLENE CHLORIDE				1.1E+04		2.2E+03	USDOE FW Chronic PRG		6.4E+03		1.2E+04			
METHYLNAPHTHALENE (total 1- & 2-)						2.1E+00	USDOE FW Chronic PRG				3.0E+02			
MOLYBDENUM					2.4E+02									
NAPHTHALENE		6.2E+02		2.3E+03	2.4E+01						2.4E+03			
NICKEL	5.2E+01		4.7E+02		1.6E+02			8.2E+00		7.4E+01		8.2E+00		
PENTACHLOROPHENOL	1.5E+01		1.9E+01		1.3E+01			7.9E+00		1.3E+01		7.9E+00		
PERCHLORATE					6.0E+02									
PHENANTHRENE	6.3E+00		3.0E+01		6.3E+00			4.6E+00		7.7E+00		8.3E+00		
PHENOL		2.56E+03		1.02E+04							5.8E+03			
POLYCHLORINATED BIPHENYLS (PCBs)	1.4E-02				1.9E-01			3.0E-02						
PYRENE						2.0E+00	50% MOEE FW Chronic LOEL							
SELENIUM	5.0E+00				5.0E+00			7.1E+01		2.9E+02		7.1E+01		
SILVER			3.2E+00							1.9E+00				
STYRENE														
tert-BUTYL ALCOHOL						1.8E+04	10% Acute FW LC 0							
TETRACHLOROETHANE, 1,1,1,2-				9.32E+03										
TETRACHLOROETHANE, 1,1,2,2-		2.4E+03		9.32E+03	4.2E+02						9.02E+03			
TETRACHLOROETHYLENE		8.4E+02		5.28E+03	1.2E+02				4.5E+02		1.02E+04			

TABLE F-4b. SUMMARY OF CNMI/USEPA AND OTHER PUBLISHED AQUATIC HABITAT GOALS
(ug/l)

	Freshwater							Marine					Other	
CHEMICAL PARAMETER	CNMI/ USEPA CCC	USEPA Chronic LOEL	CNMI/ USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Other	Basis	CNMI/ USEPA CCC	USEPA Chronic LOEL	CNMI/ USEPA CMC	USEPA Acute LOEL	Ecotox Chronic Threshold (AWQC, FCV Or Tier II)	Value	Basis
THALLIUM		4.0E+01		1.4E+03							2.13E+03			
TOLUENE				1.75E+04	1.3E+02				5.0E+03		6.3E+03			
TOXAPHENE	2.0E-04		7.3E-01		1.1E-02			2.0E-04		2.1E-01		2.1E-01		
TPH (gasolines)						5.0E+02	SFBRWQCB						3.7E+03	SFBRWQCB
TPH (middle distillates)						6.4E+02	SFBRWQCB							
TPH (residual fuels)						6.4E+02	SFBRWQCB							
TRICHLOROBENZENE, 1,2,4-		5.0E+01		2.5E+02	1.1E+02				1.29E+02		1.6E+02			
TRICHLOROETHANE, 1,1,1-				1.8E+04	6.2E+01						3.12E+04			
TRICHLOROETHANE, 1,1,2-		9.4E+03		1.8E+04										
TRICHLOROETHYLENE		2.19E+04		4.5E+04	3.6E+02						2.0E+03			
TRICHLOROPHENOL, 2,4,5-	6.3E+01		1.0E+02					1.1E+01		2.4E+02				
TRICHLOROPHENOL, 2,4,6-		9.7E+02												
VANADIUM					1.9E+01									
VINYL CHLORIDE						7.8E+02	USDOE FW Chronic PRG							
XYLENES													1.0E+02	5% acute SW LC 50
ZINC	1.2E+02		1.2E+02		1.0E+02			8.1E+01		9.0E+01		8.1E+01		

References:

Primary sources CNMI (2004), USEPA (1996b), MOEE (1996), USDOE (1997). USEPA criteria summarized in *A Compilation of Water Quality Goals* (August 2003), CalEPA RWQCB Central Valley Region (RWQCBCV 2003 and updates). USEPA CCC and CMC water quality goals adopted in CNMI Water Quality Standards by reference (CNMI 2004).

LC 50 values for 1,4 Dioxane presented in "Solvent Stabilizers White Paper" (Mohr 2001).

Chronic goal for perchlorate from "Perchlorate Environmental Contamination (draft)" (USEPA 1998).

Notes:

Used for development of groundwater and soil screening levels.

See text for prioritization and selection of surface water quality screening levels.

Lowest Chronic Aquatic Habitat Goal: Addresses potential impact on freshwater or marine aquatic life.

Acute LOEL and CMC criteria divided by a factor of ten if selected as lowest screening level. LC 50 divided by factor of twenty.

Barium aquatic habitat goal presented in USEPA Ecotox document not considered for screening of groundwater due to low confidence in goals and elevated background concentrations of barium in Bay area groundwater.

tert Buytl Alcohol (TBA): Chronic aquatic goal based on in-house review of USEPA ECOTOX database for TBA (USEPA 2003b). Ten percent of LC0 concentration for Lepomis macrochirus (Bluegill) selected as most conservative goal of data presented.

Xylenes: Acute saltwater screening level based on review on data in UK Marine SAC summary and marine LC50 of 2.0 mg/L (Cole et al., 1999). Confidence in USDOE PRG and USEPA Ecotox goals low.

AWQC: Aquatic Water Quality Criteria

CCC: Criterion for Continuous Concentration

CMC: Criterion for Maximum Concentration

FCV: Final Chronic Value

FW: Freshwater

LOEL: Lowest Observed Effects Level

MOEE: Ontario Ministry of Environment and Energy (MOEE 1996)

PRG: USDOE Preliminary Remediation Goal for ecological concerns.

SW: Saltwater

TPH Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

USDOE: U. S. Department of Energy

USEPA: U.S. Environmental Protection Agency

TABLE F-4c. SURFACE WATER QUALITY STANDARDS FOR BIOACCUMULATION AND HUMAN CONSUMPTION OF AQUATIC ORGANISMS
(ug/l)

CHEMICAL PARAMETER	[1]CNMI/USEPA NWQC
ACENAPHTHENE	9.9E+02
ACENAPHTHYLENE	
ACETONE	
ALDRIN	5.0E-05
ANTHRACENE	4.0E+04
ANTIMONY	6.4E+02
ARSENIC	1.4E-01
BARIUM	
BENZENE	5.1E+01
BENZO(a)ANTHRACENE	1.8E-02
BENZO(a)PYRENE	1.8E-02
BENZO(b)FLUORANTHENE	1.8E-02
BENZO(g,h,i)PERYLENE	
BENZO(k)FLUORANTHENE	1.8E-02
BERYLLIUM	
BIPHENYL, 1,1-	
BIS(2-CHLOROETHYL)ETHER	5.3E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.5E+04
BIS(2-ETHYLHEXYL)PHTHALATE	2.2E+00
BORON	
BROMODICHLOROMETHANE	
BROMOFORM	1.4E+02
BROMOMETHANE	1.5E+03
CADMIUM	
CARBON TETRACHLORIDE	1.6E+00
CHLORDANE	8.1E-04
CHLOROANILINE, p-	
CHLOROBENZENE	2.1E+04
CHLOROETHANE	
CHLOROFORM	4.7E+02
CHLOROMETHANE	
CHLOROPHENOL, 2-	1.5E+02
CHROMIUM (Total)	
CHROMIUM III	
CHROMIUM VI	
CHRYSENE	1.8E-02
COBALT	
COPPER	
CYANIDE (Free)	2.2E+05
DIBENZO(a,h)ANTHTRACENE	1.8E-02
DIBROMO,1,2- CHLOROPROPANE,3-	
DIBROMOCHLOROMETHANE	1.3E+01
DIBROMOETHANE, 1,2-	
DICHLOROBENZENE, 1,2-	1.7E+04
DICHLOROBENZENE, 1,3-	9.6E+02
DICHLOROBENZENE, 1,4-	2.6E+03
DICHLOROBENZIDINE, 3,3-	2.8E-02
DICHLORODIPHENYLDICHLOROETHANE (DDD)	3.1E-04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.2E-04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.2E-04
DICHLOROETHANE, 1,1-	
DICHLOROETHANE, 1,2-	3.7E+01

TABLE F-4c. SURFACE WATER QUALITY STANDARDS FOR BIOACCUMULATION AND HUMAN CONSUMPTION OF AQUATIC ORGANISMS (ug/l)

CHEMICAL PARAMETER	[1]CNMI/USEPA NWQC
DICHLOROETHYLENE, 1,1-	3.2E+00
DICHLOROETHYLENE, Cis 1,2-	
DICHLOROETHYLENE, Trans 1,2-	140000
DICHLOROPHENOL, 2,4-	2.9E+02
DICHLOROPROPANE, 1,2-	1.5E+01
DICHLOROPROPENE, 1,3-	1.7E+03
DIELDRIN	5.4E-05
DIETHYLPHTHALATE	4.4E+04
DIMETHYLPHENOL, 2,4-	8.5E+02
DIMETHYLPHTHALATE	1.1E+06
DINITROPHENOL, 2,4-	5.3E+03
DINITROTOLUENE, 2,4-	3.4E+00
DIOXANE, 1,4-	
DIOXIN (2,3,7,8-TCDD)	5.1E-09
ENDOSULFAN	8.9E+01
ENDRIN	8.1E-01
ETHANOL	
ETHYLBENZENE	2.9E+04
FLUORANTHENE	1.4E+02
FLUORENE	5.3E+03
HEPTACHLOR	7.9E-05
HEPTACHLOR EPOXIDE	3.9E-05
HEXACHLOROBENZENE	2.9E-04
HEXACHLOROBUTADIENE	1.8E+01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	6.3E-02
HEXACHLOROETHANE	3.3E+00
INDENO(1,2,3-cd)PYRENE	1.8E-02
LEAD	
MERCURY	3.0E-01
METHOXYCHLOR	
METHYL ETHYL KETONE	
METHYL ISOBUTYL KETONE	
METHYL MERCURY	
METHYL TERT BUTYL ETHER	
METHYLENE CHLORIDE	5.9E+02
METHYLNAPHTHALENE (total 1- & 2-)	
MOLYBDENUM	
NAPHTHALENE	
NICKEL	4.6E+03
PENTACHLOROPHENOL	3.0E+00
PERCHLORATE	
PHENANTHRENE	
PHENOL	1.7E+06
POLYCHLORINATED BIPHENYLS (PCBs)	6.4E-05
PYRENE	4.0E+03
SELENIUM	
SILVER	
STYRENE	
tert-BUTYL ALCOHOL	
TETRACHLOROETHANE, 1,1,1,2-	
TETRACHLOROETHANE, 1,1,2,2-	4.0E+00
TETRACHLOROETHYLENE	3.3E+00

TABLE F-4c. SURFACE WATER QUALITY STANDARDS FOR BIOACCUMULATION AND HUMAN CONSUMPTION OF AQUATIC ORGANISMS (ug/l)

CHEMICAL PARAMETER	[1]CNMI/USEPA NWQC
THALLIUM	6.3E+00
TOLUENE	2.0E+05
TOXAPHENE	2.8E-04
TPH (gasolines)	
TPH (middle distillates)	
TPH (residual fuels)	
TRICHLOROBENZENE, 1,2,4-	
TRICHLOROETHANE, 1,1,1-	
TRICHLOROETHANE, 1,1,2-	1.6E+01
TRICHLOROETHYLENE	3.0E+01
TRICHLOROPHENOL, 2,4,5-	3.6E+03
TRICHLOROPHENOL, 2,4,6-	
VANADIUM	
VINYL CHLORIDE	5.3E+02
XYLENES	
ZINC	

References:

1. USEPA National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047. Inc Quality Standards by reference (CNMI 204).

Addresses potential accumulation of chemical in aquatic organisms and subsequent consumption by humans.

TABLE F-5. CALIFORNIA AGRICULTURAL WATER QUALITY GOALS
(ug/l)

CHEMICAL PARAMETER	Agricultural Water Quality Goals
ACENAPHTHENE	-
ACENAPHTHYLENE	-
ACETONE	-
ALDRIN	-
ANTHRACENE	-
ANTIMONY	-
ARSENIC	1.0E+02
BARIUM	-
BENZENE	-
BENZO(a)ANTHRACENE	-
BENZO(a)PYRENE	-
BENZO(b)FLUORANTHENE	-
BENZO(g,h,i)PERYLENE	-
BENZO(k)FLUORANTHENE	-
BERYLLIUM	1.0E+02
BIPHENYL, 1,1-	-
BIS(2-CHLOROETHYL)ETHER	-
BIS(2-CHLOROISOPROPYL)ETHER	-
BIS(2-ETHYLHEXYL)PHTHALATE	-
BORON	7.0E+02
BROMODICHLOROMETHANE	-
BROMOFORM	-
BROMOMETHANE	-
CADMIUM	1.0E+01
CARBON TETRACHLORIDE	-
CHLORDANE	-
CHLOROANILINE, p-	-
CHLOROBENZENE	-
CHLOROETHANE	-
CHLOROFORM	-
CHLOROMETHANE	-
CHLOROPHENOL, 2-	-
CHROMIUM (Total)	-
CHROMIUM III	-
CHROMIUM VI	1.0E+02
CHRYSENE	-
COBALT	5.0E+01
COPPER	2.0E+02
CYANIDE (Free)	-
DIBENZO(a,h)ANTHTRACENE	-
DIBROMO,1,2- CHLOROPROPANE,3-	-
DIBROMOCHLOROMETHANE	-
DIBROMOETHANE, 1,2-	-
DICHLOROBENZENE, 1,2-	-
DICHLOROBENZENE, 1,3-	-
DICHLOROBENZENE, 1,4-	-
DICHLOROBENZIDINE, 3,3-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	-
DICHLOROETHANE, 1,1-	-
DICHLOROETHANE, 1,2-	-
DICHLOROETHYLENE, 1,1-	-
DICHLOROETHYLENE, Cis 1,2-	-

TABLE F-5. CALIFORNIA AGRICULTURAL WATER QUALITY GOALS
(ug/l)

CHEMICAL PARAMETER	Agricultural Water Quality Goals
DICHLOROETHYLENE, Trans 1,2-	-
DICHLOROPHENOL, 2,4-	-
DICHLOROPROPANE, 1,2-	-
DICHLOROPROPENE, 1,3-	-
DIELDRIN	-
DIETHYLPHTHALATE	-
DIMETHYLPHENOL, 2,4-	-
DIMETHYLPHTHALATE	-
DINITROPHENOL, 2,4-	-
DINITROTOLUENE, 2,4-	-
DIOXANE, 1,4-	-
DIOXIN (2,3,7,8-TCDD)	-
ENDOSULFAN	-
ENDRIN	-
ETHANOL	-
ETHYLBENZENE	-
FLUORANTHENE	-
FLUORENE	-
HEPTACHLOR	-
HEPTACHLOR EPOXIDE	-
HEXACHLOROBENZENE	-
HEXACHLOROBUTADIENE	-
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	-
HEXACHLOROETHANE	-
INDENO(1,2,3-cd)PYRENE	-
LEAD	-
MERCURY	-
METHOXYCHLOR	-
METHYL ETHYL KETONE	-
METHYL ISOBUTYL KETONE	-
METHYL MERCURY	-
METHYL TERT BUTYL ETHER	-
METHYLENE CHLORIDE	-
METHYLNAPHTHALENE (total 1- & 2-)	-
MOLYBDENUM	1.0E+01
NAPHTHALENE	-
NICKEL	2.0E+02
PENTACHLOROPHENOL	-
PERCHLORATE	-
PHENANTHRENE	-
PHENOL	-
POLYCHLORINATED BIPHENYLS (PCBs)	-
PYRENE	-
SELENIUM	2.0E+01
SILVER	-
STYRENE	-
tert-BUTYL ALCOHOL	-
TETRACHLOROETHANE, 1,1,1,2-	-
TETRACHLOROETHANE, 1,1,2,2-	-
TETRACHLOROETHYLENE	-
THALLIUM	-
TOLUENE	-
TOXAPHENE	-

TABLE F-5. CALIFORNIA AGRICULTURAL WATER QUALITY GOALS
(ug/l)

CHEMICAL PARAMETER	Agricultural Water Quality Goals
TPH (gasolines)	-
TPH (middle distillates)	-
TPH (residual fuels)	-
TRICHLOROBENZENE, 1,2,4-	-
TRICHLOROETHANE, 1,1,1-	-
TRICHLOROETHANE, 1,1,2-	-
TRICHLOROETHYLENE	-
TRICHLOROPHENOL, 2,4,5-	-
TRICHLOROPHENOL, 2,4,6-	-
VANADIUM	1.0E+02
VINYL CHLORIDE	-
XYLENES	-
ZINC	2.0E+03

References:
A Compiliation of Water Quality Goals (RWQCBCV 2003).

Notes:
Addresses use of water (including groundwater) for agricultural/irrigation purposes.

TABLE F-6. TOXICITY-BASED DRINKING WATER GOALS
(ug/l)

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Tap Water Goal (NonCarcinogenic Effects)	Tap Water Goal (Carcinogenic Effects)
ACENAPHTHENE	3.7E+02	noncarcinogenic effects	3.7E+02	
ACENAPHTHYLENE	2.4E+02	noncarcinogenic effects	2.4E+02	
ACETONE	5.5E+03	noncarcinogenic effects	5.5E+03	
ALDRIN	4.0E-03	carcinogenic effects	1.1E+00	4.0E-03
ANTHRACENE	1.8E+03	noncarcinogenic effects	1.8E+03	
ANTIMONY	1.5E+01	noncarcinogenic effects	1.5E+01	
ARSENIC	4.5E-02	carcinogenic effects	1.1E+01	4.5E-02
BARIUM	2.6E+03	noncarcinogenic effects	2.6E+03	
BENZENE	3.5E-01	carcinogenic effects	4.4E+01	3.5E-01
BENZO(a)ANTHRACENE	9.2E-02	carcinogenic effects		9.2E-02
BENZO(a)PYRENE	9.2E-03	carcinogenic effects		9.2E-03
BENZO(b)FLUORANTHENE	9.2E-02	carcinogenic effects		9.2E-02
BENZO(g,h,i)PERYLENE	1.5E+03	noncarcinogenic effects	1.5E+03	
BENZO(k)FLUORANTHENE	9.2E-01	carcinogenic effects		9.2E-01
BERYLLIUM	7.3E+01	noncarcinogenic effects	7.3E+01	
BIPHENYL, 1,1-	3.0E+02	noncarcinogenic effects	3.0E+02	
BIS(2-CHLOROETHYL)ETHER	9.5E-03	carcinogenic effects		9.5E-03
BIS(2-CHLOROISOPROPYL)ETHER	2.7E-01	carcinogenic effects	2.4E+02	2.7E-01
BIS(2-ETHYLHEXYL)PHTHALATE	4.8E+00	carcinogenic effects	7.3E+02	4.8E+00
BORON	7.3E+03	noncarcinogenic effects	7.3E+03	
BROMODICHLOROMETHANE	1.8E-01	carcinogenic effects	1.2E+02	1.8E-01
BROMOFORM	8.5E+00	carcinogenic effects	7.3E+02	8.5E+00
BROMOMETHANE	8.5E+00	noncarcinogenic effects	8.5E+00	
CADMIUM	1.8E+01	noncarcinogenic effects	1.8E+01	
CARBON TETRACHLORIDE	1.7E-01	carcinogenic effects	4.3E+00	1.7E-01
CHLORDANE	1.9E-01	carcinogenic effects	1.8E+01	1.9E-01
CHLOROANILINE, p-	1.5E+02	noncarcinogenic effects	1.5E+02	
CHLOROBENZENE	1.1E+02	noncarcinogenic effects	1.1E+02	
CHLOROETHANE	3.9E+00	carcinogenic effects	8.6E+03	3.9E+00
CHLOROFORM	1.7E-01	carcinogenic effects	8.0E+01	1.7E-01
CHLOROMETHANE	1.6E+02	noncarcinogenic effects	1.6E+02	
CHLOROPHENOL, 2-	3.0E+01	noncarcinogenic effects	3.0E+01	
CHROMIUM (Total)				
CHROMIUM III	5.5E+04	noncarcinogenic effects	5.5E+04	
CHROMIUM VI	1.1E+02	noncarcinogenic effects	1.1E+02	
CHRYSENE	9.2E+00	carcinogenic effects		9.2E+00
COBALT	7.3E+02	noncarcinogenic effects	7.3E+02	
COPPER	1.5E+03	noncarcinogenic effects	1.5E+03	
CYANIDE (Free)	7.3E+02	noncarcinogenic effects	7.3E+02	
DIBENZO(a,h)ANTHTRACENE	9.2E-03	carcinogenic effects		9.2E-03
DIBROMO,1,2- CHLOROPROPANE,3-	4.8E-02	carcinogenic effects	3.5E-01	4.8E-02
DIBROMOCHLOROMETHANE	1.3E-01	carcinogenic effects	1.2E+02	1.3E-01
DIBROMOETHANE, 1,2-	5.6E-03	carcinogenic effects	1.8E+01	5.6E-03
DICHLOROBENZENE, 1,2-	3.7E+02	noncarcinogenic effects	3.7E+02	
DICHLOROBENZENE, 1,3-	1.8E+02	noncarcinogenic effects	1.8E+02	
DICHLOROBENZENE, 1,4-	5.0E-01	carcinogenic effects	1.8E+02	5.0E-01
DICHLOROBENZIDINE, 3,3-	1.5E-01	carcinogenic effects		1.5E-01
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.8E-01	carcinogenic effects		2.8E-01
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.8E-01	carcinogenic effects		2.8E-01
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.0E-01	carcinogenic effects	1.8E+01	2.0E-01
DICHLOROETHANE, 1,1-	8.0E+02	noncarcinogenic effects	8.0E+02	
DICHLOROETHANE, 1,2-	1.2E-01	carcinogenic effects	1.0E+01	1.2E-01
DICHLOROETHYLENE, 1,1-	3.4E+02	noncarcinogenic effects	3.4E+02	
DICHLOROETHYLENE, Cis 1,2-	6.1E+01	noncarcinogenic effects	6.1E+01	
DICHLOROETHYLENE, Trans 1,2-	1.2E+02	noncarcinogenic effects	1.2E+02	

TABLE F-6. TOXICITY-BASED DRINKING WATER GOALS
(ug/l)

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Tap Water Goal (NonCarcinogenic Effects)	Tap Water Goal (Carcinogenic Effects)
DICHLOROPHENOL, 2,4-	1.1E+02	noncarcinogenic effects	1.1E+02	
DICHLOROPROPANE, 1,2-	1.6E-01	carcinogenic effects	6.7E+00	1.6E-01
DICHLOROPROPENE, 1,3-	4.0E-01	carcinogenic effects	4.0E+01	4.0E-01
DIELDRIN	4.2E-03	carcinogenic effects	1.8E+00	4.2E-03
DIETHYLPHTHALATE	2.9E+04	noncarcinogenic effects	2.9E+04	
DIMETHYLPHENOL, 2,4-	7.3E+02	noncarcinogenic effects	7.3E+02	
DIMETHYLPHTHALATE	3.7E+05	noncarcinogenic effects	3.7E+05	
DINITROPHENOL, 2,4-	7.3E+01	noncarcinogenic effects	7.3E+01	
DINITROTOLUENE, 2,4-	3.4E+01	carcinogenic effects	7.3E+01	3.4E+01
DIOXANE, 1,4-	6.1E+00	carcinogenic effects		6.1E+00
DIOXIN (2,3,7,8-TCDD)	4.5E-07	carcinogenic effects		4.5E-07
ENDOSULFAN	2.2E+02	noncarcinogenic effects	2.2E+02	
ENDRIN	1.1E+01	noncarcinogenic effects	1.1E+01	
ETHANOL				
ETHYLBENZENE	1.3E+03	noncarcinogenic effects	1.3E+03	
FLUORANTHENE	1.5E+03	noncarcinogenic effects	1.5E+03	
FLUORENE	2.4E+02	noncarcinogenic effects	2.4E+02	
HEPTACHLOR	1.5E-02	carcinogenic effects	1.8E+01	1.5E-02
HEPTACHLOR EPOXIDE	7.4E-03	carcinogenic effects	4.7E-01	7.4E-03
HEXACHLOROBENZENE	4.2E-02	carcinogenic effects	2.9E+01	4.2E-02
HEXACHLOROBUTADIENE	8.6E-01	carcinogenic effects	1.1E+01	8.6E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.2E-02	carcinogenic effects	1.1E+01	5.2E-02
HEXACHLOROETHANE	4.8E+00	carcinogenic effects	3.7E+01	4.8E+00
INDENO(1,2,3-cd)PYRENE	9.2E-02	carcinogenic effects		9.2E-02
LEAD				
MERCURY	5.8E+00	noncarcinogenic effects	5.8E+00	
METHOXYCHLOR	1.8E+02	noncarcinogenic effects	1.8E+02	
METHYL ETHYL KETONE	7.0E+03	noncarcinogenic effects	7.0E+03	
METHYL ISOBUTYL KETONE	2.0E+03	noncarcinogenic effects	2.0E+03	
METHYL MERCURY	3.7E+00	noncarcinogenic effects	3.7E+00	
METHYL TERT BUTYL ETHER	1.1E+01	carcinogenic effects	5.2E+03	1.1E+01
METHYLENE CHLORIDE	4.3E+00	carcinogenic effects	1.6E+03	4.3E+00
METHYLNAPHTHALENE (total 1- & 2-)	2.4E+02	noncarcinogenic effects	2.4E+02	
MOLYBDENUM	1.8E+02	noncarcinogenic effects	1.8E+02	
NAPHTHALENE	6.2E+00	noncarcinogenic effects	6.2E+00	
NICKEL	7.3E+02	noncarcinogenic effects	7.3E+02	
PENTACHLOROPHENOL	5.6E-01	carcinogenic effects	1.1E+03	5.6E-01
PERCHLORATE	3.7E+00	noncarcinogenic effects	3.7E+00	
PHENANTHRENE	2.4E+02	noncarcinogenic effects	2.4E+02	
PHENOL	1.1E+04	noncarcinogenic effects	1.1E+04	
POLYCHLORINATED BIPHENYLS (PCBs)	3.4E-02	carcinogenic effects	7.3E-01	3.4E-02
PYRENE	1.8E+02	noncarcinogenic effects	1.8E+02	
SELENIUM	1.8E+02	noncarcinogenic effects	1.8E+02	
SILVER	1.8E+02	noncarcinogenic effects	1.8E+02	
STYRENE	1.6E+03	noncarcinogenic effects	1.6E+03	
tert-BUTYL ALCOHOL	3.7E+00	carcinogenic effects		3.7E+00
TETRACHLOROETHANE, 1,1,1,2-	4.3E-01	carcinogenic effects	1.8E+02	4.3E-01
TETRACHLOROETHANE, 1,1,2,2-	5.6E-02	carcinogenic effects	3.7E+02	5.6E-02
TETRACHLOROETHYLENE	1.0E-01	carcinogenic effects	6.1E+01	1.0E-01
THALLIUM	2.4E+00	noncarcinogenic effects	2.4E+00	
TOLUENE	7.2E+02	noncarcinogenic effects	7.2E+02	
TOXAPHENE	5.6E-02	carcinogenic effects		5.6E-02
TPH (gasolines)	9.3E+01	noncarcinogenic effects	9.3E+01	
TPH (middle distillates)	9.3E+01	noncarcinogenic effects	9.3E+01	
TPH (residual fuels)	1.1E+03	noncarcinogenic effects	1.1E+03	

TABLE F-6. TOXICITY-BASED DRINKING WATER GOALS
(ug/l)

CHEMICAL PARAMETER	Lowest Tapwater Goal (ug/L	Basis	Tap Water Goal (NonCarcinogenic Effects)	Tap Water Goal (Carcinogenic Effects)
TRICHLOROBENZENE, 1,2,4-	7.2E+00	noncarcinogenic effects	7.2E+00	
TRICHLOROETHANE, 1,1,1-	3.2E+03	noncarcinogenic effects	3.2E+03	
TRICHLOROETHANE, 1,1,2-	2.0E-01	carcinogenic effects	2.4E+01	2.0E-01
TRICHLOROETHYLENE	2.8E-02	carcinogenic effects	9.5E+00	2.8E-02
TRICHLOROPHENOL, 2,4,5-	6.1E+02	noncarcinogenic effects	6.1E+02	
TRICHLOROPHENOL, 2,4,6-	3.7E+00	noncarcinogenic effects	3.7E+00	6.1E+00
VANADIUM	3.7E+01	noncarcinogenic effects	3.7E+01	
VINYL CHLORIDE	4.1E-02	carcinogenic effects	7.2E+01	4.1E-02
XYLENES	2.1E+02	noncarcinogenic effects	2.1E+02	
ZINC	1.1E+04	noncarcinogenic effects	1.1E+04	

References:
Calculated using Tap Water equations in USEPA Region IX Preliminary Remediation Goals document (USEPA 2004).

Notes:
Addresses use of water for drinking water and inhalation of volatile chemicals during showering.
Tap Water value for TBA calculated using PRG methodology (not in PRGs).
Target risk = 10-6. Target HQ = 1.0. See Appendix 2 for equations.

TABLE G. SOIL SCREENING LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations		Soil Leaching Screening Levels	
CHEMICAL	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Drinking Water Resource) (Table F-1a) (ug/L)	Target Groundwater Concentration (NON-Drinking Water Resource) (Table F-1b) (ug/L)	Soil Leaching Screening Level (Drinking Water Resource) (mg/kg)	Soil Leaching Screening Level (NON-Drinking Water Resource) (mg/kg)
ACENAPHTHENE	4.90E+03	1.55E-04	8.14E+02	1.3E+02	2.0E+01	2.3E+01	1.6E+01	1.9E+01
ACENAPHTHYLENE	2.50E+03	1.45E-03	4.24E+02	5.9E+01	3.0E+01	3.0E+01	1.3E+01	1.3E+01
ACETONE	5.75E-01	3.88E-05	3.36E-01	1.0E+05	1.5E+03	1.5E+03	5.0E-01	5.0E-01
#ALDRIN	4.90E+04	4.96E-05	8.13E+03	5.0E+00	4.0E-03	1.3E-01	5.0E+00	5.0E+00
ANTHRACENE	2.35E+04	6.50E-05	3.90E+03	6.1E+00	7.3E-01	7.3E-01	2.8E+00	2.8E+00
ANTIMONY					6.0E+00	3.0E+01		
ARSENIC					1.0E+01	3.6E+01		
BARIUM					2.0E+03	2.0E+03		
BENZENE	5.89E+01	5.55E-03	4.42E+01	8.7E+02	5.0E+00	4.6E+01	2.2E-01	2.0E+00
#BENZO(a)ANTHRACENE	2.00E+05	1.00E-06	3.32E+04	1.2E+01	2.7E-02	2.7E-02	1.2E+01	1.2E+01
#BENZO(a)PYRENE	5.50E+06	4.90E-07	9.13E+05	1.3E+02	1.4E-02	1.4E-02	1.3E+02	1.3E+02
#BENZO(b)FLUORANTHENE	5.50E+05	1.22E-05	9.13E+04	4.6E+01	9.2E-02	9.2E-02	4.6E+01	4.6E+01
#BENZO(g,h,i)PERYLENE	1.60E+06	1.44E-07	2.66E+05	2.5E+00	1.0E-01	1.0E-01	2.7E+01	2.7E+01
#BENZO(k)FLUORANTHENE	5.50E+05	3.87E-05	9.13E+04	2.6E+00	4.0E-01	4.0E-01	3.7E+01	3.7E+01
BERYLLIUM					2.7E+00	2.7E+00		
BIPHENYL, 1,1-	7.76E+03	3.00E-04	1.29E+03	3.5E+02	5.0E-01	5.0E+00	6.5E-01	6.5E+00
BIS(2-CHLOROETHYL)ETHER	7.60E+01	1.80E-05	1.27E+01	9.6E+03	9.5E-03	6.1E+01	1.2E-04	7.8E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.10E+01	1.13E-04	1.08E+01	7.9E+02	2.7E-01	6.1E+01	3.0E-03	6.6E-01
BIS(2-ETHYLHEXYL)PHTHALATE	1.00E+05	3.00E-07	1.66E+04	7.8E+02	6.0E+00	3.2E+01	1.0E+02	5.3E+02
BORON					1.6E+00	1.6E+00		
BROMODICHLOROMETHANE	5.50E+01	1.60E-03	1.91E+01	3.0E+03	1.8E-01	2.7E+02	3.4E-03	5.1E+00
BROMOFORM	1.10E+02	5.32E-04	2.16E+01	2.4E+03	1.0E+02	3.2E+03	2.2E+00	6.9E+01
BROMOMETHANE	9.00E+00	6.24E-03	4.02E+01	3.1E+03	8.5E+00	1.6E+02	3.4E-01	6.4E+00
CADMIUM					2.5E-01	2.5E-01		
CARBON TETRACHLORIDE	1.74E+02	3.04E-02	2.18E+02	1.1E+03	5.0E+00	9.8E+00	1.1E+00	2.1E+00
#CHLORDANE	4.40E+04	4.79E-05	7.30E+03	1.5E+01	4.0E-03	4.0E-03	1.5E+01	1.5E+01
CHLOROANILINE, p-	6.40E+01	3.31E-07	1.06E+01	1.3E+03	5.0E+00	5.0E+00	5.3E-02	5.3E-02
CHLOROBENZENE	2.19E+02	3.70E-03	5.93E+01	6.8E+02	2.5E+01	2.5E+01	1.5E+00	1.5E+00
CHLOROETHANE	1.47E+01	1.10E-02	7.07E+01	1.6E+03	3.9E+00	3.9E+00	2.7E-01	2.7E-01
CHLOROFORM	3.98E+01	3.67E-03	2.94E+01	2.9E+03	6.2E+01	6.2E+01	1.8E+00	1.8E+00
CHLOROMETHANE	3.50E+01	2.40E-02	1.55E+02	4.1E+03	1.6E+02	1.9E+03	2.4E+01	2.9E+02
CHLOROPHENOL, 2-	3.98E+02	3.91E-04	6.85E+01	5.5E+04	1.8E-01	1.8E+00	1.2E-02	1.2E-01
CHROMIUM (Total)					7.4E+01	7.4E+01		
CHROMIUM III					7.4E+01	7.4E+01		
CHROMIUM VI					1.1E+01	1.1E+01		
#CHRYSENE	4.00E+05	9.46E-05	6.64E+04	3.8E+00	3.5E-01	3.5E-01	2.3E+01	2.3E+01
COBALT					3.0E+00	3.0E+00		
COPPER					3.1E+00	3.1E+00		

TABLE G. SOIL SCREENING LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations		Soil Leaching Screening Levels	
CHEMICAL	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Drinking Water Resource) (Table F-1a) (ug/L)	Target Groundwater Concentration (NON-Drinking Water Resource) (Table F-1b) (ug/L)	Soil Leaching Screening Level (Drinking Water Resource) (mg/kg)	Soil Leaching Screening Level (NON-Drinking Water Resource) (mg/kg)
CYANIDE (Free)	9.20E+00	1.90E+03	1.18E+07	1.5E+10	1.0E+00	1.0E+00	1.2E+04	1.2E+04
#DIBENZO(a,h)ANTHTRACENE	3.30E+06	7.30E-08	5.48E+05	9.9E+00	9.2E-03	2.5E-01	9.9E+00	1.4E+02
DIBROMO,1,2- CHLOROPROPANE,3-	1.30E+02	1.47E-04	2.25E+01	1.1E+03	2.0E-01	2.0E-01	4.5E-03	4.5E-03
DIBROMOCHLOROMETHANE	4.68E+02	8.50E-04	8.30E+01	1.3E+04	1.3E-01	1.6E+02	1.1E-02	1.3E+01
DIBROMOETHANE, 1,2-	4.40E+01	3.20E-04	9.29E+00	1.2E+03	5.0E-02	1.6E+01	4.6E-04	1.5E-01
DICHLOROBENZENE, 1,2-	6.17E+02	1.90E-03	1.14E+02	6.0E+02	1.0E+01	1.4E+01	1.1E+00	1.6E+00
DICHLOROBENZENE, 1,3-	6.17E+02	1.90E-03	1.14E+02	6.0E+02	6.5E+01	6.5E+01	7.4E+00	7.4E+00
DICHLOROBENZENE, 1,4-	6.17E+02	2.43E-03	1.18E+02	2.8E+02	5.0E+00	1.5E+01	5.9E-01	1.8E+00
DICHLOROBENZIDINE, 3,3-	1.60E+03	8.33E-07	2.66E+02	3.0E+01	1.5E-01	2.5E+02	4.0E-02	6.6E+01
#DICHLORODIPHENYLDICHLOROETHANE (DDD)	7.80E+05	7.96E-06	1.29E+05	7.5E+02	1.0E-03	1.0E-03	7.5E+02	7.5E+02
#DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	4.40E+06	6.80E-05	7.30E+05	1.1E+03	1.0E-03	1.0E-03	1.1E+03	1.1E+03
#DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.40E+05	3.89E-05	3.98E+04	4.3E+00	1.0E-03	1.0E-03	4.3E+00	4.3E+00
DICHLOROETHANE, 1,1-	3.16E+01	5.62E-03	4.01E+01	1.7E+03	4.7E+01	4.7E+01	1.9E+00	1.9E+00
DICHLOROETHANE, 1,2-	1.74E+01	9.79E-04	8.97E+00	1.8E+03	5.0E+00	1.3E+02	4.5E-02	1.2E+00
DICHLOROETHYLENE, 1,1-	5.89E+01	2.61E-02	1.72E+02	1.5E+03	7.0E+00	2.5E+01	1.2E+00	4.3E+00
DICHLOROETHYLENE, Cis 1,2-	3.55E+01	4.08E-03	3.12E+01	1.2E+03	7.0E+01	5.9E+02	2.2E+00	1.8E+01
DICHLOROETHYLENE, Trans 1,2-	5.25E+01	9.38E-03	6.69E+01	3.1E+03	1.0E+02	5.9E+02	6.7E+00	3.9E+01
DICHLOROPHENOL, 2,4-	6.00E+03	2.80E-06	9.96E+02	1.6E+05	3.0E-01	3.0E+00	3.0E-01	3.0E+00
DICHLOROPROPANE, 1,2-	4.37E+01	2.80E-03	2.46E+01	1.1E+03	5.0E+00	1.0E+02	1.2E-01	2.5E+00
DICHLOROPROPENE, 1,3-	4.57E+01	1.77E-02	1.17E+02	1.4E+03	4.0E-01	1.2E+02	4.6E-02	1.4E+01
DIELDRIN	7.40E+03	5.84E-05	1.23E+03	8.3E+00	1.9E-03	1.9E-03	2.3E-03	2.3E-03
DIETHYLPHTHALATE	1.40E+02	1.14E-06	2.32E+01	8.4E+02	1.5E+00	1.5E+00	3.5E-02	3.5E-02
DIMETHYLPHENOL, 2,4-	4.00E+01	2.00E-06	6.65E+00	2.7E+03	1.1E+02	1.1E+02	7.3E-01	7.3E-01
DIMETHYLPHTHALATE	1.40E+02	1.05E-07	2.32E+01	4.7E+03	1.5E+00	1.5E+00	3.5E-02	3.5E-02
DINITROPHENOL, 2,4-	1.70E+01	6.45E-10	2.82E+00	1.1E+03	7.3E+01	7.5E+01	2.1E-01	2.1E-01
DINITROTOLUENE, 2,4-	4.50E+01	4.50E-06	7.50E+00	1.0E+02	3.4E+01	1.2E+02	2.5E-01	8.6E-01
DIOXANE, 1,4-	3.50E+00	3.00E-06	6.00E-01	1.2E+05	6.1E+00	5.0E+04	3.7E-03	3.0E+01
DIOXIN (2,3,7,8-TCDD)	1.30E+07	8.10E-05	2.16E+06	1.1E+06	3.0E-08	5.0E-06	1.1E+06	1.1E+06
ENDOSULFAN	3.20E+03	1.00E-05	5.31E+02	2.9E+00	8.7E-03	8.7E-03	4.6E-03	4.6E-03
ENDRIN	1.70E+03	7.51E-06	2.82E+02	2.7E+00	2.3E-03	2.3E-03	6.5E-04	6.5E-04
ETHANOL	3.09E-01	6.29E-06	9.03E-02	1.0E+05	5.0E+04	5.0E+04	4.5E+00	4.5E+00
ETHYLBENZENE	3.63E+02	7.88E-03	1.09E+02	4.0E+02	3.0E+01	2.9E+02	3.3E+00	3.2E+01
#FLUORANTHENE	3.80E+04	6.50E-06	6.31E+03	6.0E+01	8.0E+00	8.0E+00	6.0E+01	6.0E+01
FLUORENE	1.38E+04	7.70E-05	2.29E+03	1.6E+02	3.9E+00	3.9E+00	8.9E+00	8.9E+00
HEPTACHLOR	2.20E+04	1.48E-03	3.66E+03	7.4E+00	3.6E-03	3.6E-03	1.3E-02	1.3E-02
HEPTACHLOR EPOXIDE	2.30E+04	3.16E-05	3.82E+03	4.8E+01	3.6E-03	3.6E-03	1.4E-02	1.4E-02
#HEXACHLOROBENZENE	1.20E+06	1.70E-03	1.99E+05	7.9E+02	1.0E+00	3.7E+00	7.9E+02	7.9E+02
HEXACHLOROBUTADIENE	2.90E+04	2.56E-02	4.97E+03	3.5E+02	8.6E-01	4.7E+00	4.3E+00	2.3E+01

TABLE G. SOIL SCREENING LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations		Soil Leaching Screening Levels	
CHEMICAL	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Drinking Water Resource) (Table F-1a) (ug/L)	Target Groundwater Concentration (NON-Drinking Water Resource) (Table F-1b) (ug/L)	Soil Leaching Screening Level (Drinking Water Resource) (mg/kg)	Soil Leaching Screening Level (NON-Drinking Water Resource) (mg/kg)
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.70E+03	4.93E-07	6.14E+02	1.6E+02	8.0E-02	8.0E-02	4.9E-02	4.9E-02
HEXACHLOROETHANE	2.00E+04	9.85E-03	3.38E+03	6.0E+03	4.8E+00	1.2E+01	1.6E+01	4.1E+01
#INDENO(1,2,3-cd)PYRENE	1.60E+06	6.95E-08	2.66E+05	5.1E+00	9.2E-02	9.2E-02	2.4E+01	2.4E+01
LEAD					2.5E+00	2.5E+00		
MERCURY					7.7E-01	7.7E-01		
#METHOXYCHLOR	7.90E+04	1.58E-05	1.31E+04	1.9E+01	1.9E-02	1.9E-02	1.9E+01	1.9E+01
METHYL ETHYL KETONE	4.50E+00	2.74E-05	9.17E-01	3.4E+04	7.0E+03	1.4E+04	6.4E+00	1.3E+01
METHYL ISOBUTYL KETONE	1.34E+02	1.40E-04	2.31E+01	1.7E+04	1.7E+02	1.7E+02	3.9E+00	3.9E+00
METHYL MERCURY					3.0E-03	3.0E-03		
METHYL TERT BUTYL ETHER	6.00E+00	5.87E-04	4.64E+00	2.1E+04	5.0E+00	1.8E+03	2.3E-02	8.4E+00
METHYLENE CHLORIDE	1.11E+01	2.19E-03	1.54E+01	2.4E+03	4.3E+00	2.2E+03	6.7E-02	3.4E+01
METHYLNAPHTHALENE (total 1- & 2-)	7.20E+02	2.90E-04	1.21E+02	1.1E+02	2.1E+00	2.1E+00	2.5E-01	2.5E-01
MOLYBDENUM					1.8E+02	2.4E+02		
NAPHTHALENE	1.19E+03	4.83E-04	2.01E+02	2.2E+02	6.2E+00	2.4E+01	1.2E+00	4.8E+00
NICKEL					8.2E+00	8.2E+00		
PENTACHLOROPHENOL	3.20E+04	2.80E-06	5.31E+03	2.7E+06	1.0E+00	7.9E+00	5.3E+00	4.2E+01
PERCHLORATE					3.7E+00	6.0E+02	7.0E-03	1.2E+00
PHENANTHRENE	1.40E+04	3.93E-05	2.32E+03	6.9E+01	4.6E+00	4.6E+00	1.1E+01	1.1E+01
PHENOL	9.10E+01	1.30E-06	1.51E+01	5.2E+04	5.0E+00	1.3E+03	7.6E-02	1.9E+01
#POLYCHLORINATED BIPHENYLS (PCBs)	3.30E+04	5.20E-04	5.48E+03	6.3E+00	1.4E-02	1.4E-02	6.3E+00	6.3E+00
#PYRENE	1.05E+05	1.10E-05	1.74E+04	8.5E+01	2.0E+00	2.0E+00	8.5E+01	8.5E+01
SELENIUM					5.0E+00	5.0E+00		
SILVER					1.9E-01	1.9E-01		
STYRENE	7.76E+02	2.75E-03	1.46E+02	1.5E+03	1.0E+01	1.0E+02	1.5E+00	1.5E+01
tert-BUTYL ALCOHOL	3.70E+01	1.17E-05	6.21E+00	3.2E+05	3.7E+00	1.8E+04	2.3E-02	1.1E+02
TETRACHLOROETHANE, 1,1,1,2-	9.37E+01	3.45E-04	1.77E+01	2.0E+03	4.3E-01	9.3E+02	7.6E-03	1.6E+01
TETRACHLOROETHANE, 1,1,2,2-	9.37E+01	3.45E-04	1.77E+01	2.0E+03	5.6E-02	1.5E+02	9.9E-04	2.7E+00
TETRACHLOROETHYLENE	1.55E+02	1.84E-02	1.40E+02	2.3E+02	5.0E+00	9.9E+01	7.0E-01	1.4E+01
THALLIUM					2.0E+00	2.0E+01		
TOLUENE	1.82E+02	6.64E-03	7.14E+01	6.5E+02	4.0E+01	1.3E+02	2.9E+00	9.3E+00
TOXAPHENE	4.90E+03	2.10E-01	2.12E+03	9.3E+01	2.0E-04	2.0E-04	4.2E-04	4.2E-04
TPH (gasolines)	5.00E+03	7.20E-04	8.34E+02	4.5E+03	1.0E+02	5.0E+02	1.0E+02	4.0E+02
TPH (middle distillates)	5.00E+03	7.20E-04	8.34E+02	1.5E+02	1.0E+02	6.4E+02	1.0E+02	5.0E+02
TPH (residual fuels)					1.0E+02	6.4E+02	1.0E+03	1.0E+03
TRICHLOROBENZENE, 1,2,4-	1.78E+03	1.42E-03	3.04E+02	3.2E+03	2.5E+01	2.5E+01	7.6E+00	7.6E+00
TRICHLOROETHANE, 1,1,1-	1.10E+02	1.72E-02	1.25E+02	1.2E+03	6.2E+01	6.2E+01	7.8E+00	7.8E+00
TRICHLOROETHANE, 1,1,2-	5.01E+01	9.13E-04	1.40E+01	1.8E+03	5.0E+00	2.8E+02	7.0E-02	3.9E+00
TRICHLOROETHYLENE	1.66E+02	1.03E-02	9.15E+01	1.3E+03	5.0E+00	7.4E+01	4.6E-01	6.8E+00

TABLE G. SOIL SCREENING LEVELS FOR LEACHING CONCERNS

					Target Groundwater Concentrations		Soil Leaching Screening Levels	
CHEMICAL	Organic Carbon Coefficient (Koc) (cm^3/g)	Henry's Law Constant (H) ($atm\text{-}m^3/mol$)	Dilution/ Atenuation Factor (DAF)	Saturation Limit (mg/kg)	Target Groundwater Concentration (Drinking Water Resource) (Table F-1a) (ug/L)	Target Groundwater Concentration (NON-Drinking Water Resource) (Table F-1b) (ug/L)	Soil Leaching Screening Level (Drinking Water Resource) (mg/kg)	Soil Leaching Screening Level (NON-Drinking Water Resource) (mg/kg)
TRICHLOROPHENOL, 2,4,5-	8.90E+01	2.18E-04	1.61E+01	7.6E+02	1.1E+01	1.1E+01	1.8E-01	1.8E-01
TRICHLOROPHENOL, 2,4,6-	2.00E+03	4.00E-06	3.32E+02	9.7E+03	3.7E+00	4.9E+02	1.2E+00	1.6E+02
VANADIUM					1.9E+01	1.9E+01		
VINYL CHLORIDE	1.86E+01	2.70E-02	1.71E+02	1.2E+03	2.0E+00	1.1E+01	3.4E-01	1.9E+00
XYLENES	4.07E+02	7.34E-03	1.13E+02	4.2E+02	2.0E+01	1.0E+02	2.3E+00	1.1E+01
ZINC					8.1E+01	8.1E+01		

Notes:

Soil leaching equation from Ontario MOEE guidance (see text).

Groundwater Category Drinking Water Resource - protective of groundwater that is a source of drinking water AND protective of discharge of groundwater to a surface water and subsequent impact on aquatic life.

Groundwater Category NON-Drinking Water Resource - protective of discharge of impacted groundwater to surface water and subsequent impact on aquatic life.

#: Leaching model used considered to be excessively conservative for highly sorptive chemicals. For chemicals with koc values greater than 30,000 cm^3/g, theoretical soil saturation level ("sat") used in place of leaching model screening level if higher (see text). Soil saturation levels calculated using equation presented in USEPA Region IX PRG guidance (USEPA 2004, see Appendix 2). Exceptions include bis(2-ethylhexyl)phthalate and pentachlorophenol (see text).

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

Physio-Chemical constants for chemicals from USEPA Region IX (USEPA 2004) or Ontario MOEE (MOEE 1996) when not available unless otherwise noted (see also Table J).

Physio-Chemical constants for TPH (gasolines and middle distillates) based on constants developed for C11 to C22 aromatic carbon range fraction by Massachusetts DEP and used to develop RBSLs for leaching of TPH in general from soil (MADEP 1997). Soil leaching level rounded to nearest hundred.

Target groundwater concentrations from Table F-1a and F-1b.

Ethanol Dilution/Atenuation Factor (DAF) modified by a factor of ten to take into account anticipated high biodegradation rate in nature (refer to Section 3.4 and Chapter 5 of Appendix 1).

Target groundwater concentration and corresponding soil leaching levels for TPH based on criteria in Board Order 99-045 for San Francisco Airport (RWQCBSF,1999).

Screening Levels for TPH (gasolines) and TPH (middle distilates) rounded to nearest 100 mg/kg.

TPH (residual fuels) soil screening level for leaching from California Regional Water Board, Region 4 - drinking water protection, C23-C32 carbon range (RWQCBLA 1996).

Screening levels for perchlorate calculated using leaching equation in USEPA Soil Screening Guidance and assumed Dilution/Attenuation Factor of 20 (see text).

TABLE H-1. CRITERIA FOR ASSIGNMENT OF SOIL GROSS CONTAMINATION CEILING LEVELS

Soil Category	Criteria	Gross Contamination Ceiling Level (mg/kg)
Surface Soils		
Residential/Parkland/Agricultural	Odor Index ≥ 100 OR no Odor Index and Vapor Pressure ≥ 1 Torr OR no data	100
	0.1 ≤ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	500
	Odor Index < 0.1 OR non-odorous chemical	1000
Industrial/Commercial	Odor Index ≥ 100 OR no Odor Index and Vapor Pressure ≥ 1 Torr OR no data	500
	0.1 ≤ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	1000
	Odor Index < 0.1 OR non-odorous chemical	2500
Subsurface Soils		
Residential/Parkland/Agricultural	Odor Index ≥ 100 OR no Odor Index and Vapor Pressure ≥ 1 Torr OR no data	500
	0.1 ≤ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	1000
	Odor Index < 0.1 OR non-odorous chemical	2500
Industrial/Commercial	Odor Index ≥ 100 OR no Odor Index and Vapor Pressure ≥ 1 Torr OR no data	1000
	0.1 ≤ Odor Index < 100 OR no Odor Index and Vapor Pressure < 1 Torr	2500
	Odor Index < 0.1 OR non-odorous chemical	5000

Modified from Ontario Ministry of Environment and Energy (MOEE 1996) and Massachusetts Department of Environmental Protection (MADEP 1994).

TABLE H-2. COMPONENTS FOR SHALLOW SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
ACENAPHTHENE	1.0E+03	2.5E+03	NA	4.5E-03	5.13E+02	8.00E-02	5.63E-02
ACENAPHTHYLENE	5.0E+02	1.0E+03	NA	2.9E-02	-	-	-
ACETONE	5.0E+02	1.0E+03	1.0E+05	2.70E+02	3.09E+04	1.30E+01	2.08E+01
ALDRIN	1.0E+03	2.5E+03	NA	2.3E-05	2.63E+02	1.70E-02	1.35E-03
ANTHRACENE	5.0E+02	1.0E+03	NA	1.7E-05	-	-	-
ANTIMONY	1.0E+03	2.5E+03	NA	-	-	-	-
ARSENIC	1.0E+03	2.5E+03	NA	-	-	-	-
BARIUM	1.0E+03	2.5E+03	NA	-	-	-	-
BENZENE	5.0E+02	8.7E+02	8.7E+02	9.50E+01	4.89E+03	1.50E+00	6.33E+01
BENZO(a)ANTHRACENE	5.0E+02	1.0E+03	NA	2.2E-08	-	-	-
BENZO(a)PYRENE	5.0E+02	1.0E+03	NA	5.6E-09	-	-	-
BENZO(b)FLUORANTHENE	5.0E+02	1.0E+03	NA	5.0E-07	-	-	-
BENZO(g,h,i)PERYLENE	5.0E+02	1.0E+03	NA	1.1E-10	-	-	-
BENZO(k)FLUORANTHENE	5.0E+02	1.0E+03	NA	9.6E-11	-	-	-
BERYLLIUM	1.0E+03	2.5E+03	NA	-	-	-	-
BIPHENYL, 1,1-	5.0E+02	1.0E+03	NA	5.00E-03	6.00E+01	9.50E-03	5.26E-01
BIS(2-CHLOROETHYL)ETHER	5.0E+02	1.0E+03	9.6E+03	7.1E-01	2.87E+02	4.9E-02	1.45E+01
BIS(2-CHLOROISOPROPYL)ETHER	5.0E+02	7.9E+02	7.9E+02	8.5E-01	2.24E+03	3.20E-01	2.66E+00
BIS(2-ETHYLHEXYL)PHTHALATE	5.0E+02	1.0E+03	NA	6.2E-08	-	-	-
BORON	no criteria	no critiera	NA	-	-	-	-
BROMODICHLOROMETHANE	1.0E+03	2.5E+03	3.0E+03	5.00E+01	1.10E+07	1.68E+03	2.98E-02
BROMOFORM	5.0E+02	1.0E+03	NA	5.60E+00	1.35E+04	1.30E+00	4.31E+00
BROMOMETHANE	5.0E+02	1.0E+03	3.1E+03	1.42E+03	8.00E+04	2.00E+01	7.10E+01
CADMIUM	1.0E+03	2.5E+03	NA	-	-	-	-
CARBON TETRACHLORIDE	5.0E+02	1.0E+03	1.1E+03	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE	1.0E+03	2.5E+03	NA	1.0E-05	8.40E+00	4.92E-04	2.03E-02
CHLOROANILINE, p-	1.0E+03	2.5E+03	NA	1.0E-05	-	-	-
CHLOROBENZENE	5.0E+02	6.8E+02	6.8E+02	1.18E+01	1.00E+03	2.20E-01	5.36E+01
CHLOROETHANE	5.0E+02	1.0E+03	1.6E+03	1.01E+03	3.80E+05	1.40E+02	7.20E+00
CHLOROFORM	5.0E+02	1.0E+03	2.9E+03	1.60E+02	4.22E+05	8.50E+01	1.88E+00
CHLOROMETHANE	1.0E+02	5.0E+02	4.1E+03	4.30E+03	-	-	-
CHLOROPHENOL, 2-	1.0E+02	5.0E+02	5.5E+04	1.42E+00	1.90E+01	3.60E-03	3.94E+02
CHROMIUM (Total)	1.0E+03	2.5E+03	NA	-	-	-	-
CHROMIUM III	1.0E+03	2.5E+03	NA	-	-	-	-
CHROMIUM VI	1.0E+03	2.5E+03	NA	-	-	-	-
CHRYSENE	1.0E+03	2.5E+03	NA	6.3E-07	-	-	-
COBALT	1.0E+03	2.5E+03	NA	-	-	-	-
COPPER	1.0E+03	2.5E+03	NA	-	-	-	-
CYANIDE (Free)	1.0E+02	5.0E+02	NA	6.20E+02	6.52E+02	5.80E-01	1.07E+03

TABLE H-2. COMPONENTS FOR SHALLOW SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
DIBENZO(a,h)ANTHTRACENE	5.0E+02	1.0E+03	NA	1.0E-10	-	-	-
DIBROMO,1,2- CHLOROPROPANE,3-	5.0E+02	1.0E+03	NA	8.00E-01	-	-	-
DIBROMOCHLOROMETHANE	1.0E+02	5.0E+02	1.3E+04	7.60E+01	-	-	-
DIBROMOETHANE, 1,2-	5.0E+02	1.0E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01
DICHLOROBENZENE, 1,2-	6.0E+02	6.0E+02	6.0E+02	1.50E+00	3.05E+05	5.00E+01	3.00E-02
DICHLOROBENZENE, 1,3-	1.0E+02	6.0E+02	6.0E+02	2.30E+00	-	-	-
DICHLOROBENZENE, 1,4-	5.0E+02	1.0E+03	NA	1.80E+00	1.10E+03	1.80E-01	1.00E+01
DICHLOROBENZIDINE, 3,3-	5.0E+02	1.0E+03	NA	4.5E-09	-	-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	5.0E+02	1.0E+03	NA	1.0E-06	-	-	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	5.0E+02	1.0E+03	NA	6.5E-06	-	-	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.0E+03	2.5E+03	NA	5.5E-06	-	-	-
DICHLOROETHANE, 1,1-	5.0E+02	1.0E+03	1.7E+03	2.34E+02	1.25E+05	3.00E+01	7.80E+00
DICHLOROETHANE, 1,2-	5.0E+02	1.0E+03	1.8E+03	7.90E+01	2.42E+03	5.90E-01	1.34E+02
DICHLOROETHYLENE, 1,1-	5.0E+02	1.0E+03	1.5E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	1.0E+02	5.0E+02	1.2E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	5.0E+02	1.0E+03	3.1E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	5.0E+02	1.0E+03	NA	6.7E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPROPANE, 1,2-	1.0E+02	5.0E+02	1.1E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	5.0E+02	1.0E+03	1.4E+03	4.30E+01	4.16E+03	1.00E+00	4.30E+01
DIELDRIN	1.0E+03	2.5E+03	NA	1.8E-08	-	-	-
DIETHYLPHTHALATE	5.0E+02	1.0E+03	NA	3.5E-04	-	-	-
DIMETHYLPHENOL, 2,4-	1.0E+02	5.0E+02	NA	9.8E-02	1.00E+00	1.97E-04	4.97E+02
DIMETHYLPHTHALATE	5.0E+02	1.0E+03	NA	1.7E-03	-	-	-
DINITROPHENOL, 2,4-	5.0E+02	1.0E+03	NA	1.5E-05	-	-	-
DINITROTOLUENE, 2,4-	5.0E+02	1.0E+03	NA	5.1E-03	-	-	-
DIOXANE, 1,4-	5.0E+02	1.0E+03	NA	3.70E+01	6.12E+05	1.70E+02	2.18E-01
DIOXIN (2,3,7,8-TCDD)	no criteria	no criteria	NA	-	-	-	-
ENDOSULFAN	5.0E+02	1.0E+03	NA	1.0E-05	-	-	-
ENDRIN	5.0E+02	1.0E+03	NA	2.0E-07	-	-	-
ETHANOL	5.0E+02	1.0E+03	0.0E+00	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.0E+02	4.0E+02	4.0E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	5.0E+02	1.0E+03	NA	5.0E-06	-	-	-
FLUORENE	5.0E+02	1.0E+03	NA	3.2E-04	-	-	-
HEPTACHLOR	1.0E+03	2.5E+03	NA	3.0E-04	3.00E+02	2.00E-02	1.50E-02
HEPTACHLOR EPOXIDE	1.0E+03	2.5E+03	NA	2.6E-06	3.00E+02	1.90E-02	1.37E-04
HEXACHLOROBENZENE	5.0E+02	1.0E+03	NA	1.1E-05	-	-	-
HEXACHLOROBUTADIENE	5.0E+02	1.0E+03	NA	1.50E-01	1.20E+04	1.10E+00	1.36E-01
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	5.0E+02	1.0E+03	NA	9.4E-06	-	-	-
HEXACHLOROETHANE	5.0E+02	1.0E+03	NA	2.1E-01	-	-	-

TABLE H-2. COMPONENTS FOR SHALLOW SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
INDENO(1,2,3-cd)PYRENE	5.0E+02	1.0E+03	NA	1.0E-06	-	-	-
LEAD	1.0E+03	2.5E+03	NA	-	-	-	-
MERCURY	5.0E+02	1.0E+03	NA	2.0E-03	-	-	-
METHOXYCHLOR	5.0E+02	1.0E+03	NA	1.4E-06	-	-	-
METHYL ETHYL KETONE	5.0E+02	1.0E+03	3.4E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	1.0E+02	5.0E+02	1.7E+04	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	1.0E+02	5.0E+02	NA	-	-	-	-
METHYL TERT BUTYL ETHER	1.0E+02	5.0E+02	NA	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	5.0E+02	1.0E+03	NA	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE (total 1- & 2-)	5.0E+02	1.0E+03	1.1E+02	6.8E-02	6.80E+01	1.15E-02	5.91E+00
MOLYBDENUM	1.0E+03	2.5E+03	NA	-	-	-	-
NAPHTHALENE	5.0E+02	1.0E+03	NA	8.2E-02	4.40E+02	8.40E-02	9.76E-01
NICKEL	1.0E+03	2.5E+03	NA	-	-	-	-
PENTACHLOROPHENOL	5.0E+02	1.0E+03	NA	1.1E-04	-	-	-
PERCHLORATE	1.0E+03	2.5E+03	NA	-	-	-	-
PHENANTHRENE	5.0E+02	1.0E+03	NA	9.6E-04	5.50E+01	7.42E-03	1.29E-01
PHENOL	5.0E+02	1.0E+03	NA	3.50E-01	1.56E+02	4.00E-02	8.75E+00
POLYCHLORINATED BIPHENYLS (PCBs)	5.0E+02	1.0E+03	NA	4.9E-04 to 6.7E-03	-	-	-
PYRENE	5.0E+02	1.0E+03	NA	2.5E-06	-	-	-
SELENIUM	1.0E+03	2.5E+03	NA	-	-	-	-
SILVER	1.0E+03	2.5E+03	NA	-	-	-	-
STYRENE	5.0E+02	1.0E+03	1.5E+03	5.00E+00	1.36E+03	3.00E-01	1.67E+01
tert-BUTYL ALCOHOL	1.0E+02	5.0E+02	3.2E+05	4.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,1,2-	1.0E+02	5.0E+02	2.0E+03	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	1.0E+03	2.0E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	2.3E+02	2.3E+02	2.3E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
THALLIUM	1.0E+03	2.5E+03	NA	-	-	-	-
TOLUENE	5.0E+02	6.5E+02	6.5E+02	2.80E+01	3.00E+04	8.00E+00	3.50E+00
TOXAPHENE	5.0E+02	1.0E+03	NA	4.00E-01	-	-	-
TPH (gasolines)	1.0E+02	5.0E+02	-	3.00E+02	1.00E+02	2.20E-02	1.36E+04
TPH (middle distillates)	1.0E+02	5.0E+02	-	5.00E+00	1.00E+03	1.41E-02	3.55E+02
TPH (residual fuels)	5.0E+02	2.5E+03	-	-	-	-	-
TRICHLOROBENZENE, 1,2,4-	5.0E+02	1.0E+03	NA	2.9E-01	2.20E+04	2.96E+00	9.80E-02
TRICHLOROETHANE, 1,1,1-	5.0E+02	1.0E+03	1.2E+03	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	1.0E+02	5.0E+02	1.8E+03	2.25E+01	-	-	-
TRICHLOROETHYLENE	5.0E+02	8.2E+02	1.3E+03	7.70E+01	1.36E+06	2.49E+02	3.09E-01
TRICHLOROPHENOL, 2,4,5-	1.0E+02	5.0E+02	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	5.0E+02	1.0E+03	NA	1.2E-02	3.00E-01	3.60E-05	3.33E+02
VANADIUM	1.0E+03	2.5E+03	NA	-	-	-	-

TABLE H-2. COMPONENTS FOR SHALLOW SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
VINYL CHLORIDE	5.0E+02	1.0E+03	1.2E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	4.2E+02	4.2E+02	4.2E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	1.0E+03	2.5E+03	NA	-	-	-	-

Notes:

1. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Odor Index = VP/ORT in ppm-v
Physio-chemical constants Ontario MOEE (MOEE 1996) except as noted.
Physio-chemical constants for cloroethane and chloromethane from ATSDR Toxicological Profiles (ATSDR 2001).
Odor Recognition Threshold in parts per million - volume (ppm-v = (concentration in mg/m3) x (24/molecular weight)).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
Ceiling Level: Based on comparison of vapor pressure and odor index to Table H-1 or saturation limit, if lower.
Saturation limits calculated using equation in USEPA Region IX PRG guidance (for chemicals that are liquid at ambient temperatures and pressures; refer to Appendix 2).
Odor Threshold for ethanol of 10 ppmv from U.S. Coast Guard Chemical Hazards Response Information System (USCG 1999).
Odor Threshold of 0.13 ppmv for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).
TPH VP values from NIOSH (2005); ORT values from ATSDR (2001a).
Ceiling Levels for TPH after guidance from Massachusetts Department of Environmental Protection (MADEP 1997a). Adjust as needed in field.

References for vapor pressure and odor threshold data (in order of use):

1. Ontario Ministry of Environment and Energy (MOEE 1996).
2. Massachusetts Department of Environmental Protection (MADEP 1994).
3. Agency for Toxic Substances and Disease Registry (ATSDR 2001).
4. Vapor Pressure for 1,4 Dioxane from "Solvent Stabilizers - White Paper" (Mohr 2001). Odor Threshold from US Department of Health and Human Services, National Toxicology Program (USDHHS, 2001).

TABLE H-3. COMPONENTS FOR DEEP SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
ACENAPHTHENE	2.5E+03	5.0E+03	NA	4.5E-03	5.13E+02	8.00E-02	5.63E-02
ACENAPHTHYLENE	1.0E+03	2.5E+03	NA	2.9E-02	-	-	-
ACETONE	1.0E+03	2.5E+03	1.0E+05	2.70E+02	3.09E+04	1.30E+01	2.08E+01
ALDRIN	2.5E+03	5.0E+03	NA	2.3E-05	2.63E+02	1.70E-02	1.35E-03
ANTHRACENE	1.0E+03	2.5E+03	NA	1.7E-05	-	-	-
ANTIMONY	2.5E+03	5.0E+03	NA	-	-	-	-
ARSENIC	2.5E+03	5.0E+03	NA	-	-	-	-
BARIUM	2.5E+03	5.0E+03	NA	-	-	-	-
BENZENE	8.7E+02	8.7E+02	8.7E+02	9.50E+01	4.89E+03	1.50E+00	6.33E+01
BENZO(a)ANTHRACENE	1.0E+03	2.5E+03	NA	2.2E-08	-	-	-
BENZO(a)PYRENE	1.0E+03	2.5E+03	NA	5.6E-09	-	-	-
BENZO(b)FLUORANTHENE	1.0E+03	2.5E+03	NA	5.0E-07	-	-	-
BENZO(g,h,i)PERYLENE	1.0E+03	2.5E+03	NA	1.1E-10	-	-	-
BENZO(k)FLUORANTHENE	1.0E+03	2.5E+03	NA	9.6E-11	-	-	-
BERYLLIUM	2.5E+03	5.0E+03	NA	-	-	-	-
BIPHENYL, 1,1-	1.0E+03	2.5E+03	NA	5.00E-03	6.00E+01	9.50E-03	5.26E-01
BIS(2-CHLOROETHYL)ETHER	1.0E+03	2.5E+03	9.6E+03	7.1E-01	2.87E+02	4.9E-02	1.45E+01
BIS(2-CHLOROISOPROPYL)ETHER	7.9E+02	7.9E+02	7.9E+02	8.5E-01	2.24E+03	3.20E-01	2.66E+00
BIS(2-ETHYLHEXYL)PHTHALATE	1.0E+03	2.5E+03	NA	6.2E-08	-	-	-
BORON	no criteria	no critiera	NA	-	-	-	-
BROMODICHLOROMETHANE	2.5E+03	4.8E+03	3.0E+03	5.00E+01	1.10E+07	1.68E+03	2.98E-02
BROMOFORM	1.0E+03	2.5E+03	NA	5.60E+00	1.35E+04	1.30E+00	4.31E+00
BROMOMETHANE	1.0E+03	2.5E+03	3.1E+03	1.42E+03	8.00E+04	2.00E+01	7.10E+01
CADMIUM	2.5E+03	5.0E+03	NA	-	-	-	-
CARBON TETRACHLORIDE	1.0E+03	1.1E+03	1.1E+03	1.13E+02	6.30E+04	1.00E+01	1.13E+01
CHLORDANE	2.5E+03	5.0E+03	NA	1.0E-05	8.40E+00	4.92E-04	2.03E-02
CHLOROANILINE, p-	2.5E+03	5.0E+03	NA	1.0E-05	-	-	-
CHLOROBENZENE	6.8E+02	6.8E+02	6.8E+02	1.18E+01	1.00E+03	2.20E-01	5.36E+01
CHLOROETHANE	1.0E+03	1.6E+03	1.6E+03	1.01E+03	3.80E+05	1.40E+02	7.20E+00
CHLOROFORM	1.0E+03	2.5E+03	2.9E+03	1.60E+02	4.22E+05	8.50E+01	1.88E+00
CHLOROMETHANE	5.0E+02	1.0E+03	4.1E+03	4.30E+03	-	-	-
CHLOROPHENOL, 2-	5.0E+02	1.0E+03	5.5E+04	1.42E+00	1.90E+01	3.60E-03	3.94E+02
CHROMIUM (Total)	2.5E+03	5.0E+03	NA	-	-	-	-
CHROMIUM III	2.5E+03	5.0E+03	NA	-	-	-	-
CHROMIUM VI	2.5E+03	5.0E+03	NA	-	-	-	-
CHRYSENE	2.5E+03	5.0E+03	NA	6.3E-07	-	-	-
COBALT	2.5E+03	5.0E+03	NA	-	-	-	-
COPPER	2.5E+03	5.0E+03	NA	-	-	-	-

TABLE H-3. COMPONENTS FOR DEEP SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
CYANIDE (Free)	5.0E+02	1.0E+03	NA	6.20E+02	6.52E+02	5.80E-01	1.07E+03
DIBENZO(a,h)ANTHTRACENE	1.0E+03	2.5E+03	NA	1.0E-10	-	-	-
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+03	1.1E+03	NA	8.00E-01	-	-	-
DIBROMOCHLOROMETHANE	5.0E+02	1.0E+03	1.3E+04	7.60E+01	-	-	-
DIBROMOETHANE, 1,2-	1.0E+03	2.5E+03	NA	1.20E+01	2.00E+05	2.60E+01	4.62E-01
DICHLOROBENZENE, 1,2-	6.0E+02	6.0E+02	6.0E+02	1.50E+00	3.05E+05	5.00E+01	3.00E-02
DICHLOROBENZENE, 1,3-	6.0E+02	6.0E+02	6.0E+02	2.30E+00	-	-	-
DICHLOROBENZENE, 1,4-	1.0E+03	2.5E+03	NA	1.80E+00	1.10E+03	1.80E-01	1.00E+01
DICHLOROBENZIDINE, 3,3-	1.0E+03	2.5E+03	NA	4.5E-09	-	-	-
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E+03	2.5E+03	NA	1.0E-06	-	-	-
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E+03	2.5E+03	NA	6.5E-06	-	-	-
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	2.5E+03	5.0E+03	NA	5.5E-06	-	-	-
DICHLOROETHANE, 1,1-	1.0E+03	1.7E+03	1.7E+03	2.34E+02	1.25E+05	3.00E+01	7.80E+00
DICHLOROETHANE, 1,2-	1.0E+03	1.8E+03	1.8E+03	7.90E+01	2.42E+03	5.90E-01	1.34E+02
DICHLOROETHYLENE, 1,1-	1.0E+03	1.5E+03	1.5E+03	5.91E+02	2.00E+06	5.00E+02	1.18E+00
DICHLOROETHYLENE, Cis 1,2-	5.0E+02	1.0E+03	1.2E+03	2.15E+02	-	-	-
DICHLOROETHYLENE, Trans 1,2-	1.0E+03	2.5E+03	3.1E+03	3.31E+02	6.73E+04	1.70E+01	1.95E+01
DICHLOROPHENOL, 2,4-	1.0E+03	2.5E+03	NA	6.7E-02	1.40E+03	2.10E-01	3.19E-01
DICHLOROPROPANE, 1,2-	5.0E+02	1.0E+03	1.1E+03	4.20E+01	1.19E+03	2.50E-01	1.68E+02
DICHLOROPROPENE, 1,3-	1.0E+03	1.4E+03	1.4E+03	4.30E+01	4.16E+03	1.00E+00	4.30E+01
DIELDRIN	2.5E+03	5.0E+03	NA	1.8E-08	-	-	-
DIETHYLPHTHALATE	1.0E+03	2.5E+03	NA	3.5E-04	-	-	-
DIMETHYLPHENOL, 2,4-	5.0E+02	1.0E+03	NA	9.8E-02	1.00E+00	1.97E-04	4.97E+02
DIMETHYLPHTHALATE	1.0E+03	2.5E+03	NA	1.7E-03	-	-	-
DINITROPHENOL, 2,4-	1.0E+03	2.5E+03	NA	1.5E-05	-	-	-
DINITROTOLUENE, 2,4-	1.0E+03	2.5E+03	NA	5.1E-03	-	-	-
DIOXANE, 1,4-	1.0E+03	2.5E+03	NA	3.70E+01	6.12E+05	1.70E+02	2.18E-01
DIOXIN (2,3,7,8-TCDD)	no criteria	no criteria	NA	-	-	-	-
ENDOSULFAN	1.0E+03	2.5E+03	NA	1.0E-05	-	-	-
ENDRIN	1.0E+03	2.5E+03	NA	2.0E-07	-	-	-
ETHANOL	1.0E+03	2.5E+03	0.0E+00	5.65E+01	1.92E+04	1.00E+01	5.65E+00
ETHYLBENZENE	4.0E+02	4.0E+02	4.0E+02	1.00E+01	2.00E+03	4.50E-01	2.22E+01
FLUORANTHENE	1.0E+03	2.5E+03	NA	5.0E-06	-	-	-
FLUORENE	1.0E+03	2.5E+03	NA	3.2E-04	-	-	-
HEPTACHLOR	2.5E+03	5.0E+03	NA	3.0E-04	3.00E+02	2.00E-02	1.50E-02
HEPTACHLOR EPOXIDE	2.5E+03	5.0E+03	NA	2.6E-06	3.00E+02	1.90E-02	1.37E-04
HEXACHLOROBENZENE	1.0E+03	2.5E+03	NA	1.1E-05	-	-	-
HEXACHLOROBUTADIENE	1.0E+03	2.5E+03	NA	1.50E-01	1.20E+04	1.10E+00	1.36E-01

TABLE H-3. COMPONENTS FOR DEEP SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.0E+03	2.5E+03	NA	9.4E-06	-	-	-
HEXACHLOROETHANE	1.0E+03	2.5E+03	NA	2.1E-01	-	-	-
INDENO(1,2,3-cd)PYRENE	1.0E+03	2.5E+03	NA	1.0E-06	-	-	-
LEAD	2.5E+03	5.0E+03	NA	-	-	-	-
MERCURY	1.0E+03	2.5E+03	NA	2.0E-03	-	-	-
METHOXYCHLOR	1.0E+03	2.5E+03	NA	1.4E-06	-	-	-
METHYL ETHYL KETONE	1.0E+03	2.5E+03	3.4E+04	1.00E+02	3.20E+04	1.10E+01	9.09E+00
METHYL ISOBUTYL KETONE	5.0E+02	1.0E+03	1.7E+04	1.00E+01	4.20E+02	1.00E-01	1.00E+02
METHYL MERCURY	5.0E+02	1.0E+03	NA	-	-	-	-
METHYL TERT BUTYL ETHER	5.0E+02	1.0E+03	NA	2.45E+02	5.30E+02	1.30E-01	1.88E+03
METHYLENE CHLORIDE	1.0E+03	2.4E+03	NA	4.29E+02	5.60E+05	1.60E+02	2.68E+00
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+03	2.5E+03	1.1E+02	6.8E-02	6.80E+01	1.15E-02	5.91E+00
MOLYBDENUM	2.5E+03	5.0E+03	NA	-	-	-	-
NAPHTHALENE	1.0E+03	2.5E+03	NA	8.2E-02	4.40E+02	8.40E-02	9.76E-01
NICKEL	2.5E+03	5.0E+03	NA	-	-	-	-
PENTACHLOROPHENOL	1.0E+03	2.5E+03	NA	1.1E-04	-	-	-
PERCHLORATE	2.5E+03	5.0E+03	NA	-	-	-	-
PHENANTHRENE	1.0E+03	2.5E+03	NA	9.6E-04	5.50E+01	7.42E-03	1.29E-01
PHENOL	1.0E+03	2.5E+03	NA	3.50E-01	1.56E+02	4.00E-02	8.75E+00
POLYCHLORINATED BIPHENYLS (PCBs)	1.0E+03	2.5E+03	NA	4.9E-04 to 6.7E-03	-	-	-
PYRENE	1.0E+03	2.5E+03	NA	2.5E-06	-	-	-
SELENIUM	2.5E+03	5.0E+03	NA	-	-	-	-
SILVER	2.5E+03	5.0E+03	NA	-	-	-	-
STYRENE	1.0E+03	1.5E+03	1.5E+03	5.00E+00	1.36E+03	3.00E-01	1.67E+01
tert-BUTYL ALCOHOL	5.0E+02	1.0E+03	3.2E+05	4.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,1,2-	5.0E+02	1.0E+03	2.0E+03	1.20E+01	-	-	-
TETRACHLOROETHANE, 1,1,2,2-	1.0E+03	1.7E+03	2.0E+03	4.00E+00	1.05E+04	1.50E+00	2.67E+00
TETRACHLOROETHYLENE	2.3E+02	2.3E+02	2.3E+02	1.90E+01	3.17E+04	4.68E+00	4.06E+00
THALLIUM	2.5E+03	5.0E+03	NA	-	-	-	-
TOLUENE	6.5E+02	6.5E+02	6.5E+02	2.80E+01	3.00E+04	8.00E+00	3.50E+00
TOXAPHENE	1.0E+03	2.5E+03	NA	4.00E-01	-	-	-
TPH (gasolines)	5.0E+03	5.0E+03	-	3.00E+02	1.00E+02	2.20E-02	1.36E+04
TPH (middle distillates)	5.0E+03	5.0E+03	-	5.00E+00	1.00E+03	1.41E-02	3.55E+02
TPH (residual fuels)	5.0E+03	5.0E+03	-	-	-	-	-
TRICHLOROBENZENE, 1,2,4-	1.0E+03	2.5E+03	NA	2.9E-01	2.20E+04	2.96E+00	9.80E-02
TRICHLOROETHANE, 1,1,1-	1.0E+03	1.2E+03	1.2E+03	1.00E+02	6.51E+04	1.20E+01	8.33E+00
TRICHLOROETHANE, 1,1,2-	5.0E+02	1.0E+03	1.8E+03	2.25E+01	-	-	-
TRICHLOROETHYLENE	1.0E+03	1.3E+03	1.3E+03	7.70E+01	1.36E+06	2.49E+02	3.09E-01

TABLE H-3. COMPONENTS FOR DEEP SOIL GROSS CONTAMINATION CEILING LEVELS (mg/kg)

CHEMICAL PARAMETER	[1]Residential Gross Contamination Ceiling Level	Industrial/ Commercial Gross Contamination Ceiling Level	Soil Saturation Limit (mg/kg)	Vapor Pressure (VP) (Torr @ 20-30 °C)	50 Percentile Odor Recognition Threshold (ORT) (ug/m^3)	50 Percentile Odor Recognition Threshold (ORT) (ppm-v)	Odor Index
TRICHLOROPHENOL, 2,4,5-	5.0E+02	1.0E+03	NA	-	-	-	-
TRICHLOROPHENOL, 2,4,6-	1.0E+03	2.5E+03	NA	1.2E-02	3.00E-01	3.60E-05	3.33E+02
VANADIUM	2.5E+03	5.0E+03	NA	-	-	-	-
VINYL CHLORIDE	1.0E+03	2.5E+03	1.2E+03	2.58E+03	7.71E+05	2.94E+02	8.78E+00
XYLENES	4.2E+02	4.2E+02	4.2E+02	6.00E+00	4.41E+02	1.00E-01	6.00E+01
ZINC	2.5E+03	5.0E+03	NA	-	-	-	-

Notes:

1. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).

Odor Index = VP/ORT in ppm-v

Physio-chemical constants Ontario MOEE (MOEE 1996) except as noted.

Physio-chemical constants for cloroethane and chloromethane from ATSDR Toxicological Profiles (ATSDR 2001).

Odor Recognition Threshold in parts per million - volume (ppm-v = (concentration in mg/m3) x (24/molecular weight)).

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

Ceiling Level: Based on comparison of vapor pressure and odor index to Table H-1 or saturation limit, if lower.

Saturation limits calculated using equation in USEPA Region IX PRG guidance (for chemicals that are liquid at ambient temperatures and pressures; refer to Appendix 2).

Odor Threshold for ethanol of 10 ppmv from U.S. Coast Guard Chemical Hazards Response Information System (USCG 1999).

Odor Threshold of 0.13 ppmv for MTBE from information in CaEPA Public Health Goal for MTBE (CalEPA 1999).

TPH VP values from NIOSH (2005); ORT values from ATSDR (2001a).

Ceiling Levels for TPH after guidance from Massachusetts Department of Environmental Protection (MADEP 1997a). Adjust as needed in field.

References for vapor pressure and odor threshold data (in order of use):

1. Ontario Ministry of Environment and Energy (MOEE 1996).
2. Massachusetts Department of Environmental Protection (MADEP 1994).
3. Agency for Toxic Substances and Disease Registry (ATSDR 2001).
4. National Library of Medicine, Hazardous Substances Data Bank (NLM 2000).
5. U.S. Department of Health and Human Services (NIOSH 2005).

TABLE I-1. GROUNDWATER CEILING LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.1E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Taste & Odors	5.0E+08	2.0E+04	Amoore & Hautala	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	1.7E+02	Taste & Odors	8.8E+05	1.7E+02	Amoore & Hautala	5.0E+04
BENZO(a)ANTHRACENE	5.0E+00	Solubility	5.0E+00	-	-	5.0E+04
BENZO(a)PYRENE	1.9E+00	Solubility	1.9E+00	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.0E+00	Solubility	7.0E+00	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E-01	Taste & Odors	3.8E+03	5.0E-01	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+02	Taste & Odors	8.6E+06	3.6E+02	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+02	Taste & Odors	8.5E+05	3.2E+02	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	6.5E+02	Solubility	6.5E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	3.4E+06	-	-	5.0E+04
BROMOFORM	5.1E+02	Taste & Odors	1.6E+06	5.1E+02	Amoore & Hautala	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+02	Taste & Odors	4.0E+05	5.2E+02	Amoore & Hautala	5.0E+04
CHLORDANE	2.5E+00	Taste & Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	1.3E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Taste & Odors	2.4E+05	5.0E+01	Amoore & Hautala	5.0E+04
CHLOROETHANE	1.6E+01	Taste & Odors	2.9E+06	1.6E+01	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+03	Taste & Odors	4.0E+06	2.4E+03	Amoore & Hautala	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	4.1E+06		-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Taste & Odors	1.1E+07	1.8E-01	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit		-	-	5.0E+04

TABLE I-1. GROUNDWATER CEILING LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
CHRYSENE	8.0E-01	Solubility	8.0E-01	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	1.0E+03	Taste & Odors		1.0E+03	CalDHS 2nd MCL	5.0E+04
CYANIDE (Free)	1.7E+02	Taste & Odors	5.0E+08	1.7E+02	Amoore & Hautala	5.0E+04
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Solubility	2.5E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Taste & Odors	6.0E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	1.7E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Taste & Odors	7.8E+04	1.0E+01	USEPA 2nd MCL	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	5.0E+00	Taste & Odors	3.7E+04	5.0E+00	USEPA 2nd MCL	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	8.0E+01	Solubility	8.0E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.5E+00	Solubility	1.5E+00	3.5E+02	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	7.0E+03	Taste & Odors	4.3E+06	7.0E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Taste & Odors	1.1E+06	1.5E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	3.2E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.3E+06	3.0E-01	Ontario MOEE	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+01	Taste & Odors	1.4E+06	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	4.1E+01	Taste & Odors	9.3E+01	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	4.5E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	Taste & Odors	3.9E+06	4.0E+02	Cal DHS AL	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	2.8E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXIN (2,3,7,8-TCDD)	7.0E+03	Solubility	7.0E+03	-	-	5.0E+04
ENDOSULFAN	7.5E+01	Solubility	7.5E+01	-	-	5.0E+04
ENDRIN	4.1E+01	Taste & Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+01	Taste & Odors	8.5E+04	3.0E+01	USEPA 2nd MCL	5.0E+04

TABLE I-1. GROUNDWATER CEILING LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Taste & Odors	2.8E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.8E+02	Solubility	1.8E+02	-	-	5.0E+04
HEXACHLOROBENZENE	5.5E+01	Solubility	5.5E+01	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Taste & Odors	1.0E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.5E+03	Solubility	3.5E+03	1.2E+04	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+01	Taste & Odors	2.5E+04	1.0E+01	Amoore & Hautala	5.0E+04
INDENO(1,2,3-cd)PYRENE	2.7E-01	Solubility	2.7E-01	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHOXYCHLOR	2.0E+01	Solubility	2.0E+01	4.7E+03	Amoore & Hautala	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Taste & Odors	1.3E+08	8.4E+03	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+03	Taste & Odors	9.5E+06	1.3E+03	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	5.0E+00	Taste & Odors	7.5E+07	5.0E+00	Cal DHS 2nd MCL	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Taste & Odors	6.6E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+01	Taste & Odors	1.6E+04	2.1E+01	Amoore & Hautala	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
PENTACHLOROPHENOL	3.0E+01	Taste & Odors	7.0E+06	3.0E+01	Amoore & Hautala	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.0E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+03	Ontario MOEE	5.0E+04
PHENOL	5.0E+00	Taste & Odors	4.0E+07	5.0E+00	Cal DHS AL	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	1.0E+02	Taste & Odors		1.0E+02	Cal DHS 2nd MCL	5.0E+04
STYRENE	1.0E+01	Taste & Odors	1.6E+05	1.0E+01	USEPA 2nd MCL	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Taste & Odors	1.5E+06	5.0E+02	Amoore & Hautala	5.0E+04
TETRACHLOROETHYLENE	1.7E+02	Taste & Odors	1.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04

TABLE I-1. GROUNDWATER CEILING LEVELS
(groundwater IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
TOLUENE	4.0E+01	Taste & Odors	2.6E+05	4.0E+01	USEPA 2nd MCL	5.0E+04
TOXAPHENE	1.4E+02	Taste & Odors	1.5E+03	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	1.0E+02	Taste & Odors	7.5E+04	1.0E+02	USEPA SNARL	5.0E+04
TPH (middle distillates)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TPH (residual fuels)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+03	Taste & Odors	1.5E+05	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	9.7E+02	Taste & Odors	6.7E+05	9.7E+02	Amoore & Hautala	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
TRICHLOROETHYLENE	3.1E+02	Taste & Odors	5.5E+05	3.1E+02	Amoore & Hautala	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+02	Taste & Odors	6.0E+05	2.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Taste & Odors	4.0E+05	1.0E+02	Ontario MOEE	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Taste & Odors	1.4E+06	3.4E+03	Amoore & Hautala	5.0E+04
XYLENES	2.0E+01	Taste & Odors	8.1E+04	2.0E+01	USEPA 2nd MCL	5.0E+04
ZINC	5.0E+03	Taste & Odors		5.0E+03	Cal DHS 2nd MCL	5.0E+04

References:
Unless otherwise noted, criteria for drinking water taste and odor threshhold from summary in *A Compilation of Water Quality Goals* (RWQCBCV 2003) or Ontario MOEE if not available (MOEE 1996).
Upper limit of 50000 ug/L intended to limit general groundwater resource degradation (MOEE 1996).
1/2 solubility based on solubility constants in USEPA Region IX (USEPA 1998) or Ontario MOEE (MOEE 1996) if not available.

Notes:
Ceiling Level: lowest of 1/2 solubility, taste and odor threshhold and 50000 ug/L maximum level
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
TPH ceiling levels after Massachusetts DEP (MADEP 1997a).
TPH Taste and Odor Thresholds based on USEPA Suggested-No-Adverse-reaction (SNARL) level for TPH diesel.

TABLE I-2. GROUNDWATER GROSS CONTAMINATION CEILING LEVELS
(groundwater IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+02	Nuisance Odors	2.1E+03	2.0E+02	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	5.0E+04	Upper Limit	5.0E+08	200000	Ontario MOEE	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	170	Ontario MOEE	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit			-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	2.0E+04	Nuisance Odors	8.8E+05	2.0E+04	Ontario MOEE	5.0E+04
BENZO(a)ANTHRACENE	5.0E+00	Solubility	5.0E+00	-	-	5.0E+04
BENZO(a)PYRENE	1.9E+00	Solubility	1.9E+00	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.0E+00	Solubility	7.0E+00	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E+00	Nuisance Odors	3.8E+03	5.0E+00	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+03	Nuisance Odors	8.6E+06	3.6E+03	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+03	Nuisance Odors	8.5E+05	3.2E+03	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	6.5E+02	Solubility	6.5E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	3.4E+06	-	-	5.0E+04
BROMOFORM	5.1E+03	Nuisance Odors	1.6E+06	5.1E+03	Ontario MOEE	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+03	Nuisance Odors	4.0E+05	5.2E+03	Ontario MOEE	5.0E+04
CHLORDANE	2.5E+01	Nuisance Odors	2.8E+01	2.5E+01	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	1.3E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+02	Nuisance Odors	2.4E+05	5.0E+02	Ontario MOEE	5.0E+04
CHLOROETHANE	1.6E+02	Nuisance Odors	2.9E+06	1.6E+02	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+04	Nuisance Odors	4.0E+06	2.4E+04	Ontario MOEE	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	4.1E+06	-	-	5.0E+04
CHLOROPHENOL, 2-	1.8E+00	Nuisance Odors	1.1E+07	1.8E+00	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit		-	-	5.0E+04
CHRYSENE	8.0E-01	Solubility	8.0E-01	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04

TABLE I-2. GROUNDWATER GROSS CONTAMINATION CEILING LEVELS
(groundwater IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
COPPER	5.0E+04	Upper Limit		-	-	5.0E+04
CYANIDE (Free)	1.7E+03	Nuisance Odors	5.0E+08	1.7E+03	Ontario MOEE	5.0E+04
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Solubility	2.5E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+02	Nuisance Odors	6.0E+05	1.0E+02	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	1.7E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+02	Nuisance Odors	7.8E+04	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+02	Nuisance Odors	3.7E+04	1.1E+02	Ontario MOEE	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	8.0E+01	Solubility	8.0E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.5E+00	Solubility	1.5E+00	3.5E+03	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	5.0E+04	Upper Limit	4.3E+06	2.0E+05	Ontario MOEE	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+04	Nuisance Odors	1.1E+06	1.5E+04	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+03	Nuisance Odors	3.2E+06	2.6E+03	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E+00	Nuisance Odors	2.3E+06	3.0E+00	Ontario MOEE	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+02	Nuisance Odors	1.4E+06	1.0E+02	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	9.3E+01	Solubility	9.3E+01	4.1E+02	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	4.5E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+03	Nuisance Odors	3.9E+06	4.0E+03	Ontario MOEE	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	2.8E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXIN (2,3,7,8-TCDD)	7.0E+03	Solubility	7.0E+03	-	-	5.0E+04
ENDOSULFAN	7.5E+01	Solubility	7.5E+01	-	-	5.0E+04
ENDRIN	1.3E+02	Solubility	1.3E+02	4.1E+02	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+02	Nuisance Odors	8.5E+04	3.0E+02	USEPA 2nd MCL	5.0E+04
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
HEPTACHLOR	2.8E+01	Solubility	2.8E+01	2.0E+02	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.8E+02	Solubility	1.8E+02	-	-	5.0E+04

TABLE I-2. GROUNDWATER GROSS CONTAMINATION CEILING LEVELS
(groundwater IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
HEXACHLOROBENZENE	5.5E+01	Solubility	5.5E+01	3.0E+04	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+01	Nuisance Odors	1.0E+03	6.0E+01	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.5E+03	Solubility	3.5E+03	1.2E+05	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+02	Nuisance Odors	2.5E+04	1.0E+02	Ontario MOEE	5.0E+04
INDENO(1,2,3-cd)PYRENE	2.7E-01	Solubility	2.7E-01	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHOXYCHLOR	2.0E+01	Solubility	2.0E+01	4.7E+04	Ontario MOEE	5.0E+04
METHYL ETHYL KETONE	5.0E+04	Upper Limit	1.3E+08	8.4E+04	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+04	Nuisance Odors	9.5E+06	1.3E+04	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	1.8E+03	Nuisance Odors	7.5E+07	1.8E+03	CalDHS	5.0E+04
METHYLENE CHLORIDE	5.0E+04	Upper Limit	6.6E+06	9.1E+04	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+02	Nuisance Odors	1.3E+04	1.0E+02	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+02	Nuisance Odors	1.6E+04	2.1E+02	Ontario MOEE	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
PENTACHLOROPHENOL	5.9E+03	Nuisance Odors	7.0E+06	5.9E+03	Ontario MOEE	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.0E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+04	Ontario MOEE	5.0E+04
PHENOL	5.0E+04	Upper Limit	4.0E+07	7.9E+04	Ontario MOEE	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	5.0E+04	Upper Limit		-	-	5.0E+04
STYRENE	1.1E+02	Nuisance Odors	1.6E+05	1.1E+02	Ontario MOEE	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+03	Nuisance Odors	1.5E+06	5.0E+03	Ontario MOEE	5.0E+04
TETRACHLOROETHYLENE	3.0E+03	Nuisance Odors	1.0E+05	3.0E+03	Ontario MOEE	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+02	Nuisance Odors	2.6E+05	4.0E+02	Ontario MOEE	5.0E+04
TOXAPHENE	1.4E+02	Nuisance Odors	1.5E+03	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	5.0E+03	Nuisance Odors	7.5E+04	5.0E+03	MADEP	5.0E+04
TPH (middle distillates)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TPH (residual fuels)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+04	Nuisance Odors	1.5E+05	3.0E+04	USEPA (1995)	5.0E+04

TABLE I-2. GROUNDWATER GROSS CONTAMINATION CEILING LEVELS
(groundwater IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
TRICHLOROETHANE, 1,1,1-	5.0E+04	Upper Limit	6.7E+05	5.0E+05	Ontario MOEE	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
TRICHLOROETHYLENE	5.0E+04	Upper Limit	5.5E+05	1.0E+05	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+03	Nuisance Odors	6.0E+05	2.0E+03	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+03	Nuisance Odors	4.0E+05	1.0E+03	Ontario MOEE	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+04	Nuisance Odors	1.4E+06	3.4E+04	Ontario MOEE	5.0E+04
XYLENES	5.3E+03	Nuisance Odors	8.1E+04	5.3E+03	Ontario MOEE	5.0E+04
ZINC	5.0E+04	Upper Limit		-	-	5.0E+04

References:

Unless otherwise noted, criteria for nuisance odor threshhold from Ontario MOEE (MOEE 1996) OR data from Amoore and Hautala (1983) as presented in *A Compilation of Water Quality Goals* if not available *(RWQCBCV 2003).*

Upper limit of 50000 ug/L intended to limit general groundwater resource degradation (MOEE 1996).

1/2 solubility based on solubility constants in USEPA Region IX (USEPA 2004) or Ontario MOEE (MOEE 1996) if not available.

Odor threshold for MTBE based on average, upper range at which most subjects could smell MTBE in water (CalEPA 1999).

Vapor Pressure for ethanol from *Fate and Transport of Ethanol-Blended Gasoline in the Environment* (Ulrich 1999). Odor threshold from

Notes:

Nuisance Odor Thresholds assume ten-fold attenuation/dilution of chemical in groundwater upon discharge to surface water.

Ceiling Level: lowest of 1/2 solubility, odor/taste threshhold and 50000 ug/L maximum level (intended to limit general groundwater resource degradation).

TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.

TPH ceiling level after Massachusetts DEP (MADEP 1997a).

TABLE I-3. SURFACE WATER CEILING LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Taste & Odors	2.1E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Taste & Odors	5.0E+08	2.0E+04	Amoore & Hautala	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	1.7E+02	Taste & Odors	8.8E+05	1.7E+02	Amoore & Hautala	5.0E+04
BENZO(a)ANTHRACENE	5.0E+00	Solubility	5.0E+00	-	-	5.0E+04
BENZO(a)PYRENE	1.9E+00	Solubility	1.9E+00	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.0E+00	Solubility	7.0E+00	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E-01	Taste & Odors	3.8E+03	5.0E-01	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+02	Taste & Odors	8.6E+06	3.6E+02	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+02	Taste & Odors	8.5E+05	3.2E+02	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	6.5E+02	Solubility	6.5E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	3.4E+06	-	-	5.0E+04
BROMOFORM	5.1E+02	Taste & Odors	1.6E+06	5.1E+02	Amoore & Hautala	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+02	Taste & Odors	4.0E+05	5.2E+02	Amoore & Hautala	5.0E+04
CHLORDANE	2.5E+00	Taste & Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	1.3E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Taste & Odors	2.4E+05	5.0E+01	Amoore & Hautala	5.0E+04
CHLOROETHANE	1.6E+01	Taste & Odors	2.9E+06	1.6E+01	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+03	Taste & Odors	4.0E+06	2.4E+03	Amoore & Hautala	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	4.1E+06		-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Taste & Odors	1.1E+07	1.8E-01	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit		-	-	5.0E+04

TABLE I-3. SURFACE WATER CEILING LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
CHRYSENE	8.0E-01	Solubility	8.0E-01	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04
COPPER	1.0E+03	Taste & Odors		1.0E+03	CalDHS 2nd MCL	5.0E+04
CYANIDE (Free)	1.7E+02	Taste & Odors	5.0E+08	1.7E+02	Amoore & Hautala	5.0E+04
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Solubility	2.5E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Taste & Odors	6.0E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	1.7E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Taste & Odors	7.8E+04	1.0E+01	USEPA 2nd MCL	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	5.0E+00	Taste & Odors	3.7E+04	5.0E+00	USEPA 2nd MCL	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	8.0E+01	Solubility	8.0E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.5E+00	Solubility	1.5E+00	3.5E+02	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	7.0E+03	Taste & Odors	4.3E+06	7.0E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Taste & Odors	1.1E+06	1.5E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Taste & Odors	3.2E+06	2.6E+02	Amoore & Hautala	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Taste & Odors	2.3E+06	3.0E-01	Ontario MOEE	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+01	Taste & Odors	1.4E+06	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	4.1E+01	Taste & Odors	9.3E+01	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	4.5E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	Taste & Odors	3.9E+06	4.0E+02	Cal DHS AL	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	2.8E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	2.3E+05	Amoore & Hautala	5.0E+04
DIOXIN (2,3,7,8-TCDD)	7.0E+03	Solubility	7.0E+03	-	-	5.0E+04
ENDOSULFAN	7.5E+01	Solubility	7.5E+01	-	-	5.0E+04
ENDRIN	4.1E+01	Taste & Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+01	Taste & Odors	8.5E+04	3.0E+01	USEPA 2nd MCL	5.0E+04

TABLE I-3. SURFACE WATER CEILING LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Taste & Odors	2.8E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.8E+02	Solubility	1.8E+02	-	-	5.0E+04
HEXACHLOROBENZENE	5.5E+01	Solubility	5.5E+01	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Taste & Odors	1.0E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.5E+03	Solubility	3.5E+03	1.2E+04	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+01	Taste & Odors	2.5E+04	1.0E+01	Amoore & Hautala	5.0E+04
INDENO(1,2,3-cd)PYRENE	2.7E-01	Solubility	2.7E-01	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHOXYCHLOR	2.0E+01	Solubility	2.0E+01	4.7E+03	Amoore & Hautala	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Taste & Odors	1.3E+08	8.4E+03	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+03	Taste & Odors	9.5E+06	1.3E+03	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	5.0E+00	Taste & Odors	7.5E+07	5.0E+00	Cal DHS 2nd MCL	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Taste & Odors	6.6E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+01	Taste & Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+01	Taste & Odors	1.6E+04	2.1E+01	Amoore & Hautala	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
PENTACHLOROPHENOL	3.0E+01	Taste & Odors	7.0E+06	3.0E+01	Amoore & Hautala	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.0E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+03	Ontario MOEE	5.0E+04
PHENOL	5.0E+00	Taste & Odors	4.0E+07	5.0E+00	Cal DHS AL	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	1.0E+02	Taste & Odors		1.0E+02	Cal DHS 2nd MCL	5.0E+04
STYRENE	1.0E+01	Taste & Odors	1.6E+05	1.0E+01	USEPA 2nd MCL	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Taste & Odors	1.5E+06	5.0E+02	Amoore & Hautala	5.0E+04
TETRACHLOROETHYLENE	1.7E+02	Taste & Odors	1.0E+05	1.7E+02	Amoore & Hautala	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04

TABLE I-3. SURFACE WATER CEILING LEVELS
(surface water IS a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Ceiling Level	Basis	Solubility (1/2)	Taste And Odor Threshold	Basis	Upper Limit
TOLUENE	4.0E+01	Taste & Odors	2.6E+05	4.0E+01	USEPA 2nd MCL	5.0E+04
TOXAPHENE	1.4E+02	Taste & Odors	1.5E+03	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	1.0E+02	Taste & Odors	7.5E+04	1.0E+02	USEPA SNARL	5.0E+04
TPH (middle distillates)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TPH (residual fuels)	1.0E+02	Taste & Odors	2.5E+03	1.0E+02	USEPA SNARL	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+03	Taste & Odors	1.5E+05	3.0E+03	USEPA (1995)	5.0E+04
TRICHLOROETHANE, 1,1,1-	9.7E+02	Taste & Odors	6.7E+05	9.7E+02	Amoore & Hautala	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
TRICHLOROETHYLENE	3.1E+02	Taste & Odors	5.5E+05	3.1E+02	Amoore & Hautala	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+02	Taste & Odors	6.0E+05	2.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Taste & Odors	4.0E+05	1.0E+02	Ontario MOEE	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Taste & Odors	1.4E+06	3.4E+03	Amoore & Hautala	5.0E+04
XYLENES	2.0E+01	Taste & Odors	8.1E+04	2.0E+01	USEPA 2nd MCL	5.0E+04
ZINC	5.0E+03	Taste & Odors		5.0E+03	Cal DHS 2nd MCL	5.0E+04

References:
Unless otherwise noted, criteria for drinking water taste and odor threshhold from summary in *A Compilation of Water Quality Goals* (RWQCBCV 2003) or Ontario MOEE if not available (MOEE 1996).
Upper limit of 50000 ug/L intended to limit general groundwater resource degradation (MOEE 1996).
1/2 solubility based on solubility constants in USEPA Region IX (USEPA 2004) or Ontario MOEE (MOEE 1996) if not available.

Notes:
Ceiling Level: lowest of 1/2 solubility, taste and odor threshhold and 50000 ug/L maximum level
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
TPH ceiling levels after Massachusetts DEP (MADEP 1997a).
TPH Taste and Odor Thresholds based on USEPA Suggested-No-Adverse-reaction (SNARL) level for TPH diesel.

TABLE I-4. SURFACE WATER GROSS CONTAMINATION CEILING LEVELS
(surface water IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
ACENAPHTHENE	2.0E+01	Nuisance Odors	2.1E+03	2.0E+01	Ontario MOEE	5.0E+04
ACENAPHTHYLENE	2.0E+03	Solubility	2.0E+03	-	-	5.0E+04
ACETONE	2.0E+04	Nuisance Odors	5.0E+08	2.0E+04	Ontario MOEE	5.0E+04
ALDRIN	8.5E+00	Solubility	8.5E+00	1.7E+01	Ontario MOEE	5.0E+04
ANTHRACENE	2.2E+01	Solubility	2.2E+01	-	-	5.0E+04
ANTIMONY	5.0E+04	Upper Limit		-	-	5.0E+04
ARSENIC	5.0E+04	Upper Limit		-	-	5.0E+04
BARIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BENZENE	2.0E+03	Nuisance Odors	8.8E+05	2.0E+03	Ontario MOEE	5.0E+04
BENZO(a)ANTHRACENE	5.0E+00	Solubility	5.0E+00	-	-	5.0E+04
BENZO(a)PYRENE	1.9E+00	Solubility	1.9E+00	-	-	5.0E+04
BENZO(b)FLUORANTHENE	7.0E+00	Solubility	7.0E+00	-	-	5.0E+04
BENZO(g,h,i)PERYLENE	1.3E-01	Solubility	1.3E-01	-	-	5.0E+04
BENZO(k)FLUORANTHENE	4.0E-01	Solubility	4.0E-01	-	-	5.0E+04
BERYLLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
BIPHENYL, 1,1-	5.0E-01	Nuisance Odors	3.8E+03	5.0E-01	Amoore & Hautala	5.0E+04
BIS(2-CHLOROETHYL)ETHER	3.6E+02	Nuisance Odors	8.6E+06	3.6E+02	Amoore & Hautala	5.0E+04
BIS(2-CHLOROISOPROPYL)ETHER	3.2E+02	Nuisance Odors	8.5E+05	3.2E+02	Ontario MOEE	5.0E+04
BIS(2-ETHYLHEXYL)PHTHALATE	6.5E+02	Solubility	6.5E+02	-	-	5.0E+04
BORON	5.0E+04	Upper Limit		-	-	5.0E+04
BROMODICHLOROMETHANE	5.0E+04	Upper Limit	3.4E+06	-	-	5.0E+04
BROMOFORM	5.1E+02	Nuisance Odors	1.6E+06	5.1E+02	Ontario MOEE	5.0E+04
BROMOMETHANE	5.0E+04	Upper Limit	7.6E+06	-	-	5.0E+04
CADMIUM	5.0E+04	Upper Limit		-	-	5.0E+04
CARBON TETRACHLORIDE	5.2E+02	Nuisance Odors	4.0E+05	5.2E+02	Ontario MOEE	5.0E+04
CHLORDANE	2.5E+00	Nuisance Odors	2.8E+01	2.5E+00	Ontario MOEE	5.0E+04
CHLOROANILINE, p-	5.0E+04	Upper Limit	1.3E+06	-	-	5.0E+04
CHLOROBENZENE	5.0E+01	Nuisance Odors	2.4E+05	5.0E+01	Ontario MOEE	5.0E+04
CHLOROETHANE	1.6E+01	Nuisance Odors	2.9E+06	1.6E+01	Amoore & Hautala	5.0E+04
CHLOROFORM	2.4E+03	Nuisance Odors	4.0E+06	2.4E+03	Ontario MOEE	5.0E+04
CHLOROMETHANE	5.0E+04	Upper Limit	4.1E+06	-	-	5.0E+04
CHLOROPHENOL, 2-	1.8E-01	Nuisance Odors	1.1E+07	1.8E-01	Ontario MOEE	5.0E+04
CHROMIUM (Total)	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM III	5.0E+04	Upper Limit		-	-	5.0E+04
CHROMIUM VI	5.0E+04	Upper Limit		-	-	5.0E+04
CHRYSENE	8.0E-01	Solubility	8.0E-01	-	-	5.0E+04
COBALT	5.0E+04	Upper Limit		-	-	5.0E+04

TABLE I-4. SURFACE WATER GROSS CONTAMINATION CEILING LEVELS
(surface water IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
COPPER	5.0E+04	Upper Limit		-	-	5.0E+04
CYANIDE (Free)	1.7E+02	Nuisance Odors	5.0E+08	1.7E+02	Ontario MOEE	5.0E+04
DIBENZO(a,h)ANTHTRACENE	2.5E-01	Solubility	2.5E-01	-	-	5.0E+04
DIBROMO,1,2- CHLOROPROPANE,3-	1.0E+01	Nuisance Odors	6.0E+05	1.0E+01	Amoore & Hautala	5.0E+04
DIBROMOCHLOROMETHANE	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
DIBROMOETHANE, 1,2-	5.0E+04	Upper Limit	1.7E+06	-	-	5.0E+04
DICHLOROBENZENE, 1,2-	1.0E+01	Nuisance Odors	7.8E+04	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROBENZENE, 1,3-	5.0E+04	Upper Limit	7.8E+04	-	-	5.0E+04
DICHLOROBENZENE, 1,4-	1.1E+01	Nuisance Odors	3.7E+04	1.1E+01	Ontario MOEE	5.0E+04
DICHLOROBENZIDINE, 3,3-	1.6E+03	Solubility	1.6E+03	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHANE (DDD)	8.0E+01	Solubility	8.0E+01	-	-	5.0E+04
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.0E+01	Solubility	2.0E+01	-	-	5.0E+04
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.5E+00	Solubility	1.5E+00	3.5E+02	Ontario MOEE	5.0E+04
DICHLOROETHANE, 1,1-	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DICHLOROETHANE, 1,2-	2.0E+04	Nuisance Odors	4.3E+06	2.0E+04	Ontario MOEE	5.0E+04
DICHLOROETHYLENE, 1,1-	1.5E+03	Nuisance Odors	1.1E+06	1.5E+03	Amoore & Hautala	5.0E+04
DICHLOROETHYLENE, Cis 1,2-	5.0E+04	Upper Limit	1.8E+06	-	-	5.0E+04
DICHLOROETHYLENE, Trans 1,2-	2.6E+02	Nuisance Odors	3.2E+06	2.6E+02	Ontario MOEE	5.0E+04
DICHLOROPHENOL, 2,4-	3.0E-01	Nuisance Odors	2.3E+06	3.0E-01	Ontario MOEE	5.0E+04
DICHLOROPROPANE, 1,2-	1.0E+01	Nuisance Odors	1.4E+06	1.0E+01	Ontario MOEE	5.0E+04
DICHLOROPROPENE, 1,3-	5.0E+04	Upper Limit	1.4E+06	-	-	5.0E+04
DIELDRIN	4.1E+01	Nuisance Odors	9.3E+01	4.1E+01	Ontario MOEE	5.0E+04
DIETHYLPHTHALATE	5.0E+04	Upper Limit	4.5E+05	-	-	5.0E+04
DIMETHYLPHENOL, 2,4-	4.0E+02	Nuisance Odors	3.9E+06	4.0E+02	Ontario MOEE	5.0E+04
DIMETHYLPHTHALATE	5.0E+04	Upper Limit	2.5E+06	-	-	5.0E+04
DINITROPHENOL, 2,4-	5.0E+04	Upper Limit	2.8E+06	-	-	5.0E+04
DINITROTOLUENE, 2,4-	5.0E+04	Upper Limit	1.4E+05	-	-	5.0E+04
DIOXANE, 1,4-	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
DIOXIN (2,3,7,8-TCDD)	7.0E+03	Solubility	7.0E+03	-	-	5.0E+04
ENDOSULFAN	7.5E+01	Solubility	7.5E+01	-	-	5.0E+04
ENDRIN	4.1E+01	Nuisance Odors	1.3E+02	4.1E+01	Ontario MOEE	5.0E+04
ETHANOL	5.0E+04	Upper Limit	5.0E+08	7.6E+05	Amoore & Hautala	5.0E+04
ETHYLBENZENE	3.0E+01	Nuisance Odors	8.5E+04	3.0E+01	USEPA 2nd MCL	5.0E+04
FLUORANTHENE	1.3E+02	Solubility	1.3E+02	-	-	5.0E+04
FLUORENE	9.5E+02	Solubility	9.5E+02	-	-	5.0E+04
HEPTACHLOR	2.0E+01	Nuisance Odors	2.8E+01	2.0E+01	Ontario MOEE	5.0E+04
HEPTACHLOR EPOXIDE	1.8E+02	Solubility	1.8E+02	-	-	5.0E+04

TABLE I-4. SURFACE WATER GROSS CONTAMINATION CEILING LEVELS
(surface water IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
HEXACHLOROBENZENE	5.5E+01	Solubility	5.5E+01	3.0E+03	Ontario MOEE	5.0E+04
HEXACHLOROBUTADIENE	6.0E+00	Nuisance Odors	1.0E+03	6.0E+00	Ontario MOEE	5.0E+04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	3.5E+03	Solubility	3.5E+03	1.2E+04	Ontario MOEE	5.0E+04
HEXACHLOROETHANE	1.0E+01	Nuisance Odors	2.5E+04	1.0E+01	Ontario MOEE	5.0E+04
INDENO(1,2,3-cd)PYRENE	2.7E-01	Solubility	2.7E-01	-	-	5.0E+04
LEAD	5.0E+04	Upper Limit		-	-	5.0E+04
MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHOXYCHLOR	2.0E+01	Solubility	2.0E+01	4.7E+03	Ontario MOEE	5.0E+04
METHYL ETHYL KETONE	8.4E+03	Nuisance Odors	1.3E+08	8.4E+03	Amoore & Hautala	5.0E+04
METHYL ISOBUTYL KETONE	1.3E+03	Nuisance Odors	9.5E+06	1.3E+03	Amoore & Hautala	5.0E+04
METHYL MERCURY	5.0E+04	Upper Limit		-	-	5.0E+04
METHYL TERT BUTYL ETHER	1.8E+02	Nuisance Odors	7.5E+07	1.8E+02	CalDHS	5.0E+04
METHYLENE CHLORIDE	9.1E+03	Nuisance Odors	6.6E+06	9.1E+03	Ontario MOEE	5.0E+04
METHYLNAPHTHALENE (total 1- & 2-)	1.0E+01	Nuisance Odors	1.3E+04	1.0E+01	Ontario MOEE	5.0E+04
MOLYBDENUM	5.0E+04	Upper Limit		-	-	5.0E+04
NAPHTHALENE	2.1E+01	Nuisance Odors	1.6E+04	2.1E+01	Ontario MOEE	5.0E+04
NICKEL	5.0E+04	Upper Limit		-	-	5.0E+04
PENTACHLOROPHENOL	5.9E+02	Nuisance Odors	7.0E+06	5.9E+02	Ontario MOEE	5.0E+04
PERCHLORATE	5.0E+04	Upper Limit	1.0E+08	-	-	5.0E+04
PHENANTHRENE	4.1E+02	Solubility	4.1E+02	1.0E+03	Ontario MOEE	5.0E+04
PHENOL	7.9E+03	Nuisance Odors	4.0E+07	7.9E+03	Ontario MOEE	5.0E+04
POLYCHLORINATED BIPHENYLS (PCBs)	1.6E+01	Solubility	1.6E+01	-	-	5.0E+04
PYRENE	6.8E+01	Solubility	6.8E+01	-	-	5.0E+04
SELENIUM	5.0E+04	Upper Limit		-	-	5.0E+04
SILVER	5.0E+04	Upper Limit		-	-	5.0E+04
STYRENE	1.1E+01	Nuisance Odors	1.6E+05	1.1E+01	Ontario MOEE	5.0E+04
tert-BUTYL ALCOHOL	5.0E+04	Upper Limit	5.0E+08	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,1,2-	5.0E+04	Upper Limit	1.5E+06	-	-	5.0E+04
TETRACHLOROETHANE, 1,1,2,2-	5.0E+02	Nuisance Odors	1.5E+06	5.0E+02	Ontario MOEE	5.0E+04
TETRACHLOROETHYLENE	3.0E+02	Nuisance Odors	1.0E+05	3.0E+02	Ontario MOEE	5.0E+04
THALLIUM	5.0E+04	Upper Limit		-	-	5.0E+04
TOLUENE	4.0E+01	Nuisance Odors	2.6E+05	4.0E+01	Ontario MOEE	5.0E+04
TOXAPHENE	1.4E+02	Nuisance Odors	1.5E+03	1.4E+02	USEPA 2nd MCL	5.0E+04
TPH (gasolines)	5.0E+03	Nuisance Odors	7.5E+04	5.0E+03	MADEP	5.0E+04
TPH (middle distillates)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TPH (residual fuels)	2.5E+03	Solubility	2.5E+03	5.0E+03	MADEP	5.0E+04
TRICHLOROBENZENE, 1,2,4-	3.0E+03	Nuisance Odors	1.5E+05	3.0E+03	USEPA (1995)	5.0E+04

TABLE I-4. SURFACE WATER GROSS CONTAMINATION CEILING LEVELS
(surface water IS NOT a current or potential source of drinking water)
(ug/L)

CHEMICAL PARAMETER	Final Gross Contamination Ceiling Level	Basis	Solubility (1/2)	Nuisance Odor Threshold	Basis	Upper Limit
TRICHLOROETHANE, 1,1,1-	5.0E+04	Nuisance Odors	6.7E+05	5.0E+04	Ontario MOEE	5.0E+04
TRICHLOROETHANE, 1,1,2-	5.0E+04	Upper Limit	2.2E+06	-	-	5.0E+04
TRICHLOROETHYLENE	1.0E+04	Nuisance Odors	5.5E+05	1.0E+04	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,5-	2.0E+02	Nuisance Odors	6.0E+05	2.0E+02	Ontario MOEE	5.0E+04
TRICHLOROPHENOL, 2,4,6-	1.0E+02	Nuisance Odors	4.0E+05	1.0E+02	Ontario MOEE	5.0E+04
VANADIUM	5.0E+04	Upper Limit		-	-	5.0E+04
VINYL CHLORIDE	3.4E+03	Nuisance Odors	1.4E+06	3.4E+03	Ontario MOEE	5.0E+04
XYLENES	5.3E+02	Nuisance Odors	8.1E+04	5.3E+02	Ontario MOEE	5.0E+04
ZINC	5.0E+04	Upper Limit		-	-	5.0E+04

References:
Unless otherwise noted, criteria for nuisance odor threshhold from Ontario MOEE (MOEE 1996, minus groundwater-to-surface water dilution factor) OR data from Amoore and Hautala (1983) as presented in *A Compilation of Water Quality Goals* if not available (RWQCBCV 2003).
Upper limit of 50000 ug/L intended to limit general groundwater resource degradation (MOEE 1996).
1/2 solubility based on solubility constants in USEPA Region IX (USEPA 2004) or Ontario MOEE (MOEE 1996) if not available.
Odor threshold for MTBE based on average, upper range at which most subjects could smell MTBE in water (CalEPA 1999).
Notes:
Nuisance Odor Thresholds assume no attenuation/dilution of chemical in surface water.
Ceiling Level: lowest of 1/2 solubility, odor/taste threshhold and 50000 ug/L maximum level (intended to limit general groundwater resource degradation).
TPH -Total Petroleum Hydrocarbons. See text for discussion of different TPH categories.
TPH ceiling level after Massachusetts DEP (MADEP 1997a).

TABLE J. PHYSIO-CHEMICAL AND TOXICITY CONSTANTS USED IN MODELS.

CHEMICAL PARAMETER	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's Law constant H (atm-m^3/mol)	Henry's Law constant H' (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo $(mg/kg\text{-}d)^{-1}$	Cancer Slope Factor Inhaled CSFi $(mg/kg\text{-}d)^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Dose Inhaled RfDi (mg/kg-d)
ACENAPHTHENE	V	S	154	4.90E+03	4.21E-02	7.69E-06	4.24E+00	1.55E-04	6.36E-03				6.00E-02	6.00E-02
ACENAPHTHYLENE	V	S	152	2.50E+03	6.08E-02	7.88E-06	3.93E+00	1.45E-03	5.95E-02				4.00E-02	4.00E-02
ACETONE	V	L	58	5.75E-01	1.24E-01	1.14E-05	1.00E+06	3.88E-05	1.59E-03				9.00E-01	9.00E-01
ALDRIN	NV	S	365	4.90E+04			1.70E-02	4.96E-05	2.03E-03	0.10	1.7E+01	1.7E+01	3.00E-05	3.00E-05
ANTHRACENE	V	S	178	2.35E+04	3.24E-02	7.74E-06	4.34E-02	6.50E-05	2.67E-03				3.00E-01	3.00E-01
ANTIMONY	NV	S	122										4.00E-04	
ARSENIC	NV	S	75							0.030	1.5E+00	1.5E+01	3.00E-04	
BARIUM	NV	S	137										7.00E-02	1.40E-04
BENZENE	V	L	78	5.89E+01	8.80E-02	9.80E-06	1.75E+03	5.55E-03	2.28E-01		5.5E-02	2.7E-02	4.00E-03	8.60E-03
BENZO(a)ANTHRACENE	NV	S	228	2.00E+05			1.00E-02	1.00E-06	4.10E-05	0.13	7.3E-01	7.3E-01		
BENZO(a)PYRENE	NV	S	252	5.50E+06			3.80E-03	4.90E-07	2.01E-05	0.13	7.30E+00	7.30E+00		
BENZO(b)FLUORANTHENE	NV	S	252	5.50E+05			1.40E-02	1.22E-05	5.00E-04	0.13	7.3E-01	7.3E-01		
BENZO(g,h,i)PERYLENE	NV	S	276	1.60E+06			2.60E-04	1.44E-07	5.90E-06	0.13			4.00E-02	4.00E-02
BENZO(k)FLUORANTHENE	NV	S	252	5.50E+05			8.00E-04	3.87E-05	1.59E-03	0.13	7.3E-02	7.30E-02		
BERYLLIUM	NV	S	9									8.4E+00	2.00E-03	5.70E-06
BIPHENYL, 1,1-	V	S	150	7.76E+03	4.04E-02	8.20E-06	7.50E+00	3.00E-04	1.23E-02				5.00E-02	5.00E-02
BIS(2-CHLOROETHYL)ETHER	V	L	142	7.60E+01	6.92E-02	7.53E-06	1.72E+04	1.80E-05	7.38E-04		1.1E+00	1.2E+00		
BIS(2-CHLOROISOPROPYL)ETHER	V	L	171	6.10E+01	6.31E-02	6.40E-06	1.70E+03	1.13E-04	4.63E-03		7.0E-02	3.5E-02	4.00E-02	4.00E-02
BIS(2-ETHYLHEXYL)PHTHALATE	NV	S	391	1.00E+05			1.30E+00	3.00E-07	1.23E-05	0.10	1.4E-02	1.4E-02	2.00E-02	2.20E-02
BORON	NV	S	11							0.10			2.00E-01	5.70E-03
BROMODICHLOROMETHANE	V	L	164	5.50E+01	2.98E-02	1.06E-05	6.74E+03	1.60E-03	6.56E-02		6.2E-02	6.2E-02	2.00E-02	2.00E-02
BROMOFORM	NV	S	253	1.10E+02			3.20E+03	5.32E-04	2.18E-02	0.10	7.9E-03	3.9E-03	2.00E-02	2.00E-02
BROMOMETHANE	V	G	95	9.00E+00	7.28E-02	1.21E-05	1.52E+04	6.24E-03	2.56E-01				1.40E-03	1.40E-03
CADMIUM	NV	S	112							0.001		6.3E+00	5.00E-04	
CARBON TETRACHLORIDE	V	L	154	1.74E+02	7.80E-02	8.80E-06	7.93E+02	3.04E-02	1.25E+00		1.3E-01	5.3E-02	7.00E-04	7.00E-04
CHLORDANE	NV	S	410	4.40E+04			5.60E-02	4.79E-05	1.96E-03	0.04	3.5E-01	3.5E-01	5.00E-04	2.00E-04
CHLOROANILINE, p-	NV	S	128	6.40E+01			2.60E+03	3.31E-07	1.36E-05	0.10			4.00E-03	4.00E-03
CHLOROBENZENE	V	L	113	2.19E+02	7.30E-02	8.70E-06	4.72E+02	3.70E-03	1.52E-01				2.00E-02	1.70E-02
CHLOROETHANE	V	G	65	1.47E+01	1.04E-01	1.15E-05	5.70E+03	1.10E-02	4.51E-01		2.9E-03	2.9E-03	4.00E-01	2.90E+00
CHLOROFORM	V	L	119	3.98E+01	1.04E-01	1.00E-05	7.92E+03	3.67E-03	1.50E-01			8.1E-02	1.00E-02	1.40E-02
CHLOROMETHANE	V	G	51	3.50E+01	1.10E-01	6.50E-06	8.20E+03	2.40E-02	9.84E-01				2.60E-02	2.60E-02
CHLOROPHENOL, 2-	V	L	132	3.98E+02	5.01E-01	9.46E-06	2.20E+04	3.91E-04	1.60E-02				5.00E-03	5.00E-03
CHROMIUM (Total)	NV	S	52									4.2E+01		
CHROMIUM III	NV	S	52										1.50E+00	
CHROMIUM VI	NV	S	52									3.0E+02	3.00E-03	2.20E-06
CHRYSENE	NV	S	228	4.00E+05	2.48E-02	6.21E-06	1.60E-03	9.46E-05	3.88E-03	0.13	7.3E-03	7.3E-03		
COBALT	NV	S	59									9.8E+00	2.00E-02	5.70E-06
COPPER	NV	S	64										4.00E-02	
CYANIDE (Free)	V	S	26	9.20E+00	1.80E-01	1.80E-05	1.00E+06	1.90E+03	7.79E+04	0.10			2.00E-02	
DIBENZO(a,h)ANTHTRACENE	NV	S	278	3.30E+06			5.00E-04	7.30E-08	2.99E-06	0.13	7.3E+00	7.3E+00		
DIBROMO,1,2- CHLOROPROPANE,3-	V	L	236	1.30E+02	2.12E-02	7.00E-06	1.20E+03	1.47E-04	6.03E-03		1.4E+00	2.4E-03	5.70E-05	5.70E-05
DIBROMOCHLOROMETHANE	V	S	208	4.68E+02	9.60E-02	1.00E-05	4.40E+03	8.50E-04	3.49E-02		8.4E-02	8.4E-02	2.00E-02	2.00E-02
DIBROMOETHANE, 1,2-	V	S	188	4.40E+01	7.33E-02	8.06E-06	3.40E+03	3.20E-04	1.31E-02		2.0E+00	2.0E+00	9.00E-03	2.60E-03
DICHLOROBENZENE, 1,2-	V	L	147	6.17E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	7.79E-02				9.00E-02	5.70E-02
DICHLOROBENZENE, 1,3-	V	L	147	6.17E+02	6.90E-02	7.90E-06	1.56E+02	1.90E-03	7.79E-02				3.00E-02	3.00E-02
DICHLOROBENZENE, 1,4-	V	S	147	6.17E+02	6.90E-02	7.90E-06	7.38E+01	2.43E-03	9.96E-02		2.4E-02	2.2E-02	3.00E-02	3.00E-02
DICHLOROBENZIDINE, 3,3-	NV	S	253	1.60E+03			3.11E+00	8.33E-07	3.42E-05	0.10	4.5E-01	4.5E-01		
DICHLORODIPHENYLDICHLOROETHANE (DDD)	NV	S	331	7.80E+05			1.60E-01	7.96E-06	3.26E-04	0.03	2.4E-01	2.4E-01		
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	NV	S	329	4.40E+06			4.00E-02	6.80E-05	2.79E-03	0.03	2.4E-01	2.4E-01		
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	NV	S	355	2.40E+05			3.00E-03	3.89E-05	1.59E-03	0.03	3.4E-01	3.4E-01	5.00E-04	5.00E-04

TABLE J. PHYSIO-CHEMICAL AND TOXICITY CONSTANTS USED IN MODELS.

CHEMICAL PARAMETER	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's Law constant H (atm-m^3/mol)	Henry's Law constant H' (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo $(mg/kg\text{-}d)^{-1}$	Cancer Slope Factor Inhaled CSFi $(mg/kg\text{-}d)^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Dose Inhaled RfDi (mg/kg-d)
DICHLOROETHANE, 1,1-	V	L	99	3.16E+01	7.42E-02	1.05E-05	5.06E+03	5.62E-03	2.30E-01				1.00E-01	1.40E-01
DICHLOROETHANE, 1,2-	V	L	99	1.74E+01	1.04E-01	9.90E-06	8.52E+03	9.79E-04	4.01E-02		9.1E-02	9.1E-02	3.00E-02	1.40E-03
DICHLOROETHYLENE, 1,1-	V	L	97	5.89E+01	9.00E-02	1.04E-05	2.25E+03	2.61E-02	1.07E+00				5.00E-02	5.70E-02
DICHLOROETHYLENE, Cis 1,2-	V	L	97	3.55E+01	7.36E-02	1.13E-05	3.50E+03	4.08E-03	1.67E-01				1.00E-02	1.00E-02
DICHLOROETHYLENE, Trans 1,2-	V	L	97	5.25E+01	7.07E-02	1.19E-05	6.30E+03	9.38E-03	3.85E-01				2.00E-02	2.00E-02
DICHLOROPHENOL, 2,4-	NV	S	163	6.00E+03			4.50E+03	2.80E-06	1.15E-04	0.10			3.00E-03	3.00E-03
DICHLOROPROPANE, 1,2-	V	L	113	4.37E+01	7.82E-02	8.73E-06	2.80E+03	2.80E-03	1.15E-01		6.8E-02	6.8E-02	1.10E-03	1.10E-03
DICHLOROPROPENE, 1,3-	V	L	111	4.57E+01	6.26E-02	1.00E-05	2.80E+03	1.77E-02	7.26E-01		1.0E-01	1.4E-02	3.00E-02	5.70E-03
DIELDRIN	NV	S	381	7.40E+03			1.86E-01	5.84E-05	2.39E-03	0.10	1.6E+01	1.6E+01	5.00E-05	5.00E-05
DIETHYLPHTHALATE	NV	S	222	1.40E+02			8.96E+02	1.14E-06	4.67E-05	0.10			8.00E-01	8.00E-01
DIMETHYLPHENOL, 2,4-	V	S	122	4.00E+01			7.87E+03	2.00E-06	8.20E-05	0.10			2.00E-02	2.00E-02
DIMETHYLPHTHALATE	NV	S	194	1.40E+02			5.00E+03	1.05E-07	4.31E-06	0.10			1.00E+01	1.00E+01
DINITROPHENOL, 2,4-	NV	S	184	1.70E+01			5.60E+03	6.45E-10	2.64E-08	0.10			2.00E-03	2.00E-03
DINITROTOLUENE, 2,4-	NV	S	182	4.50E+01			2.70E+02	4.50E-06	1.85E-04	0.10	2.0E-03	2.0E-03	2.00E-03	2.00E-03
DIOXANE, 1,4-	NV	L	88	3.50E+00			1.00E+06	3.00E-06	1.23E-04	0.10	1.1E-02	1.1E-02		
DIOXIN (2,3,7,8-TCDD)	NV	S	322	1.30E+07			1.40E+01	8.10E-05	3.32E-03	0.03	1.5E+05	1.5E+05		
ENDOSULFAN	NV	S	407	3.20E+03			1.50E-01	1.00E-05	4.10E-04	0.10			6.00E-03	6.00E-03
ENDRIN	NV	S	381	1.70E+03			2.60E-01	7.51E-06	3.08E-04	0.10			3.00E-04	3.00E-04
ETHANOL	NV	L	46	3.09E-01			1.00E+06	6.29E-06	2.58E-04					
ETHYLBENZENE	V	L	106	3.63E+02	7.50E-02	7.80E-06	1.69E+02	7.88E-03	3.23E-01				1.00E-01	2.90E-01
FLUORANTHENE	NV	S	202	3.80E+04			2.65E-01	6.50E-06	2.67E-04	0.13			4.00E-02	4.00E-02
FLUORENE	V	S	166	1.38E+04	6.08E-02	7.88E-06	1.90E+00	7.70E-05	3.16E-03				4.00E-02	4.00E-02
HEPTACHLOR	NV	S	373	2.20E+04			5.60E-02	1.48E-03	6.07E-02	0.10	4.5E+00	4.6E+00	5.00E-04	5.00E-04
HEPTACHLOR EPOXIDE	NV	S	389	2.30E+04			3.50E-01	3.16E-05	1.30E-03	0.10	9.1E+00	9.1E+00	1.30E-05	1.30E-05
HEXACHLOROBENZENE	NV	S	285	1.20E+06			1.10E-01	1.70E-03	6.97E-02	0.10	1.6E+00	1.6E+00	8.00E-04	8.00E-04
HEXACHLOROBUTADIENE	NV	S	261	2.90E+04			2.00E+00	2.56E-02	1.05E+00	0.10	7.8E-02	7.8E-02	3.00E-04	3.00E-04
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NV	S	291	3.70E+03			7.00E+00	4.93E-07	2.02E-05	0.04	1.3E+00	1.3E+00	3.00E-04	3.00E-04
HEXACHLOROETHANE	NV	S	237	2.00E+04			5.00E+01	9.85E-03	4.04E-01	0.10	1.4E-02	1.4E-02	1.00E-03	1.00E-03
INDENO(1,2,3-cd)PYRENE	NV	S	276	1.60E+06			5.30E-04	6.95E-08	2.85E-06	0.13	7.3E-01	7.3E-01		
LEAD	NV	S	207											
MERCURY	V	S	201										3.00E-04	
METHOXYCHLOR	NV	S	347	7.90E+04			4.00E-02	1.58E-05	6.48E-04	0.10			5.00E-03	5.00E-03
METHYL ETHYL KETONE	V	L	72	4.50E+00	8.95E-02	9.80E-06	2.68E+05	2.74E-05	1.12E-03				6.00E-01	1.40E+00
METHYL ISOBUTYL KETONE	V	L	100	1.34E+02	7.50E-02	7.80E-06	1.90E+04	1.40E-04	5.74E-03				8.00E-02	8.60E-01
METHYL MERCURY	NV	S	216							0.10			1.00E-04	
METHYL TERT BUTYL ETHER	V	L	88	6.00E+00	8.00E-02	1.00E-05	1.50E+05	5.87E-04	2.41E-02		1.8E-03	9.1E-04	8.61E-01	8.60E-01
METHYLENE CHLORIDE	V	L	85	1.11E+01	1.01E-01	1.17E-05	1.32E+04	2.19E-03	8.98E-02		7.5E-03	1.6E-03	6.00E-02	8.60E-01
METHYLNAPHTHALENE (total 1- & 2-)	V	S	142	7.20E+02	5.90E-02	7.50E-06	2.60E+01	2.90E-04	1.19E-02				4.00E-02	4.00E-02
MOLYBDENUM	NV	S	96										5.00E-03	
NAPHTHALENE	V	S	128	1.19E+03	5.90E-02	7.50E-06	3.10E+01	4.83E-04	1.98E-02				2.00E-02	8.60E-04
NICKEL	NV	S	59										2.00E-02	
PENTACHLOROPHENOL	NV	S	266	3.20E+04			1.40E+04	2.80E-06	1.15E-04	0.25	1.2E-01	1.2E-01	3.00E-02	3.00E-02
PERCHLORATE	NV	S	100				2.00E+05						1.00E-04	
PHENANTHRENE	V	S	178	1.40E+04	6.08E-02	7.88E-06	8.16E-01	3.93E-05	1.61E-03				4.00E-02	4.00E-02
PHENOL	NV	S	94	9.10E+01			8.00E+04	1.30E-06	5.33E-05	0.10			3.00E-01	3.00E-01
POLYCHLORINATED BIPHENYLS (PCBs)	NV	S	327 (ave)	3.30E+04			3.20E-02	5.20E-04	2.13E-02	0.14	2.0E+00	2.0E+00	2.00E-05	2.00E-05
PYRENE	V	S	202	1.05E+05	2.72E-02	7.24E-06	1.35E-01	1.10E-05	4.51E-04				3.00E-02	3.00E-02
SELENIUM	NV	S	79										5.00E-03	
SILVER	NV	S	47										5.00E-03	
STYRENE	V	L	104	7.76E+02	7.10E-02	8.00E-06	3.10E+02	2.75E-03	1.13E-01				2.00E-01	2.90E-01

TABLE J. PHYSIO-CHEMICAL AND TOXICITY CONSTANTS USED IN MODELS.

CHEMICAL PARAMETER	Physical State		Molecular Weight	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's Law constant H (atm-m^3/mol)	Henry's Law constant H' (unitless)	Skin Absorption Factor ABS (unitless)	Cancer Slope Factor Oral CSFo $(mg/kg\text{-}d)^{-1}$	Cancer Slope Factor Inhaled CSFi $(mg/kg\text{-}d)^{-1}$	Reference Dose Oral RfDo (mg/kg-d)	Reference Dose Inhaled RfDi (mg/kg-d)
tert-BUTYL ALCOHOL	V	L	74	3.70E+01	9.00E-02	9.10E-06	1.00E+06	1.17E-05	4.80E-04		3.0E-03	3.0E-03		
TETRACHLOROETHANE, 1,1,1,2-	V	L	168	9.37E+01	7.10E-02	7.90E-06	2.97E+03	3.45E-04	1.41E-02		2.6E-02	2.6E-02	3.00E-02	3.00E-02
TETRACHLOROETHANE, 1,1,2,2-	V	L	168	9.37E+01	7.10E-02	7.90E-06	2.97E+03	3.45E-04	1.41E-02		2.0E-01	2.0E-01	6.00E-02	6.00E-02
TETRACHLOROETHYLENE	V	L	166	1.55E+02	7.20E-02	8.20E-06	2.00E+02	1.84E-02	7.54E-01		5.4E-01	2.1E-02	1.00E-02	1.00E-02
THALLIUM	NV	S	204										6.60E-05	
TOLUENE	V	L	92	1.82E+02	8.70E-02	8.60E-06	5.26E+02	6.64E-03	2.72E-01				2.00E-01	1.10E-01
TOXAPHENE	NV	S	414	4.90E+03			3.00E+00	2.10E-01	8.61E+00	0.10	1.2E+00	1.2E+00		
TPH (gasolines)	V	L	108	5.00E+03	7.00E-02	7.80E-06	1.50E+02	7.20E-04	2.95E-02	0.10			3.00E-02	1.40E-02
TPH (middle distillates)	V	L	170	5.00E+03	7.00E-02	7.80E-06	5.00E+00	7.20E-04	2.95E-02	0.10			3.00E-02	1.40E-02
TPH (residual fuels)	NV	L	200+				5.00E+00						3.00E-02	1.40E-02
TRICHLOROBENZENE, 1,2,4-	V	S	180	1.78E+03	3.00E-02	8.23E-06	3.00E+02	1.42E-03	5.82E-02				1.00E-02	1.00E-03
TRICHLOROETHANE, 1,1,1-	V	L	133	1.10E+02	7.80E-02	8.80E-06	1.33E+03	1.72E-02	7.05E-01				2.80E-01	6.30E-01
TRICHLOROETHANE, 1,1,2-	V	L	133	5.01E+01	7.80E-02	8.80E-06	4.42E+03	9.13E-04	3.74E-02		5.7E-02	5.6E-02	4.00E-03	4.00E-03
TRICHLOROETHYLENE	V	L	131	1.66E+02	7.90E-02	9.10E-06	1.10E+03	1.03E-02	4.22E-01		4.00E-01	4.0E-01	3.00E-04	1.00E-02
TRICHLOROPHENOL, 2,4,5-	V	S	198	8.90E+01	2.9E-02	7.0E-06	1.19E+03	2.18E-04	8.94E-03	0.10			1.00E-01	1.00E-01
TRICHLOROPHENOL, 2,4,6-	NV	S	198	2.00E+03			8.00E+02	4.00E-06	1.64E-04	0.10	1.1E-02	1.1E-02	1.00E-04	1.00E-04
VANADIUM	NV	S	51										1.00E-03	
VINYL CHLORIDE	V	G	63	1.86E+01	1.06E-01	1.23E-06	2.76E+03	2.70E-02	1.11E+00		1.5E+00	3.1E-02	3.00E-03	2.86E-02
XYLENES	V	L	106	4.07E+02	7.00E-02	7.80E-06	1.61E+02	7.34E-03	3.01E-01				2.00E-01	2.90E-02
ZINC	NV	S	65										3.00E-01	

Notes:

Physical state of chemical at ambient conditions (V - volatile, NV - nonvolatile, S - solid, L - liquid, G - gas).
Chemical considered to be "volatile" if Henry's number (atm m3/mole) >0.00001 and molecular weight <200.
Cancer Slope Factors and Reference Dose from USEPA as presented in Region IX PRGs (USEPA 2004) unless otherwise noted.
Physio-chemical constants and ABS values from (in order of preference): USEPA Region IX PRGs (USEPA 2004) or Ontario MOEE (MOEE 1996), except as noted.
RfDs for acenaphthylene, methylnaphthylene, and phenanthrene based on fluorene; RfDs for benzo(g,h,i)perylene based on fluoranthene (after MADEP 1994).
Dibromochloromethane, dibromochloropropane and pyrene considered volatile for purposes of modeling (USEPA 2004). (Molecular weight adjusted to 199 in column E (hidden) to permit generation of volatilization factor in soil direct-exposure models.)
Physio-chemical constants for 1,4 Dioxane from "Solvent Stabilizers - White Paper" (Mohr 2001).
Physio-chemical constants for dioxin, polychlorinated biphenyls and toxaphene from ATSDR 2001a. PCB solubility from MOEE (1996).
Molecular weight, solubility, Henry's Law Constant for ethanol from *Fate and Transport of Ethanol-Blended Gasoline in the Environment (Ulrich 1999)*. Koc estimated from log Kow of -0.31 presented in Toxnet (NLM 2005) using koc = kow x 0.63 (in Fetter 1993, conversion for miscellaneous organics). Toxicity factors for ethanol not available.
RfDs for acenaphthylene, methylnaphthylene, and phenanthrene based on fluorene; RfDs for benzo(g,h,i)perylene based on fluoranthene (after MADEP 1994). Diffusivities for acenaphthylene, and phenanthrene based on fluorene.
Diffusivity constants for methylnaphthalene not available. Constants presented based on naphthalene.
TPH -Total Petroleum Hydrocarbons. RfD values from MADEP 2002. See text for discussion of different TPH categories.
TPH as gasolines and middle distillates diffusivity constants based on xylenes. (Required for direct exposure models. Does not significantly affect action levels. See Chapter 4.
Physio-chemical constants for TBA from *Assessment and Management of MtBE Impacted Sites* (SFBRWQCB 2001). Oral cancer slope factor from CalEPA OEHHA (CalEPA 1999b). Inhalation CSF inferred from oral CSF.
Physio-chemicals and toxicity constants for xylenes based on m-xylene.
Cancer slope factors for vinyl chloride based on residential exposure as presented in USEPA Region IX PRG document (October 2004)

TABLE K-1. DIRECT-EXPOSURE SCREENING LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens [2](HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	7.3E+02	noncarcinogenic effects	-	7.3E+02	3.7E+03	NA
ACENAPHTHYLENE	2.6E+02	noncarcinogenic effects	-	2.6E+02	1.3E+03	NA
ACETONE	2.8E+03	noncarcinogenic effects	-	2.8E+03	1.4E+04	1.0E+05
ALDRIN	2.9E-02	carcinogenic effects	2.9E-02	3.7E-01	1.8E+00	NA
ANTHRACENE	4.4E+03	noncarcinogenic effects	-	4.4E+03	2.2E+04	NA
ANTIMONY	6.3E+00	noncarcinogenic effects	-	6.3E+00	3.1E+01	NA
ARSENIC	3.9E-01	carcinogenic effects	3.9E-01	4.3E+00	2.2E+01	NA
BARIUM	1.1E+03	noncarcinogenic effects	-	1.1E+03	5.4E+03	NA
BENZENE	6.4E-01	carcinogenic effects	6.4E-01	6.5E+00	3.3E+01	8.7E+02
BENZO(a)ANTHRACENE	6.2E+00	carcinogenic effects	6.2E+00	-	-	NA
BENZO(a)PYRENE	6.2E-01	carcinogenic effects	6.2E-01	-	-	NA
BENZO(b)FLUORANTHENE	6.2E+00	carcinogenic effects	6.2E+00	-	-	NA
BENZO(g,h,i)PERYLENE	4.6E+02	noncarcinogenic effects	-	4.6E+02	2.3E+03	NA
BENZO(k)FLUORANTHENE	6.2E+01	carcinogenic effects	6.2E+01	-	-	NA
BERYLLIUM	3.1E+01	noncarcinogenic effects	1.1E+03	3.1E+01	1.5E+02	NA
BIPHENYL, 1,1-	6.0E+02	noncarcinogenic effects	-	6.0E+02	3.0E+03	NA
BIS(2-CHLOROETHYL)ETHER	2.0E-01	carcinogenic effects	2.0E-01	-	-	9.6E+03
BIS(2-CHLOROISOPROPYL)ETHER	2.9E+00	carcinogenic effects	2.9E+00	1.9E+02	9.5E+02	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	3.5E+01	carcinogenic effects	3.5E+01	2.4E+02	1.2E+03	NA
BORON	2.4E+03	noncarcinogenic effects	-	2.4E+03	1.2E+04	NA
BROMODICHLOROMETHANE	8.2E-01	carcinogenic effects	8.2E-01	4.4E+01	2.2E+02	3.0E+03
BROMOFORM	6.1E+01	carcinogenic effects	6.1E+01	2.4E+02	1.2E+03	NA
BROMOMETHANE	7.6E-01	noncarcinogenic effects	-	7.6E-01	3.8E+00	3.1E+03
CADMIUM	7.8E+00	noncarcinogenic effects	1.4E+03	7.8E+00	3.9E+01	NA
CARBON TETRACHLORIDE	2.5E-01	carcinogenic effects	2.5E-01	4.3E-01	2.2E+00	1.1E+03
CHLORDANE	1.6E+00	carcinogenic effects	1.6E+00	7.0E+00	3.5E+01	NA
CHLOROANILINE, p-	4.9E+01	noncarcinogenic effects	-	4.9E+01	2.4E+02	NA
CHLOROBENZENE	3.0E+01	noncarcinogenic effects	-	3.0E+01	1.5E+02	6.8E+02
CHLOROETHANE	3.0E+00	carcinogenic effects	3.0E+00	1.0E+03	5.0E+03	1.6E+03
CHLOROFORM	2.2E-01	carcinogenic effects	2.2E-01	1.1E+01	5.4E+01	2.9E+03
CHLOROMETHANE	9.2E+00	noncarcinogenic effects	-	9.2E+00	4.6E+01	4.1E+03
CHLOROPHENOL, 2-	1.3E+01	noncarcinogenic effects	-	1.3E+01	6.3E+01	5.5E+04
CHROMIUM (Total)	2.1E+02	carcinogenic effects	2.1E+02	-	-	NA
CHROMIUM III	2.3E+04	noncarcinogenic effects	-	2.3E+04	1.2E+05	NA
CHROMIUM VI	3.0E+01	carcinogenic effects	3.0E+01	4.5E+01	2.2E+02	NA
CHRYSENE	6.2E+02	carcinogenic effects	6.2E+02	-	-	NA

TABLE K-1. DIRECT-EXPOSURE SCREENING LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens [2](HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
COBALT	1.0E+02	trench/construction worker	9.1E+02	2.8E+02	1.4E+03	NA
COPPER	6.3E+02	noncarcinogenic effects	-	6.3E+02	3.1E+03	NA
CYANIDE (Free)	2.4E+02	noncarcinogenic effects	-	2.4E+02	1.2E+03	NA
DIBENZO(a,h)ANTHTRACENE	6.2E-01	carcinogenic effects	6.2E-01	-	-	NA
DIBROMO,1,2- CHLOROPROPANE,3-	4.2E-01	noncarcinogenic effects	4.5E-01	4.2E-01	2.1E+00	NA
DIBROMOCHLOROMETHANE	1.1E+00	carcinogenic effects	1.1E+00	7.6E+01	3.8E+02	1.3E+04
DIBROMOETHANE, 1,2-	3.2E-02	carcinogenic effects	3.2E-02	8.1E+00	4.1E+01	NA
DICHLOROBENZENE, 1,2-	2.2E+02	noncarcinogenic effects	-	2.2E+02	1.1E+03	6.0E+02
DICHLOROBENZENE, 1,3-	1.1E+02	noncarcinogenic effects	-	1.1E+02	5.3E+02	6.0E+02
DICHLOROBENZENE, 1,4-	3.4E+00	carcinogenic effects	3.4E+00	9.6E+01	4.8E+02	NA
DICHLOROBENZIDINE, 3,3-	1.1E+00	carcinogenic effects	1.1E+00	-	-	NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	2.4E+00	carcinogenic effects	2.4E+00	-	-	NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	2.4E+00	carcinogenic effects	2.4E+00	-	-	NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	1.7E+00	carcinogenic effects	1.7E+00	7.2E+00	3.6E+01	NA
DICHLOROETHANE, 1,1-	9.8E+01	noncarcinogenic effects	-	9.8E+01	4.9E+02	1.7E+03
DICHLOROETHANE, 1,2-	2.7E-01	carcinogenic effects	2.7E-01	1.7E+00	8.4E+00	1.8E+03
DICHLOROETHYLENE, 1,1-	2.4E+01	noncarcinogenic effects	-	2.4E+01	1.2E+02	1.5E+03
DICHLOROETHYLENE, Cis 1,2-	8.5E+00	noncarcinogenic effects	-	8.5E+00	4.2E+01	1.2E+03
DICHLOROETHYLENE, Trans 1,2-	1.4E+01	noncarcinogenic effects	-	1.4E+01	6.9E+01	3.1E+03
DICHLOROPHENOL, 2,4-	3.7E+01	noncarcinogenic effects	-	3.7E+01	1.8E+02	NA
DICHLOROPROPANE, 1,2-	3.4E-01	carcinogenic effects	3.4E-01	1.1E+00	5.7E+00	1.1E+03
DICHLOROPROPENE, 1,3-	7.7E-01	carcinogenic effects	7.7E-01	3.2E+00	1.6E+01	1.4E+03
DIELDRIN	3.0E-02	carcinogenic effects	3.0E-02	6.1E-01	3.1E+00	NA
DIETHYLPHTHALATE	9.8E+03	noncarcinogenic effects	-	9.8E+03	4.9E+04	NA
DIMETHYLPHENOL, 2,4-	2.4E+02	noncarcinogenic effects	-	2.4E+02	1.2E+03	NA
DIMETHYLPHTHALATE	1.2E+05	noncarcinogenic effects	-	1.2E+05	6.1E+05	NA
DINITROPHENOL, 2,4-	2.4E+01	noncarcinogenic effects	-	2.4E+01	1.2E+02	NA
DINITROTOLUENE, 2,4-	2.4E+01	noncarcinogenic effects	2.4E+02	2.4E+01	1.2E+02	NA
DIOXANE, 1,4-	4.4E+01	carcinogenic effects	4.4E+01	-	-	NA
DIOXIN (2,3,7,8-TCDD)	3.9E-06	carcinogenic effects	3.9E-06	-	-	NA
ENDOSULFAN	7.3E+01	noncarcinogenic effects	-	7.3E+01	3.7E+02	NA
ENDRIN	3.7E+00	noncarcinogenic effects	-	3.7E+00	1.8E+01	NA
ETHANOL		not available				
ETHYLBENZENE	3.7E+02	noncarcinogenic effects	-	3.7E+02	1.8E+03	4.0E+02
FLUORANTHENE	4.6E+02	noncarcinogenic effects	-	4.6E+02	2.3E+03	NA
FLUORENE	5.5E+02	noncarcinogenic effects	-	5.5E+02	2.7E+03	NA

TABLE K-1. DIRECT-EXPOSURE SCREENING LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens [2](HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
HEPTACHLOR	1.1E-01	carcinogenic effects	1.1E-01	6.1E+00	3.1E+01	NA
HEPTACHLOR EPOXIDE	5.3E-02	carcinogenic effects	5.3E-02	1.6E-01	7.9E-01	NA
HEXACHLOROBENZENE	3.0E-01	carcinogenic effects	3.0E-01	9.8E+00	4.9E+01	NA
HEXACHLOROBUTADIENE	3.7E+00	noncarcinogenic effects	6.2E+00	3.7E+00	1.8E+01	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	4.4E-01	carcinogenic effects	4.4E-01	4.2E+00	2.1E+01	NA
HEXACHLOROETHANE	1.2E+01	noncarcinogenic effects	3.5E+01	1.2E+01	6.1E+01	NA
INDENO(1,2,3-cd)PYRENE	6.2E+00	carcinogenic effects	6.2E+00	-	-	NA
LEAD	4.00E+02	USEPA IX PRGs	-	-	-	NA
MERCURY	4.7E+00	noncarcinogenic effects	-	4.7E+00	2.3E+01	NA
METHOXYCHLOR	6.1E+01	noncarcinogenic effects	-	6.1E+01	3.1E+02	NA
METHYL ETHYL KETONE	4.4E+03	noncarcinogenic effects	-	4.4E+03	2.2E+04	3.4E+04
METHYL ISOBUTYL KETONE	1.1E+03	noncarcinogenic effects	-	1.1E+03	5.3E+03	1.7E+04
METHYL MERCURY	1.2E+00	noncarcinogenic effects	-	1.2E+00	6.1E+00	NA
METHYL TERT BUTYL ETHER	3.1E+01	carcinogenic effects	3.1E+01	1.1E+03	5.7E+03	NA
METHYLENE CHLORIDE	9.2E+00	carcinogenic effects	9.2E+00	3.9E+02	1.9E+03	NA
METHYLNAPHTHALENE (total 1- & 2-)	1.1E+02	saturation limit	-	2.9E+02	1.4E+03	1.1E+02
MOLYBDENUM	7.8E+01	noncarcinogenic effects	-	7.8E+01	3.9E+02	NA
NAPHTHALENE	1.1E+01	noncarcinogenic effects	-	1.1E+01	5.5E+01	NA
NICKEL	3.1E+02	noncarcinogenic effects	-	3.1E+02	1.6E+03	NA
PENTACHLOROPHENOL	3.0E+00	carcinogenic effects	3.0E+00	2.8E+02	1.4E+03	NA
PERCHLORATE	1.6E+00	noncarcinogenic effects	-	1.6E+00	7.8E+00	NA
PHENANTHRENE	5.7E+02	noncarcinogenic effects	-	5.7E+02	2.8E+03	NA
PHENOL	3.7E+03	noncarcinogenic effects	-	3.7E+03	1.8E+04	NA
POLYCHLORINATED BIPHENYLS (PCBs)	2.2E-01	carcinogenic effects	2.2E-01	2.2E-01	1.1E+00	NA
PYRENE	4.6E+02	noncarcinogenic effects	-	4.6E+02	2.3E+03	NA
SELENIUM	7.8E+01	noncarcinogenic effects	-	7.8E+01	3.9E+02	NA
SILVER	7.8E+01	noncarcinogenic effects	-	7.8E+01	3.9E+02	NA
STYRENE	8.7E+02	noncarcinogenic effects	-	8.7E+02	4.3E+03	1.5E+03
tert-BUTYL ALCOHOL	7.0E+01	carcinogenic effects	7.0E+01	-	-	3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	3.1E+00	carcinogenic effects	3.1E+00	1.0E+02	5.1E+02	2.0E+03
TETRACHLOROETHANE, 1,1,2,2-	4.1E-01	carcinogenic effects	4.1E-01	2.0E+02	1.0E+03	2.0E+03
TETRACHLOROETHYLENE	4.8E-01	carcinogenic effects	4.8E-01	7.5E+00	3.8E+01	2.3E+02
THALLIUM	1.0E+00	noncarcinogenic effects	-	1.0E+00	5.2E+00	NA
TOLUENE	1.3E+02	noncarcinogenic effects	-	1.3E+02	6.5E+02	6.5E+02
TOXAPHENE	4.0E-01	carcinogenic effects	4.0E-01	-	-	NA
TPH (gasolines)	4.0E+02	noncarcinogenic effects	-	4.0E+02	8.0E+02	NA

TABLE K-1. DIRECT-EXPOSURE SCREENING LEVELS
[1]RESIDENTIAL EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens [2](HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TPH (middle distillates)	4.0E+02	noncarcinogenic effects	-	4.0E+02	8.0E+02	NA
TPH (residual fuels)	1.2E+03	noncarcinogenic effects	-	1.2E+03	2.3E+03	NA
TRICHLOROBENZENE, 1,2,4-	1.2E+01	noncarcinogenic effects	-	1.2E+01	6.1E+01	NA
TRICHLOROETHANE, 1,1,1-	3.9E+02	noncarcinogenic effects	-	3.9E+02	2.0E+03	1.2E+03
TRICHLOROETHANE, 1,1,2-	7.2E-01	carcinogenic effects	7.2E-01	7.1E+00	3.6E+01	1.8E+03
TRICHLOROETHYLENE	5.2E-01	carcinogenic effects	5.2E-01	3.2E+00	1.6E+01	1.3E+03
TRICHLOROPHENOL, 2,4,5-	5.0E+02	noncarcinogenic effects	-	5.0E+02	2.5E+03	NA
TRICHLOROPHENOL, 2,4,6-	1.2E+00	noncarcinogenic effects	4.4E+01	1.2E+00	6.1E+00	NA
VANADIUM	1.6E+01	noncarcinogenic effects	-	1.6E+01	7.8E+01	NA
VINYL CHLORIDE	1.5E-01	carcinogenic effects	1.5E-01	7.7E+00	3.8E+01	1.2E+03
XYLENES	5.4E+01	noncarcinogenic effects	-	5.4E+01	2.7E+02	4.2E+02
ZINC	4.7E+03	noncarcinogenic effects	-	4.7E+03	2.3E+04	NA

Primary source: USEPA Region IX Preliminary Remediation Goals (PRGs, USEPA 2004), modified as noted below. See text for discussion.

Notes:

1. "Residential" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.).
2. Alternative direct-exposure screening levels for TPH based on a Hazard Quotient of 0.5 (refer to text Section 3.2).

See text for equations and assumptions used in models.

Final screening level is lowest of individual screening levels for carcinogenic effects and noncarcinogenic effects (based on HQ=0.2) or screening level for construction/trench workers if lower (see Table K-3). Saturation limit used as upper limit for volatile organic compounds that are liquid at ambient conditions (see text).

Carcinogens: Based on target cancer risk of $10^{-6.}$

Noncarcinogens: Adjusted to target hazard quotient of 0.2 for use in tables for all chemicals except TPH (TPH adjusted to HQ of 0.5; see Sections 1.3 and 3.4 in text). Screening levels based on hazard quotient of 1.0 provided for reference.

Saturation: Theoretical soil saturation level in the absence of free product; calculated for volatile organic compounds that are liquids under ambient conditions (refer to Table J).

TPH:Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Direct exposure screening levels after Massachusetts Department of Environmental Protection (see text).

Ethanol: Human health toxicity data not available. Environmental concerns driven by gross contamination/nuisance concerns.

Direct-exposure screening level for lead from USEPA Regon IX PRGs (USEPA 2004).

TABLE K-2. DIRECT-EXPOSURE SCREENING LEVELS
COMMERCIAL/INDUSTRIAL WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens (HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	5.8E+03	noncarcinogenic effects	-	5.8E+03	2.9E+04	NA
ACENAPHTHYLENE	1.2E+03	noncarcinogenic effects	-	1.2E+03	6.1E+03	NA
ACETONE	1.1E+04	noncarcinogenic effects	-	1.1E+04	5.4E+04	1.0E+05
ALDRIN	1.0E-01	carcinogenic effects	1.0E-01	3.7E+00	1.8E+01	NA
ANTHRACENE	4.8E+04	noncarcinogenic effects	-	4.8E+04	2.4E+05	NA
ANTIMONY	8.2E+01	noncarcinogenic effects	-	8.2E+01	4.1E+02	NA
ARSENIC	1.6E+00	carcinogenic effects	1.6E+00	5.1E+01	2.6E+02	NA
BARIUM	2.5E+03	trench/construction worker	-	1.3E+04	6.6E+04	NA
BENZENE	1.4E+00	carcinogenic effects	1.4E+00	2.3E+01	1.2E+02	8.7E+02
BENZO(a)ANTHRACENE	2.1E+01	carcinogenic effects	2.1E+01	-	-	NA
BENZO(a)PYRENE	2.1E+00	carcinogenic effects	2.1E+00	-	-	NA
BENZO(b)FLUORANTHENE	2.1E+01	carcinogenic effects	2.1E+01	-	-	NA
BENZO(g,h,i)PERYLENE	4.4E+03	noncarcinogenic effects	-	4.4E+03	2.2E+04	NA
BENZO(k)FLUORANTHENE	2.1E+02	carcinogenic effects	2.1E+02	-	-	NA
BERYLLIUM	9.8E+01	trench/construction worker	2.2E+03	3.9E+02	1.9E+03	NA
BIPHENYL, 1,1-	4.6E+03	noncarcinogenic effects	-	4.6E+03	2.3E+04	NA
BIS(2-CHLOROETHYL)ETHER	5.3E-01	carcinogenic effects	5.3E-01	-	-	9.6E+03
BIS(2-CHLOROISOPROPYL)ETHER	7.3E+00	carcinogenic effects	7.3E+00	8.0E+02	4.0E+03	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.2E+02	carcinogenic effects	1.2E+02	2.5E+03	1.2E+04	NA
BORON	2.5E+04	noncarcinogenic effects	-	2.5E+04	1.2E+05	NA
BROMODICHLOROMETHANE	1.8E+00	carcinogenic effects	1.8E+00	1.6E+02	8.0E+02	3.0E+03
BROMOFORM	2.2E+02	carcinogenic effects	2.2E+02	2.5E+03	1.2E+04	NA
BROMOMETHANE	2.5E+00	noncarcinogenic effects	-	2.5E+00	1.3E+01	3.1E+03
CADMIUM	1.0E+02	noncarcinogenic effects	3.0E+03	1.0E+02	5.1E+02	NA
CARBON TETRACHLORIDE	5.4E-01	carcinogenic effects	5.4E-01	1.4E+00	7.2E+00	1.1E+03
CHLORDANE	6.5E+00	carcinogenic effects	6.5E+00	8.1E+01	4.0E+02	NA
CHLOROANILINE, p-	4.9E+02	noncarcinogenic effects	-	4.9E+02	2.5E+03	NA
CHLOROBENZENE	1.0E+02	noncarcinogenic effects	-	1.0E+02	5.2E+02	6.8E+02
CHLOROETHANE	6.4E+00	carcinogenic effects	6.4E+00	3.7E+03	1.9E+04	1.6E+03
CHLOROFORM	4.6E-01	carcinogenic effects	4.6E-01	3.7E+01	1.8E+02	2.9E+03
CHLOROMETHANE	3.1E+01	noncarcinogenic effects	-	3.1E+01	1.5E+02	4.1E+03
CHLOROPHENOL, 2-	4.7E+01	noncarcinogenic effects	-	4.7E+01	2.3E+02	5.5E+04
CHROMIUM (Total)	2.2E+02	trench/construction worker	4.5E+02	-	-	NA
CHROMIUM III	3.1E+05	noncarcinogenic effects	-	3.1E+05	1.5E+06	NA
CHROMIUM VI	3.1E+01	trench/construction worker	6.4E+01	5.1E+02	2.5E+03	NA
CHRYSENE	2.1E+03	carcinogenic effects	2.1E+03	-	-	NA

TABLE K-2. DIRECT-EXPOSURE SCREENING LEVELS
COMMERCIAL/INDUSTRIAL WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens (HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
COBALT	1.0E+02	trench/construction worker	1.9E+03	2.7E+03	1.3E+04	NA
COPPER	8.2E+03	noncarcinogenic effects	-	8.2E+03	4.1E+04	NA
CYANIDE (Free)	2.5E+03	noncarcinogenic effects	-	2.5E+03	1.2E+04	NA
DIBENZO(a,h)ANTHTRACENE	2.1E+00	carcinogenic effects	2.1E+00	-	-	NA
DIBROMO,1,2- CHLOROPROPANE,3-	2.0E+00	carcinogenic effects	2.0E+00	2.1E+00	1.1E+01	NA
DIBROMOCHLOROMETHANE	2.5E+00	carcinogenic effects	2.5E+00	3.0E+02	1.5E+03	1.3E+04
DIBROMOETHANE, 1,2-	7.2E-02	carcinogenic effects	7.2E-02	2.8E+01	1.4E+02	NA
DICHLOROBENZENE, 1,2-	6.0E+02	saturation limit	-	8.1E+02	4.0E+03	6.0E+02
DICHLOROBENZENE, 1,3-	4.1E+02	noncarcinogenic effects	-	4.1E+02	2.1E+03	6.0E+02
DICHLOROBENZENE, 1,4-	7.8E+00	carcinogenic effects	7.8E+00	3.7E+02	1.8E+03	NA
DICHLOROBENZIDINE, 3,3-	3.8E+00	carcinogenic effects	3.8E+00	-	-	NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.0E+01	carcinogenic effects	1.0E+01	-	-	NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.0E+01	carcinogenic effects	1.0E+01	-	-	NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	7.0E+00	carcinogenic effects	7.0E+00	8.5E+01	4.3E+02	NA
DICHLOROETHANE, 1,1-	3.4E+02	noncarcinogenic effects	-	3.4E+02	1.7E+03	1.7E+03
DICHLOROETHANE, 1,2-	6.0E-01	carcinogenic effects	6.0E-01	5.5E+00	2.8E+01	1.8E+03
DICHLOROETHYLENE, 1,1-	8.2E+01	noncarcinogenic effects	-	8.2E+01	4.1E+02	1.5E+03
DICHLOROETHYLENE, Cis 1,2-	2.9E+01	noncarcinogenic effects	-	2.9E+01	1.4E+02	1.2E+03
DICHLOROETHYLENE, Trans 1,2-	4.6E+01	noncarcinogenic effects	-	4.6E+01	2.3E+02	3.1E+03
DICHLOROPHENOL, 2,4-	3.7E+02	noncarcinogenic effects	-	3.7E+02	1.8E+03	NA
DICHLOROPROPANE, 1,2-	7.3E-01	carcinogenic effects	7.3E-01	3.9E+00	2.0E+01	1.1E+03
DICHLOROPROPENE, 1,3-	1.7E+00	carcinogenic effects	1.7E+00	1.1E+01	5.3E+01	1.4E+03
DIELDRIN	1.1E-01	carcinogenic effects	1.1E-01	6.2E+00	3.1E+01	NA
DIETHYLPHTHALATE	9.8E+04	noncarcinogenic effects	-	9.8E+04	4.9E+05	NA
DIMETHYLPHENOL, 2,4-	2.5E+03	noncarcinogenic effects	-	2.5E+03	1.2E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum	-	1.2E+06	6.2E+06	NA
DINITROPHENOL, 2,4-	2.5E+02	noncarcinogenic effects	-	2.5E+02	1.2E+03	NA
DINITROTOLUENE, 2,4-	2.5E+02	noncarcinogenic effects	8.6E+02	2.5E+02	1.2E+03	NA
DIOXANE, 1,4-	1.6E+02	carcinogenic effects	1.6E+02	-	-	NA
DIOXIN (2,3,7,8-TCDD)	1.6E-05	carcinogenic effects	1.6E-05	-	-	NA
ENDOSULFAN	7.4E+02	noncarcinogenic effects	-	7.4E+02	3.7E+03	NA
ENDRIN	3.7E+01	noncarcinogenic effects	-	3.7E+01	1.8E+02	NA
ETHANOL		not available				
ETHYLBENZENE	4.0E+02	saturation limit	-	1.5E+03	7.3E+03	4.0E+02
FLUORANTHENE	4.4E+03	noncarcinogenic effects	-	4.4E+03	2.2E+04	NA
FLUORENE	5.2E+03	noncarcinogenic effects	-	5.2E+03	2.6E+04	NA

TABLE K-2. DIRECT-EXPOSURE SCREENING LEVELS
COMMERCIAL/INDUSTRIAL WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens (HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
HEPTACHLOR	3.8E-01	carcinogenic effects	3.8E-01	6.2E+01	3.1E+02	NA
HEPTACHLOR EPOXIDE	1.9E-01	carcinogenic effects	1.9E-01	1.6E+00	8.0E+00	NA
HEXACHLOROBENZENE	1.1E+00	carcinogenic effects	1.1E+00	9.8E+01	4.9E+02	NA
HEXACHLOROBUTADIENE	2.2E+01	carcinogenic effects	2.2E+01	3.7E+01	1.8E+02	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.7E+00	carcinogenic effects	1.7E+00	4.9E+01	2.4E+02	NA
HEXACHLOROETHANE	1.2E+02	carcinogenic effects	1.2E+02	1.2E+02	6.2E+02	NA
INDENO(1,2,3-cd)PYRENE	2.1E+01	carcinogenic effects	2.1E+01	-	-	NA
LEAD	7.5E+02	USEPA Region IX (USEPA 2004)	-	-	-	NA
MERCURY	6.1E+01	noncarcinogenic effects	-	6.1E+01	3.1E+02	NA
METHOXYCHLOR	6.2E+02	noncarcinogenic effects	-	6.2E+02	3.1E+03	NA
METHYL ETHYL KETONE	2.2E+04	noncarcinogenic effects	-	2.2E+04	1.1E+05	3.4E+04
METHYL ISOBUTYL KETONE	9.4E+03	noncarcinogenic effects	-	9.4E+03	4.7E+04	1.7E+04
METHYL MERCURY	1.2E+01	noncarcinogenic effects	-	1.2E+01	6.2E+01	NA
METHYL TERT BUTYL ETHER	7.0E+01	carcinogenic effects	7.0E+01	4.0E+03	2.0E+04	NA
METHYLENE CHLORIDE	2.1E+01	carcinogenic effects	2.1E+01	1.8E+03	9.1E+03	NA
METHYLNAPHTHALENE (total 1- & 2-)	1.1E+02	saturation limit	-	1.4E+03	7.2E+03	1.1E+02
MOLYBDENUM	1.0E+03	noncarcinogenic effects	-	1.0E+03	5.1E+03	NA
NAPHTHALENE	3.7E+01	noncarcinogenic effects	-	3.7E+01	1.9E+02	NA
NICKEL	4.1E+03	noncarcinogenic effects	-	4.1E+03	2.0E+04	NA
PENTACHLOROPHENOL	9.0E+00	carcinogenic effects	9.0E+00	2.3E+03	1.2E+04	NA
PERCHLORATE	2.0E+01	noncarcinogenic effects	-	2.0E+01	1.0E+02	NA
PHENANTHRENE	5.8E+03	noncarcinogenic effects	-	5.8E+03	2.9E+04	NA
PHENOL	3.7E+04	noncarcinogenic effects	-	3.7E+04	1.8E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	7.4E-01	carcinogenic effects	7.4E-01	2.1E+00	1.1E+01	NA
PYRENE	5.8E+03	noncarcinogenic effects	-	5.8E+03	2.9E+04	NA
SELENIUM	1.0E+03	noncarcinogenic effects	-	1.0E+03	5.1E+03	NA
SILVER	1.0E+03	noncarcinogenic effects	-	1.0E+03	5.1E+03	NA
STYRENE	1.5E+03	saturation limit	-	3.6E+03	1.8E+04	1.5E+03
tert-BUTYL ALCOHOL	1.8E+02	carcinogenic effects	1.8E+02	-	-	3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	7.2E+00	carcinogenic effects	7.2E+00	4.0E+02	2.0E+03	2.0E+03
TETRACHLOROETHANE, 1,1,2,2-	9.3E-01	carcinogenic effects	9.3E-01	8.0E+02	4.0E+03	2.0E+03
TETRACHLOROETHYLENE	1.3E+00	carcinogenic effects	1.3E+00	2.5E+01	1.3E+02	2.3E+02
THALLIUM	1.3E+01	noncarcinogenic effects	-	1.3E+01	6.7E+01	NA
TOLUENE	4.4E+02	noncarcinogenic effects	-	4.4E+02	2.2E+03	6.5E+02
TOXAPHENE	1.4E+00	carcinogenic effects	1.4E+00	-	-	NA
TPH (gasolines)	1.9E+03	noncarcinogenic effects	-	1.9E+03	3.7E+03	4.5E+03

TABLE K-2. DIRECT-EXPOSURE SCREENING LEVELS
COMMERCIAL/INDUSTRIAL WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-6}) (mg/kg)	Noncarcinogens (HQ = 0.2) (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TPH (middle distillates)	1.9E+03	noncarcinogenic effects	-	1.9E+03	3.7E+03	1.5E+02
TPH (residual fuels)	1.5E+04	noncarcinogenic effects	-	1.5E+04	3.1E+04	NA
TRICHLOROBENZENE, 1,2,4-	4.3E+01	noncarcinogenic effects	-	4.3E+01	2.1E+02	NA
TRICHLOROETHANE, 1,1,1-	1.2E+03	saturation limit	-	1.4E+03	6.9E+03	1.2E+03
TRICHLOROETHANE, 1,1,2-	1.6E+00	carcinogenic effects	1.6E+00	2.5E+01	1.3E+02	1.8E+03
TRICHLOROETHYLENE	1.1E+00	carcinogenic effects	1.1E+00	2.1E+01	1.1E+02	1.3E+03
TRICHLOROPHENOL, 2,4,5-	2.2E+03	noncarcinogenic effects	-	2.2E+03	1.1E+04	NA
TRICHLOROPHENOL, 2,4,6-	1.2E+01	noncarcinogenic effects	1.6E+02	1.2E+01	6.2E+01	NA
VANADIUM	2.0E+02	noncarcinogenic effects	-	2.0E+02	1.0E+03	NA
VINYL CHLORIDE	3.8E-01	carcinogenic effects	3.8E-01	2.9E+01	1.4E+02	1.2E+03
XYLENES	1.8E+02	noncarcinogenic effects	-	1.8E+02	8.9E+02	4.2E+02
ZINC	6.1E+04	noncarcinogenic effects	-	6.1E+04	3.1E+05	NA

Primary source: USEPA Region IX Preliminary Remediation Goals (PRGs, USEPA 2004), modified as noted below. See text for discussion.

Notes:

See text for equations and assumptions used in models.

Final screening level is lowest of individual screening levels for carcinogenic effects and noncarcinogenic effects (based on HQ=0.2) or screening level for construction/trench workers if lower (see Table K-3). Saturation limit used as upper limit for volatile organic compounds that are liquid at ambient conditions (see text).

Carcinogens: Based on target cancer risk of $10^{-6.}$

Noncarcinogens: Adjusted to target hazard quotient of 0.2 for use in tables for all chemicals except TPH (TPH adjusted to HQ of 0.5; see Sections 1.3 and 3.4 in text). Screening levels based on hazard quotient of 1.0 provided for reference.

Saturation: Theoretical soil saturation level in the absence of free product; calculated for volatile organic compounds that are liquids under ambient conditions (refer to Table J).

TPH:Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Direct exposure screening levels after Massachusetts Department of Environmental Protection (see text).

Ethanol: Human health toxicity data not available. Environmental concerns driven by gross contamination/nuisance concerns.

TABLE K-3. DIRECT-EXPOSURE SCREENING LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-5}) (mg/kg)	Noncarcinogens HQ = 0.2 (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
ACENAPHTHENE	3.5E+04	noncarcinogenic effects	-	3.5E+04	1.7E+05	NA
ACENAPHTHYLENE	1.1E+04	noncarcinogenic effects	-	1.1E+04	5.7E+04	NA
ACETONE	1.0E+05	saturation limit	-	1.2E+05	5.9E+05	1.0E+05
ALDRIN	1.2E+01	carcinogenic effects	1.2E+01	1.2E+01	6.0E+01	NA
ANTHRACENE	2.1E+05	noncarcinogenic effects	-	2.1E+05	1.1E+06	NA
ANTIMONY	3.1E+02	noncarcinogenic effects	-	3.1E+02	1.5E+03	NA
ARSENIC	1.5E+02	carcinogenic effects	1.5E+02	1.8E+02	9.2E+02	NA
BARIUM	2.5E+03	noncarcinogenic effects	-	2.5E+03	1.2E+04	NA
BENZENE	2.7E+02	noncarcinogenic effects	5.9E+02	2.7E+02	1.4E+03	8.7E+02
BENZO(a)ANTHRACENE	2.4E+02	carcinogenic effects	2.4E+02	-	-	NA
BENZO(a)PYRENE	2.4E+01	carcinogenic effects	2.4E+01	-	-	NA
BENZO(b)FLUORANTHENE	2.4E+02	carcinogenic effects	2.4E+02	-	-	NA
BENZO(g,h,i)PERYLENE	1.4E+04	noncarcinogenic effects	-	1.4E+04	7.0E+04	NA
BENZO(k)FLUORANTHENE	2.4E+03	carcinogenic effects	2.4E+03	-	-	NA
BERYLLIUM	9.8E+01	noncarcinogenic effects	1.1E+03	9.8E+01	4.9E+02	NA
BIPHENYL, 1,1-	2.8E+04	noncarcinogenic effects	-	2.8E+04	1.4E+05	NA
BIS(2-CHLOROETHYL)ETHER	1.6E+02	carcinogenic effects	1.6E+02	-	-	9.6E+03
BIS(2-CHLOROISOPROPYL)ETHER	7.9E+02	saturation limit	2.3E+03	8.2E+03	4.1E+04	7.9E+02
BIS(2-ETHYLHEXYL)PHTHALATE	8.0E+03	noncarcinogenic effects	1.4E+04	8.0E+03	4.0E+04	NA
BORON	4.6E+04	noncarcinogenic effects	-	4.6E+04	2.3E+05	NA
BROMODICHLOROMETHANE	7.4E+02	carcinogenic effects	7.4E+02	1.8E+03	9.2E+03	3.0E+03
BROMOFORM	8.0E+03	noncarcinogenic effects	2.6E+04	8.0E+03	4.0E+04	NA
BROMOMETHANE	3.1E+01	noncarcinogenic effects	-	3.1E+01	1.6E+02	3.1E+03
CADMIUM	3.8E+02	noncarcinogenic effects	1.5E+03	3.8E+02	1.9E+03	NA
CARBON TETRACHLORIDE	1.8E+01	noncarcinogenic effects	2.3E+02	1.8E+01	8.8E+01	1.1E+03
CHLORDANE	2.6E+02	noncarcinogenic effects	7.9E+02	2.6E+02	1.3E+03	NA
CHLOROANILINE, p-	1.6E+03	noncarcinogenic effects	-	1.6E+03	8.0E+03	NA
CHLOROBENZENE	6.8E+02	saturation limit	-	1.2E+03	6.2E+03	6.8E+02
CHLOROETHANE	1.6E+03	saturation limit	2.8E+03	4.2E+04	2.1E+05	1.6E+03
CHLOROFORM	2.1E+02	carcinogenic effects	2.1E+02	4.4E+02	2.2E+03	2.9E+03
CHLOROMETHANE	3.8E+02	noncarcinogenic effects	-	3.8E+02	1.9E+03	4.1E+03
CHLOROPHENOL, 2-	5.3E+02	noncarcinogenic effects	-	5.3E+02	2.6E+03	5.5E+04
CHROMIUM (Total)	2.2E+02	carcinogenic effects	2.2E+02	-	-	NA
CHROMIUM III	1.0E+06	maximum	-	1.2E+06	5.8E+06	NA
CHROMIUM VI	3.1E+01	carcinogenic effects	3.1E+01	4.0E+01	2.0E+02	NA
CHRYSENE	2.4E+04	carcinogenic effects	2.4E+04	-	-	NA

TABLE K-3. DIRECT-EXPOSURE SCREENING LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-5}) (mg/kg)	Noncarcinogens HQ = 0.2 (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
COBALT	1.0E+02	noncarcinogenic effects	9.4E+02	1.0E+02	5.2E+02	NA
COPPER	3.1E+04	noncarcinogenic effects	-	3.1E+04	1.5E+05	NA
CYANIDE (Free)	8.2E+03	noncarcinogenic effects	-	8.2E+03	4.1E+04	NA
DIBENZO(a,h)ANTHTRACENE	2.4E+01	carcinogenic effects	2.4E+01	-	-	NA
DIBROMO,1,2- CHLOROPROPANE,3-	1.9E+01	noncarcinogenic effects	2.8E+02	1.9E+01	9.4E+01	NA
DIBROMOCHLOROMETHANE	9.6E+02	carcinogenic effects	9.6E+02	3.2E+03	1.6E+04	1.3E+04
DIBROMOETHANE, 1,2-	2.9E+01	carcinogenic effects	2.9E+01	3.3E+02	1.7E+03	NA
DICHLOROBENZENE, 1,2-	6.0E+02	saturation limit	-	9.1E+03	4.6E+04	6.0E+02
DICHLOROBENZENE, 1,3-	6.0E+02	saturation limit	-	4.5E+03	2.2E+04	6.0E+02
DICHLOROBENZENE, 1,4-	3.0E+03	carcinogenic effects	3.0E+03	4.0E+03	2.0E+04	NA
DICHLOROBENZIDINE, 3,3-	4.4E+02	carcinogenic effects	4.4E+02	-	-	NA
DICHLORODIPHENYLDICHLOROETHANE (DDD)	1.2E+03	carcinogenic effects	1.2E+03	-	-	NA
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	1.2E+03	carcinogenic effects	1.2E+03	-	-	NA
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	3.0E+02	noncarcinogenic effects	8.7E+02	3.0E+02	1.5E+03	NA
DICHLOROETHANE, 1,1-	1.7E+03	saturation limit	-	4.1E+03	2.0E+04	1.7E+03
DICHLOROETHANE, 1,2-	6.9E+01	noncarcinogenic effects	2.6E+02	6.9E+01	3.4E+02	1.8E+03
DICHLOROETHYLENE, 1,1-	1.0E+03	noncarcinogenic effects	-	1.0E+03	5.0E+03	1.5E+03
DICHLOROETHYLENE, Cis 1,2-	3.5E+02	noncarcinogenic effects	-	3.5E+02	1.8E+03	1.2E+03
DICHLOROETHYLENE, Trans 1,2-	5.7E+02	noncarcinogenic effects	-	5.7E+02	2.8E+03	3.1E+03
DICHLOROPHENOL, 2,4-	1.2E+03	noncarcinogenic effects	-	1.2E+03	6.0E+03	NA
DICHLOROPROPANE, 1,2-	4.7E+01	noncarcinogenic effects	3.1E+02	4.7E+01	2.4E+02	1.1E+03
DICHLOROPROPENE, 1,3-	1.3E+02	noncarcinogenic effects	6.8E+02	1.3E+02	6.6E+02	1.4E+03
DIELDRIN	1.2E+01	carcinogenic effects	1.2E+01	2.0E+01	1.0E+02	NA
DIETHYLPHTHALATE	3.2E+05	noncarcinogenic effects	-	3.2E+05	1.6E+06	NA
DIMETHYLPHENOL, 2,4-	8.0E+03	noncarcinogenic effects	-	8.0E+03	4.0E+04	NA
DIMETHYLPHTHALATE	1.0E+06	maximum	-	4.0E+06	2.0E+07	NA
DINITROPHENOL, 2,4-	8.0E+02	noncarcinogenic effects	-	8.0E+02	4.0E+03	NA
DINITROTOLUENE, 2,4-	8.0E+02	noncarcinogenic effects	1.0E+05	8.0E+02	4.0E+03	NA
DIOXANE, 1,4-	1.8E+04	carcinogenic effects	1.8E+04	-	-	NA
DIOXIN (2,3,7,8-TCDD)	2.0E-03	carcinogenic effects	2.0E-03	-	-	NA
ENDOSULFAN	2.4E+03	noncarcinogenic effects	-	2.4E+03	1.2E+04	NA
ENDRIN	1.2E+02	noncarcinogenic effects	-	1.2E+02	6.0E+02	NA
ETHANOL		no data				
ETHYLBENZENE	4.0E+02	saturation limit	-	1.6E+04	7.9E+04	4.0E+02
FLUORANTHENE	1.4E+04	noncarcinogenic effects	-	1.4E+04	7.0E+04	NA
FLUORENE	2.6E+04	noncarcinogenic effects	-	2.6E+04	1.3E+05	NA

TABLE K-3. DIRECT-EXPOSURE SCREENING LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-5}) (mg/kg)	Noncarcinogens HQ = 0.2 (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
HEPTACHLOR	4.4E+01	carcinogenic effects	4.4E+01	2.0E+02	1.0E+03	NA
HEPTACHLOR EPOXIDE	5.2E+00	noncarcinogenic effects	2.2E+01	5.2E+00	2.6E+01	NA
HEXACHLOROBENZENE	1.2E+02	carcinogenic effects	1.2E+02	3.2E+02	1.6E+03	NA
HEXACHLOROBUTADIENE	1.2E+02	noncarcinogenic effects	2.6E+03	1.2E+02	6.0E+02	NA
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	1.7E+02	noncarcinogenic effects	2.1E+02	1.7E+02	8.3E+02	NA
HEXACHLOROETHANE	4.0E+02	noncarcinogenic effects	1.4E+04	4.0E+02	2.0E+03	NA
INDENO(1,2,3-cd)PYRENE	2.4E+02	carcinogenic effects	2.4E+02	-	-	NA
LEAD	7.5E+02	noncarcinogenic effects	-	-	-	NA
MERCURY	2.3E+02	noncarcinogenic effects	-	2.3E+02	1.2E+03	NA
METHOXYCHLOR	2.0E+03	noncarcinogenic effects	-	2.0E+03	1.0E+04	NA
METHYL ETHYL KETONE	3.4E+04	saturation limit	-	2.0E+05	9.9E+05	3.4E+04
METHYL ISOBUTYL KETONE	1.7E+04	saturation limit	-	5.0E+04	2.5E+05	1.7E+04
METHYL MERCURY	4.1E+01	noncarcinogenic effects	-	4.1E+01	2.0E+02	NA
METHYL TERT BUTYL ETHER	2.8E+04	carcinogenic effects	2.8E+04	4.7E+04	2.4E+05	NA
METHYLENE CHLORIDE	8.2E+03	carcinogenic effects	8.2E+03	1.7E+04	8.5E+04	NA
METHYLNAPHTHALENE (total 1- & 2-)	1.1E+02	saturation limit	-	1.3E+04	6.4E+04	1.1E+02
MOLYBDENUM	3.9E+03	noncarcinogenic effects	-	3.9E+03	1.9E+04	NA
NAPHTHALENE	4.6E+02	noncarcinogenic effects	-	4.6E+02	2.3E+03	NA
NICKEL	1.5E+04	noncarcinogenic effects	-	1.5E+04	7.7E+04	NA
PENTACHLOROPHENOL	9.8E+02	carcinogenic effects	9.8E+02	7.1E+03	3.5E+04	NA
PERCHLORATE	7.7E+01	noncarcinogenic effects	-	7.7E+01	3.9E+02	NA
PHENANTHRENE	2.8E+04	noncarcinogenic effects	-	2.8E+04	1.4E+05	NA
PHENOL	1.2E+05	noncarcinogenic effects	-	1.2E+05	6.0E+05	NA
POLYCHLORINATED BIPHENYLS (PCBs)	6.7E+00	noncarcinogenic effects	8.4E+01	6.7E+00	3.4E+01	NA
PYRENE	2.3E+04	noncarcinogenic effects	-	2.3E+04	1.1E+05	NA
SELENIUM	3.9E+03	noncarcinogenic effects	-	3.9E+03	1.9E+04	NA
SILVER	3.9E+03	noncarcinogenic effects	-	3.9E+03	1.9E+04	NA
STYRENE	1.5E+03	saturation limit	-	3.7E+04	1.9E+05	1.5E+03
tert-BUTYL ALCOHOL	5.6E+04	carcinogenic effects	5.6E+04	-	-	3.2E+05
TETRACHLOROETHANE, 1,1,1,2-	2.0E+03	saturation limit	2.8E+03	4.3E+03	2.2E+04	2.0E+03
TETRACHLOROETHANE, 1,1,2,2-	3.6E+02	carcinogenic effects	3.6E+02	8.7E+03	4.3E+04	2.0E+03
TETRACHLOROETHYLENE	2.3E+02	saturation limit	3.7E+02	3.1E+02	1.5E+03	2.3E+02
THALLIUM	5.1E+01	noncarcinogenic effects	-	5.1E+01	2.6E+02	NA
TOLUENE	6.5E+02	saturation limit	-	5.3E+03	2.7E+04	6.5E+02
TOXAPHENE	1.7E+02	carcinogenic effects	1.7E+02	-	-	NA
TPH (gasolines)	1.5E+04	noncarcinogenic effects	-	1.5E+04	3.0E+04	NA

TABLE K-3. DIRECT-EXPOSURE SCREENING LEVELS
CONSTRUCTION/TRENCH WORKER EXPOSURE SCENARIO

CHEMICAL	Final Screening Level (mg/kg)	Basis	Carcinogens (Risk = 10^{-5}) (mg/kg)	Noncarcinogens HQ = 0.2 (mg/kg)	Noncarcinogens (HQ = 1.0) (mg/kg)	Saturation (mg/kg)
TPH (middle distillates)	1.5E+04	noncarcinogenic effects	-	1.5E+04	3.0E+04	NA
TPH (residual fuels)	5.3E+04	noncarcinogenic effects	-	5.3E+04	1.1E+05	NA
TRICHLOROBENZENE, 1,2,4-	5.1E+02	noncarcinogenic effects	-	5.1E+02	2.5E+03	NA
TRICHLOROETHANE, 1,1,1-	1.2E+03	saturation limit	-	1.6E+04	8.1E+04	1.2E+03
TRICHLOROETHANE, 1,1,2-	3.0E+02	noncarcinogenic effects	6.6E+02	3.0E+02	1.5E+03	1.8E+03
TRICHLOROETHYLENE	4.9E+01	carcinogenic effects	4.9E+01	1.5E+02	7.4E+02	1.3E+03
TRICHLOROPHENOL, 2,4,5-	1.9E+04	noncarcinogenic effects	-	1.9E+04	9.3E+04	NA
TRICHLOROPHENOL, 2,4,6-	4.0E+01	noncarcinogenic effects	1.8E+04	4.0E+01	2.0E+02	NA
VANADIUM	7.7E+02	noncarcinogenic effects	-	7.7E+02	3.9E+03	NA
VINYL CHLORIDE	1.2E+02	carcinogenic effects	1.2E+02	3.2E+02	1.6E+03	1.2E+03
XYLENES	4.2E+02	saturation limit	-	2.2E+03	1.1E+04	4.2E+02
ZINC	2.3E+05	noncarcinogenic effects	-	2.3E+05	1.2E+06	NA

Primary source: USEPA Region IX Preliminary Remediation Goals (PRGs, USEPA 2004), modified as noted below. See text for discussion.

Notes:

See text for equations and assumptions used in models.

Final screening level is lowest of individual screening levels for carcinogenic effects and noncarcinogenic effects (based on HQ=0.2) or screening level for construction/trench workers if lower (see Table K-3). Saturation limit used as upper limit for volatile organic compounds that are liquid at ambient conditions (see text).

Carcinogens: Based on target cancer risk of 10^{-5}.

Noncarcinogens: Adjusted to target hazard quotient of 0.2 for use in tables for all chemicals except TPH (TPH adjusted to HQ of 0.5; see Sections 1.3 and 3.4 in text). Screening levels based on hazard quotient of 1.0 provided for reference.

Saturation: Theoretical soil saturation level in the absence of free product; calculated for volatile organic compounds that are liquids under ambient conditions (refer to Table J).

TPH:Total Petroleum Hydrocarbons. See text for discussion of different TPH categories. Direct exposure screening levels after Massachusetts Department of Environmental Protection (see text).

Ethanol: Human health toxicity data not available. Environmental concerns driven by gross contamination/nuisance concerns.

Total Chromium: Direct-exposure action level set equal to commercial/industrial action level. Comparison to background recommended.

TABLE L. TARGET ORGANS AND CHRONIC HEALTH EFFECTS

(For general reference only. May not be adequately comprehensive for some chemicals.
Some noted effects may be insignificant. Refer to original documents for additional information.)

	Target Organs And Health Effects													
CHEMICAL PARAMETER	[a]Carcinogen	[b]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[c]Skin	**Other**
ACENAPHTHENE	NA	5,6						4					4	
ACENAPHTHYLENE	D						5,6	4					4	= Fluorene
ACETONE	D	5,6					3		5,6					
ALDRIN	B2	6								3				
ANTHRACENE	D							4					4	
ANTIMONY	D		4			3,4	5,7				4	1,3,4		hair loss (4)
ARSENIC	A	3,4,6	1,2,4	1,2,3,4			3,4,6			1,2,3,4			1,3,4,6	
BARIUM	D		4				5		6		5			hypertension (6)
BENZENE	A	3		1,2,4			1,2,3,4	3		1,2				
BENZO(a)ANTHRACENE	B2							4					4	No chronic toxicity factors.
BENZO(b)FLUORANTHENE	B2							4					4	No chronic toxicity factors.
BENZO(k)FLUORANTHENE	B2							4					4	No chronic toxicity factors.
BENZO(g,h,i)PERYLENE	D	5,6					5,6	4	5,6				4	= Fluoranthene
BENZO(a)PYRENE	B2							4			3		4	No chronic toxicity factors.
BERYLLIUM	B1	1,6						2	1			1,2,3,4,6	3	
BIPHENYL, 1,1-	D	3							6	3				
BIS(2-CHLOROETHYL)ETHER	B2									4	4			No chronic toxicity factors.
BIS(2-CHLOROISOPROPYL)ETHER	NA						6							
BIS(2-ETHYLHEXYL)PHTHALATE	NA	7												No chronic toxicity factors.
BORON	D										4,6	5		
BROMODICHLOROMETHANE	B2	4							4,6					
BROMOFORM	B2	3,4,6							4	3,4				
BROMOMETHANE	D	3,5,6	3	1,2					3,4	1,2,3,4		1,2,3,4,5,6		
CADMIUM	B1/D								1,2,3,4,5,6			1,2,3,4		bone loss (1,4)
CARBON TETRACHLORIDE	B2	1,2,4,6		1,2					4	1,2				
CHLORDANE	B2	3,4,6						3,5		4				
CHLOROANILINE, p-	NA	3,6						5	3				3	
CHLOROBENZENE	D	1,2,3,5,6					3		1,2,3,4,5	3	1,2			
CHLOROETHANE	B	1,2		1,2,4										
CHLOROFORM	B2	1,2,3,4,6		1,2					1,2,3,4					
CHLOROMETHANE	C/D			4						3	3,4			
CHLOROPHENOL, 2-	D	1,4		1							1,5,6			
CHROMIUM (Total)														
CHROMIUM III	D												3	
CHROMIUM VI	A						1				2	1,6		
CHRYSENE	B2							4					4	No chronic toxicity factors.
COBALT	NA		3									3	3	hearing (3)
COPPER	D											1,4	3	
CYANIDE (Free)	D		1,4		1,4,6		4			1,5,6		4		
DIBENZO(a,h)ANTHTRACENE	B2							4					3,4	
DIBROMOCHLOROMETHANE	C	6												
DIBROMO,1,2- CHLOROPROPANE,3-		1		1					3		1,3,4,5,6	1		
DIBROMOETHANE, 1,2-	B2			4							4	1,3		

TABLE L. TARGET ORGANS AND CHRONIC HEALTH EFFECTS
(For general reference only. May not be adequately comprehensive for some chemicals.
Some noted effects may be insignificant. Refer to original documents for additional information.)

	Target Organs And Health Effects													
CHEMICAL PARAMETER	[a]Carcinogen	[b]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[c]Skin	Other
DICHLOROBENZENE, 1,2-	D	3							3				3	
DICHLOROBENZENE, 1,3-	D	3							3					
DICHLOROBENZENE, 1,4-	C	1,2,3,6					3		1,2,3	1,2	6	1,2		
DICHLOROBENZIDINE, 3,3-	B2	3												No chronic toxicity factors.
DICHLORODIPHENYLDICHLOROETHANE (DDD)	B2													No chronic toxicity factors.
DICHLORODIPHENYLDICHLOROETHYLENE (DDE)	B2													No chronic toxicity factors.
DICHLORODIPHENYLTRICHLOROETHANE (DDT)	B2	3,4,6								3	3			
DICHLOROETHANE, 1,1-	C	3							3,4,5,7					
DICHLOROETHANE, 1,2-	B2	1,2												
DICHLOROETHYLENE, 1,1-	C/D	1,2,3,4,5,6							3	4		4		
DICHLOROETHYLENE, Cis 1,2-	D	4					4,5,7							
DICHLOROETHYLENE, Trans 1,2-	D	4					5,6					4		
DICHLOROPHENOL, 2,4-	E							5						
DICHLOROPROPANE, 1,2-	B2	3					3					5		
DICHLOROPROPENE, 1,3-	B2	6										4		
DIELDRIN	B2	6								3				
DIETHYLPHTHALATE	D			6							4			
DIMETHYLPHTHALATE	D													
DIMETHYLPHENOL, 2,4-	NA						5,6			5,6				
DINITROPHENOL, 2,4-	NA					3,6				3				
DINITROTOLUENE, 2,4-	B2	6	3				3			3,6				
DIOXANE, 1,4-	B2	1,2	1,2						1,2					
DIOXIN (2,3,7,8-TCDD)	NA	1,2,4		1,2,4	1,2,4		1,2	4			1,2,4	1,2,4	4	No chronic toxicity factors.
ENDOSULFAN	NA	4		4,6			6	4	4,5,6	4,6	4			
ENDRIN	D	5,6		4					6	5				
ETHANOL	NA													No chronic toxicity factors.
ETHYLBENZENE	D	1,2,5,6		1,2,4,6	1,2				1,2,5,6	3	3		3	
FLUORANTHENE	D	5,6					5,6	4	5,6				4	
FLUORENE	D						5,6	4					4	
HEPTACHLOR	B2	6								7				
HEPTACHLOR EPOXIDE	B2	6								7				
HEXACHLOROBENZENE	B2	1,3,4,6			4		4	4	4	3,4	3			bones (4)
HEXACHLOROBUTADIENE	C	4							4				3	
HEXACHLOROCYCLOHEXANE (gamma) LINDANE	NA	1,3,6							1,3,6					
HEXACHLOROETHANE	C	3,4							3,4,6					
INDENO(1,2,3-cd)PYRENE	B2							4					4	No chronic toxicity factors.
LEAD	B2	3,7	7	3,7			3,7	3,7	3,7	3,7	7			
MERCURY	D			4				1	1,3	1,2,3,5,6				
METHOXYCHLOR	D	3		6					3	3	3,5,6			
METHYLENE CHLORIDE	B2	3,6	1,2						3	1,2				
METHYL ETHYL KETONE	D			6							1,3			
METHYL ISOBUTYL KETONE	NA									7				
METHYL MERCURY	C			6						1,6				

TABLE L. TARGET ORGANS AND CHRONIC HEALTH EFFECTS
(For general reference only. May not be adequately comprehensive for some chemicals.
Some noted effects may be insignificant. Refer to original documents for additional information.)

	Target Organs And Health Effects													
CHEMICAL PARAMETER	[a]Carcinogen	[b]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[c]Skin	**Other**
METHYLNAPHTHALENE (total 1- & 2-)	C						5,6	4					4	= Fluorene
METHYL TERT BUTYL ETHER	NA	1,2,6				1,2			1,2,6					
MOLYBDENUM	D						6							
NAPHTHALENE	B2					3	3	4				1,2,6	4	
NICKEL	A/D	1,6					1,2		6			1,2,3	3	
PENTACHLOROPHENOL	B2	1,3,4,6		1,4			4	4	3,6	3,4	1	3,4		
PERCHLORATE					8		3							
PHENANTHRENE	D						5,6	4					4	= Fluorene
PHENOL	D	1,2,3	1,2	4,6					1,2,3	1,2	5			
POLYCHLORINATED BIPHENYLS (PCBs)	B2	1,3,4		1,4	4	6	4	1,4,6			1,3,4		4	
PYRENE	D							4	5,6					
SELENIUM	D	1,2,3,6	1,2				6			1,2		1,3	3,4,6	Selenosis (4,6)
SILVER	D												3,4,6	
STYRENE	C	4,5,6					5,6			1,2,3,5,6		3	3	
tert-BUTYL ALCOHOL														No chronic toxicity factors.
TETRACHLOROETHANE, 1,1,1,2-	C	6							6					
TETRACHLOROETHANE, 1,1,2,2-	C	3,4								3,4				
TETRACHLOROETHYLENE	NA	1,2,3,6							1,2,3					
THALLIUM	D	3	3			3	6			3,4	3,4		3	
TOLUENE	D	5,6		1,2,4					5,6	1,2,3,6	3	1,2,6		
TOXAPHENE	B2	4			4			4	4					
TPH (gasolines)														
TPH (middle distillates)														
TPH (residual fuels)														
TRICHLOROBENZENE, 1,2,4-	D				5,6									
TRICHLOROETHANE, 1,1,1-	D	3,7								1,2				
TRICHLOROETHANE, 1,1,2-	C	6					7						3	
TRICHLOROETHYLENE	B2	3,4,7		4,7		1,2	4	7	3,4,7	1,2,3,4				
TRICHLOROPHENOL, 2,4,5-	NA	1,3,5,6		1					3,5,6		1			
TRICHLOROPHENOL, 2,4,6-	B2	3												
VANADIUM	D	4							4			3,4		

TABLE L. TARGET ORGANS AND CHRONIC HEALTH EFFECTS
(For general reference only. May not be adequately comprehensive for some chemicals. Some noted effects may be insignificant. Refer to original documents for additional information.)

CHEMICAL PARAMETER	Target Organs And Health Effects													
	[a]Carcinogen	[b]Alimentary Tract	Cardiovascular	Developmental	Endocrine	Eye	Hematologic	Immune	Kidney	Nervous	Reproductive	Respiratory	[c]Skin	Other
VINYL CHLORIDE	A	1,3,4,6		1,4			3,4	4		4	1,4		3	No chronic toxicity factors.
XYLENES	D									1,2,3,4,5,6		1,2		
ZINC	D		1		4		1,2,4,5,6					1		

Notes:

a. Carcinogen type from RWQCBCV 2001; ORNL 2001 (see classification below).
b. Includes gastro-intestinal tract, liver, spleen, gall bladder, etc.
c. Includes skin sensitization but not general dermatitus or defatting of skin.
Perchlorate: Chronic effects as summarized in California DHS Perchlorate Action Level supporting documernt (CalDHS 2001).

Carcinogen Classification

A: Human carcinogen
B: Probable human carcinogen (B1: limited human evidence; B2 Sufficient evidence in animals and inadequate or no evidence in humans)
C: Possible human carcinogen
D: Not classifiable as to human carcinogenicity
E: Evidence of noncarcinogenicity for humans
NA: Carcinogen classification information not available

References:

1. CalARB, 2001, Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values: California Air Resources Board, September, 2001, www.arb.ca.gov/toxics/healthval/healthval.html.
2. CalEPA, 2002, Determination of Noncancer Chronic Exposure Levels, Chronic Toxicity Summaries: Office of Environmental Health Hazard Assessment, September 2002. www.oehha.org/air/chronic_rels/AllChrels.html.
3. USDHHS, 2003, International Chemical Safety Cards: International Programme on Chemical Safety: United Nations Environment Program, International Labour Office and World Health Organization (accessed July 2003); published through US Department of Health and Human Services, Centers for Disease Control and Prevention, www.cdc.gov/niosh/ipcs/ipcscard.html.
4. ATSDR, 2003, ToxFAQs™: Agency for Toxic Substances and Disease Registry (accessed July 2003), http://www.atsdr.cdc.gov/toxfaq.html.
5. Illinois, 2001, Tiered Approach to Corrective Action Objectives (TACO): Illinois Environmental Protection Agency, Title 35, Part 742, Similar Acting Noncarcinogenic Chemicals (Appendix A, Table E), December, 1997, http://www.epa.state.il.us/land/taco/.
6. USEPA, 2003, IRIS: U.S. Environmental Protection Agency, IRIS Database (accessed July 2003); (Critical effect used for derivation of USEPA RfD as presented in IRIS database; may not be inclusive of all potentially significant health effects), http://www.epa.gov/iris/subst/index.html.
7. ORNL, 2003, Risk Assessment Information System (RAIS), Toxocity Profiles: Oak Ridge National Laboratory/U.S. Department of Energy (accessed July 2003), RAGs A Format, especially Critical Effect used for derivation of RfDs, http://risk.lsd.ornl.gov/tox/rap_toxp.shtml.
8. For additional online references, see also: Hazardous Substances (On-line) Database: U.S. National Library of Medicine, Toxicology Data Network, http://toxnet.nlm.nih.gov.